Stibnite Gold Project EIS Appendix K

Wildlife and Wildlife Habitat

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WILDLIFE – APPENDIX K-1

1.1 Introduction

This appendix to the Wildlife section of the Draft EIS provides additional information about the Lynx Analysis Units (LAUs) analyzed for the Midas Gold Idaho, Inc. (Midas Gold) Stibnite Gold Project. USFS identified LAUs through consultation with U.S. Fish and Wildlife Service and they are used to evaluate lynx habitat and effects to lynx within various national forests. An LAU is a subdivision of a national forest, usually based on watersheds, that is used for analysis and management of habitat for Canada lynx (*Lynx canadensis*). LAUs were delineated across the Payette and Boise National Forests (PNF and BNF, respectively) using fifth-level hydrologic unit boundaries, with some using sixth-level hydrologic unit boundaries, where applicable. **Figure 3.13-1** of the Draft EIS shows the Canada lynx analysis area, which includes approximately 656,493 acres that are defined by the seven LAUs (i.e., Stibnite, Yellowpine, Burntlog, Landmark, Warm Lake, East Mountain, and West Mountain). Each of the LAUs in the Canada lynx analysis area are described in further detail below.

1.2 Payette National Forest LAUs

The only LAU within the PNF is the Stibnite LAU. The habitat types within the LAU are described by potential vegetable groups (PVGs). Additionally, USFS identifies suitable habitat and unsuitable habitat for Canada lynx within each LAU, based on habitat types, forest age and structure, and other habitat features.

1.2.1 Stibnite LAU

The Stibnite LAU contains 39,678 acres of source habitat capacity, of which 23,880 acres are currently in a suitable condition for lynx (**Table 1; Figure 1**). The majority of the LAU consists of subalpine fir, lodgepole pine, Douglas-fir, and ponderosa pine. Foraging opportunities are found primarily in mature, multi-storied stands with brush and young trees in the understory. Mature forests with abundant down wood or pockets of down wood provide potential denning habitat.

Multiple fires have burned within the LAU over the past 30 years, which have affected suitable lynx habitat. Burned areas are not expected to provide source habitat for three or more decades post-fire or until regeneration reaches heights and densities to provide cover and food for prey during the winter.

The Stibnite Road and a system of smaller access roads currently occur within the LAU. Roads provide access for a variety of motorized vehicles and human uses during the summer and fall months. Additionally, off-highway vehicle (OHV) routes occur within the LAU, which are popular for winter recreationists participating in both motorized and non-motorized activities.

Table 1 Summary of Lynx Habitat for Stibnite LAU

LAU Name	Source Habitat Capacity[1] (acres)	Source Habitat[2] (acres)	Percent Suitable[2]	Percent Unsuitable[2]	Meets Desired Condition[3] Percent Unsuitable is ≤30%
Stibnite	39,678	23,880	60.2%	39.8%	No

1 Source Habitat Capacity is used interchangeably with 'potential' lynx habitat. This represents the potential vegetation groups (PVGs) that could at some point in successional development provide suitable habitat conditions for Canada lynx.

2 Based on mid-scale vegetation data updated in July 2017.

3 Forest Plan Standard TEST15: Unless a broad-scale assessment has been completed that substantiates different historical levels of unsuitable habitat, limit disturbance within each LAU as follows: If more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no additional habitat may be changed to unsuitable habitat as a result of vegetative management projects. Fire use, or fire hazard reduction and associated vegetation management activities within the wildland urban interface watersheds, that develop or maintain fuel profiles needed to reduce the risk of wildfire threats to the wildland urban interface areas, are NOT bound by this standard.

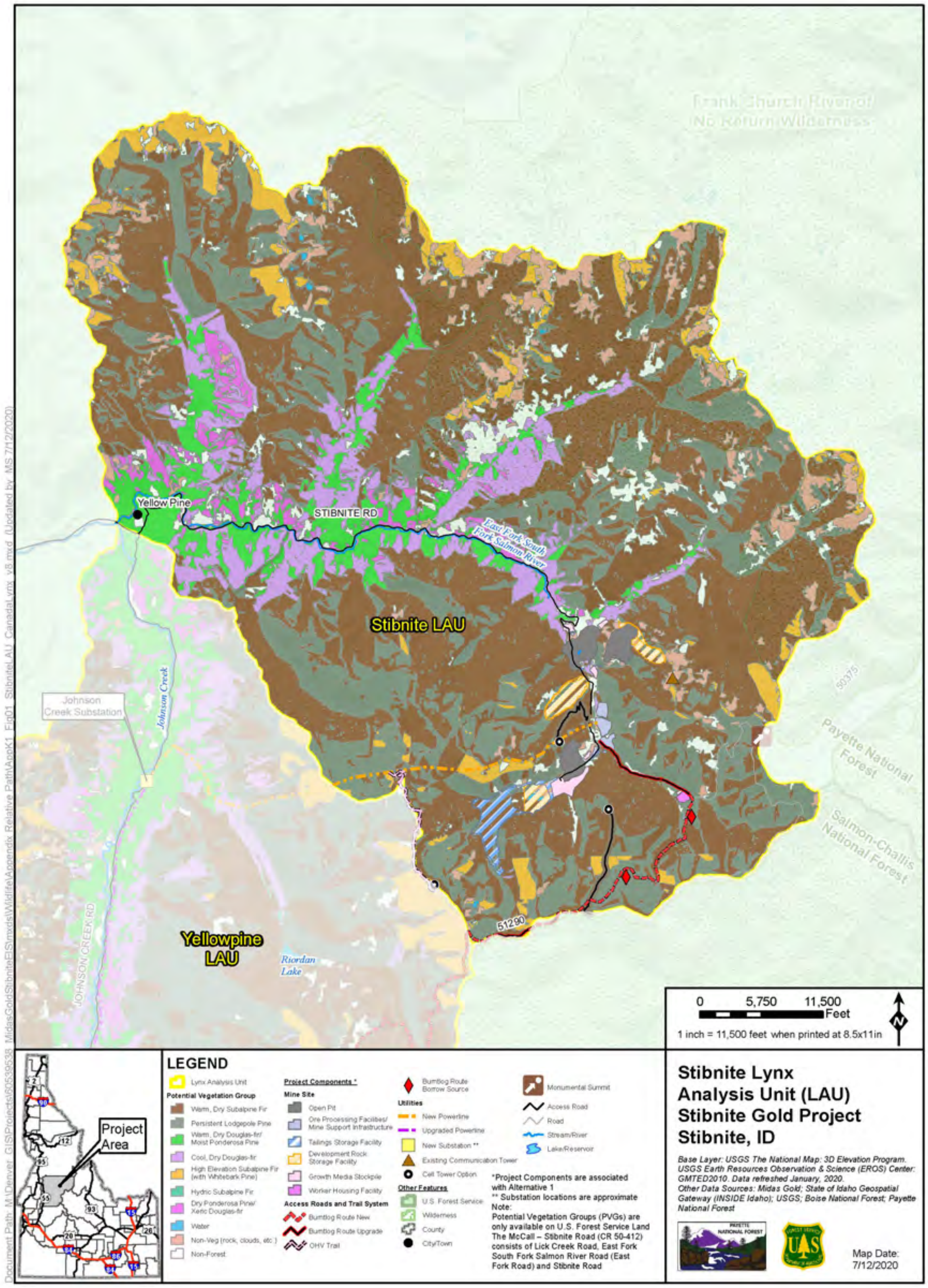

Figure 1 Stibnite Lynx Analysis Unit (LAU)

1.3 Boise National Forest LAUs

Several LAUs occur within the BNF, which are described in more detail below. The habitats within each LAU are described by PVGs, suitable habitat, and unsuitable habitat for Canada lynx, based on habitat types, forest age and structure, and other habitat features.

1.3.1 Yellowpine LAU

The Yellowpine LAU contains 30,817 acres of source habitat capacity, of which 9,107 acres are currently in a suitable condition for lynx (**Table 2; Figure 2**). PVGs located along Johnson Creek Road include Douglas-fir and ponderosa pine, while subalpine fir and lodgepole pine occur further away from the roadway. Foraging opportunities are found primarily in mature, multi-storied stands with brush and young trees in the understory. Mature forests with abundant down wood or pockets of down wood provide potential denning habitat.

Currently, 70.5% of the source habitat capacity in the LAU is in an unsuitable habitat condition (**Table 2; Figure 2**). Multiple fires have burned within the LAU over the past 30 years, which have affected suitable lynx habitat. Burned areas are not expected to provide source habitat for three or more decades post-fire or until regeneration reaches heights and densities to provide cover and food for prey during the winter. As is, the Yellowpine LAU does not meet the desired condition of less than or equal to 30% unsuitable habitat in Forest Plan Standard TEST15.

Johnson Creek Road and Old Thunder Mountain Road are the primary roadways within the LAU. Roads provide access for a variety of motorized vehicles and human uses during the summer and fall months. Additionally, off-highway vehicle (OHV) routes occur within the LAU, which are popular for winter recreationists participating in both motorized and non-motorized activities.

Table 2 Summary of Lynx Habitat for Yellowpine LAU

LAU Name	Source Habitat Capacity[1] (acres)	Source Habitat[2] (acres)	Percent Suitable[2]	Percent Unsuitable[2]	Meets Desired Condition[3] Percent Unsuitable is ≤30%
Yellowpine	30,817	9,107	29.5%	70.5%	No

1 Source Habitat Capacity is used interchangeably with ‘potential’ lynx habitat. This represents the potential vegetation groups (PVGs) that could at some point in successional development provide suitable habitat conditions for Canada lynx.

2 Based on mid-scale vegetation data updated in July 2017.

3 Forest Plan Standard TEST15: Unless a broad-scale assessment has been completed that substantiates different historical levels of unsuitable habitat, limit disturbance within each LAU as follows: If more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no additional habitat may be changed to unsuitable habitat as a result of vegetative management projects. Fire use, or fire hazard reduction and associated vegetation management activities within the wildland urban interface watersheds, that develop or maintain fuel profiles needed to reduce the risk of wildfire threats to the wildland urban interface areas, are NOT bound by this standard.

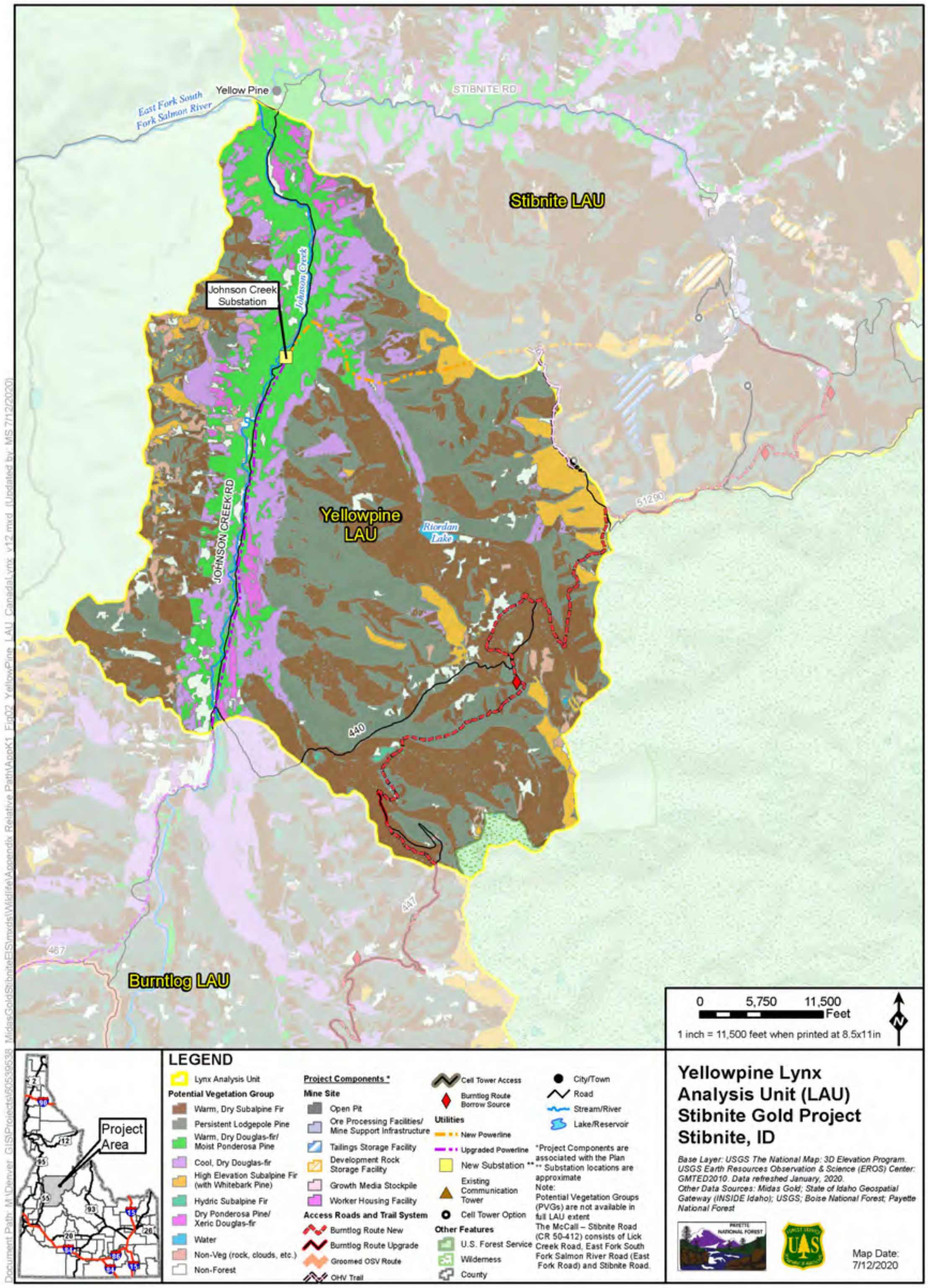

Figure 2 Yellowpine Lynx Analysis Unit (LAU)

1.3.2 Burntlog LAU

The Burntlog LAU contains 34,487 acres of source habitat capacity, of which 15,507 acres are currently in a suitable condition for lynx (**Table 3; Figure 3**). The majority of the LAU consists of subalpine fir, lodgepole pine, Douglas-fir, ponderosa pine, grand fir, and non-vegetated or non-forested areas. Foraging opportunities are found primarily in mature, multi-storied stands with brush and young trees in the understory. Mature forests with abundant down wood or pockets of down wood provide potential denning habitat.

Currently, 55.0% of the source habitat capacity in the LAU is in an unsuitable habitat condition (**Table 3; Figure 3**). Multiple fires have burned within the LAU over the past 30 years, which have affected suitable lynx habitat. Burned areas are not expected to provide source habitat for three or more decades post-fire or until regeneration reaches heights and densities to provide cover and food for prey during the winter. As is, the Burntlog LAU does not meet the desired condition of less than or equal to 30% unsuitable habitat in Forest Plan Standard TEST15.

Johnson Creek Road, Old Thunder Mountain Road, and Burntlog Road are the primary roadways within the LAU. Roads provide access for a variety of motorized vehicles and human uses during the summer and fall months. Additionally, groomed oversnow vehicle (OSV) routes occur within the LAU, which are popular for winter recreationists participating in both motorized and non-motorized activities.

Table 3 Summary of Lynx Habitat for Burntlog LAU

LAU Name	Source Habitat Capacity[1] (acres)	Source Habitat[2] (acres)	Percent Suitable[2]	Percent Unsuitable[2]	Meets Desired Condition[3] Percent Unsuitable is ≤30%
Burntlog	34,487	15,507	45.0%	55.0%	No

1 Source Habitat Capacity is used interchangeably with ‘potential’ lynx habitat. This represents the potential vegetation groups (PVGs) that could at some point in successional development provide suitable habitat conditions for Canada lynx.

2 Based on mid-scale vegetation data updated in July 2017.

3 Forest Plan Standard TEST15: Unless a broad-scale assessment has been completed that substantiates different historical levels of unsuitable habitat, limit disturbance within each LAU as follows: If more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no additional habitat may be changed to unsuitable habitat as a result of vegetative management projects. Fire use, or fire hazard reduction and associated vegetation management activities within the wildland urban interface watersheds, that develop or maintain fuel profiles needed to reduce the risk of wildfire threats to the wildland urban interface areas, are NOT bound by this standard.

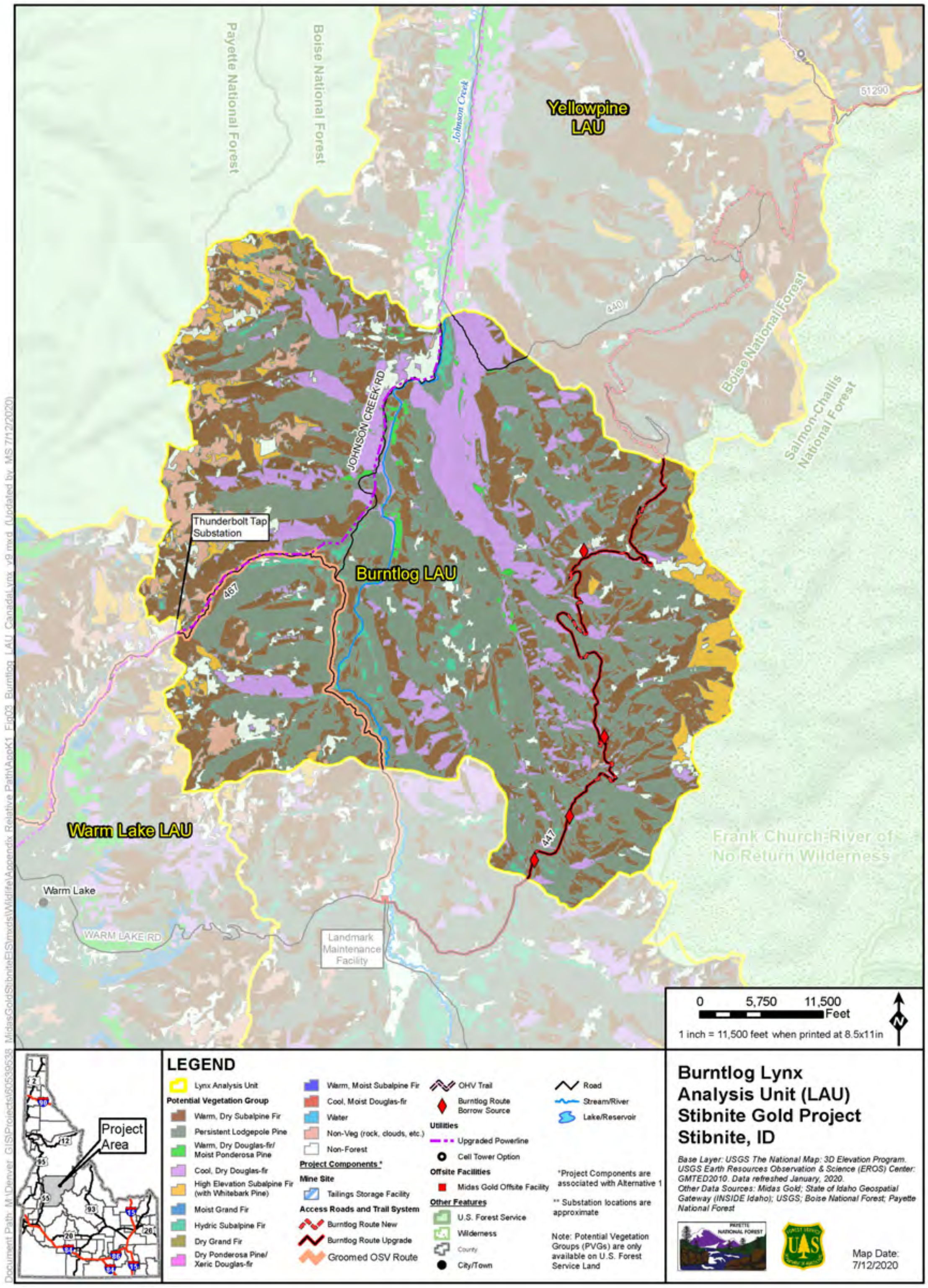

Figure 3 Burntlog Lynx Analysis Unit (LAU)

1.3.3 Landmark LAU

The Landmark LAU contains 35,106 acres of source habitat capacity, of which 7,560 acres are currently in a suitable condition for lynx (**Table 4; Figure 4**). The northwestern half of the LAU consists of subalpine fir, Douglas-fir, and lodgepole pine, and the southeast half consists of subalpine fir, Douglas-fir, grand fir, and water features. The southeast corner contains the Frank Church River of No Return Wilderness. Foraging opportunities are found primarily in mature, multi-storied stands with brush and young trees in the understory. Mature forests with abundant down wood or pockets of down wood provide potential denning habitat.

Currently, 78.5% of the source habitat capacity in the LAU is in an unsuitable habitat condition (**Table 4; Figure 4**). Multiple fires have burned within the LAU over the past 30 years, which have affected suitable lynx habitat. Burned areas are not expected to provide source habitat for three or more decades post-fire or until regeneration reaches heights and densities to provide cover and food for prey during the winter. As is, the Landmark LAU does not meet the desired condition of less than or equal to 30% unsuitable habitat in Forest Plan Standard TEST15.

Johnson Creek Road, Burntlog Road, and smaller road systems are the primary roadways within the LAU. Roads provide access for a variety of motorized vehicles and human uses during the summer and fall months. Additionally, groomed oversnow vehicle (OSV) routes occur within the LAU, which are popular for winter recreationists participating in both motorized and non-motorized activities.

Table 4 Summary of Lynx Habitat for Landmark LAU

LAU Name	Source Habitat Capacity[1] (acres)	Source Habitat[2] (acres)	Percent Suitable[2]	Percent Unsuitable[2]	Meets Desired Condition[3] Percent Unsuitable is ≤30%
Landmark	35,106	7,560	21.5%	78.5%	No

1 Source Habitat Capacity is used interchangeably with ‘potential’ lynx habitat. This represents the potential vegetation groups (PVGs) that could at some point in successional development provide suitable habitat conditions for Canada lynx.

2 Based on mid-scale vegetation data updated in July 2017.

3 Forest Plan Standard TEST15: Unless a broad-scale assessment has been completed that substantiates different historical levels of unsuitable habitat, limit disturbance within each LAU as follows: If more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no additional habitat may be changed to unsuitable habitat as a result of vegetative management projects. Fire use, or fire hazard reduction and associated vegetation management activities within the wildland urban interface watersheds, that develop or maintain fuel profiles needed to reduce the risk of wildfire threats to the wildland urban interface areas, are NOT bound by this standard.

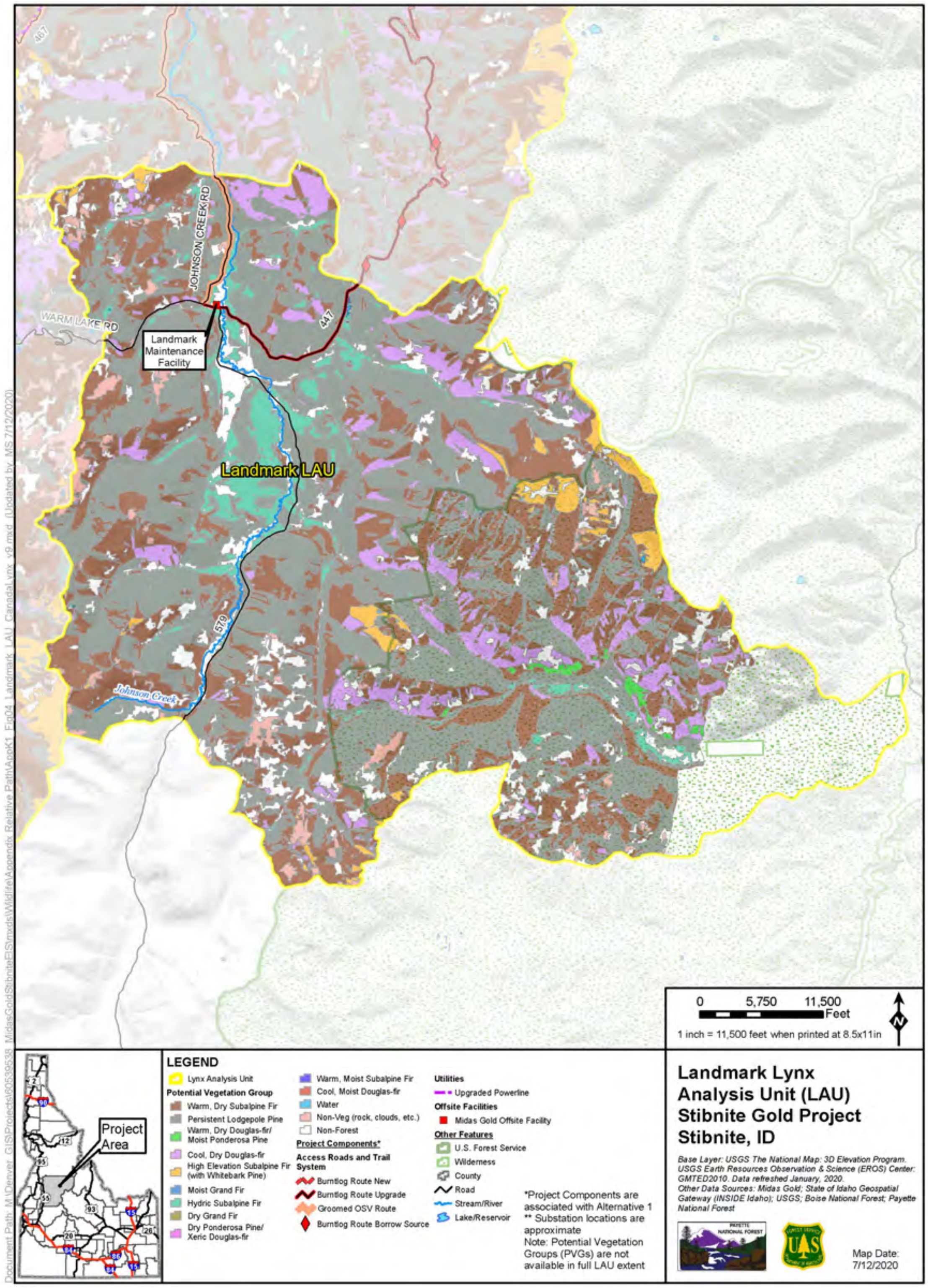

Figure 4 Landmark Lynx Analysis Unit (LAU)

1.3.4 Warm Lake LAU

The Warm Lake LAU contains 32,095 acres of source habitat capacity, of which 1,887 acres are currently in a suitable condition for lynx (**Table 5; Figure 5**). Lodgepole pine, grand fir, Douglas-fir, and ponderosa pine occur along the South Fork of the Salmon River and South Fork Road, while the remainder of the LAU consists of subalpine fir, lodgepole pine, Douglas-fir, and non-vegetated areas. Foraging opportunities are found primarily in mature, multi-storied stands with brush and young trees in the understory. Mature forests with abundant down wood or pockets of down wood provide potential denning habitat.

Currently, 94.1% of the source habitat capacity in the LAU is in an unsuitable habitat condition (**Table 5; Figure 5**). Multiple fires have burned within the LAU over the past 30 years, which have affected suitable lynx habitat. Burned areas are not expected to provide source habitat for three or more decades post-fire or until regeneration reaches heights and densities to provide cover and food for prey during the winter. As is, the Warm Lake LAU does not meet the desired condition of less than or equal to 30% unsuitable habitat in Forest Plan Standard TEST15.

South Fork Road, Cabin Creek Road, and smaller road systems are the primary roadways within the LAU. Roads provide access for a variety of motorized vehicles and human uses during the summer and fall months. Additionally, groomed oversnow vehicle (OSV) routes occur within the LAU along Cabin Creek Road, which are popular for winter recreationists participating in both motorized and non-motorized activities.

Table 5 Summary of Lynx Habitat for Warm Lake LAU

LAU Name	Source Habitat Capacity[1] (acres)	Source Habitat[2] (acres)	Percent Suitable[2]	Percent Unsuitable[2]	Meets Desired Condition[3] Percent Unsuitable is ≤30%
Warm Lake	32,095	1,887	5.9%	94.1%	No

1 Source Habitat Capacity is used interchangeably with ‘potential’ lynx habitat. This represents the potential vegetation groups (PVGs) that could at some point in successional development provide suitable habitat conditions for Canada lynx.

2 Based on mid-scale vegetation data updated in July 2017.

3 Forest Plan Standard TEST15: Unless a broad-scale assessment has been completed that substantiates different historical levels of unsuitable habitat, limit disturbance within each LAU as follows: If more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no additional habitat may be changed to unsuitable habitat as a result of vegetative management projects. Fire use, or fire hazard reduction and associated vegetation management activities within the wildland urban interface watersheds, that develop or maintain fuel profiles needed to reduce the risk of wildfire threats to the wildland urban interface areas, are NOT bound by this standard.

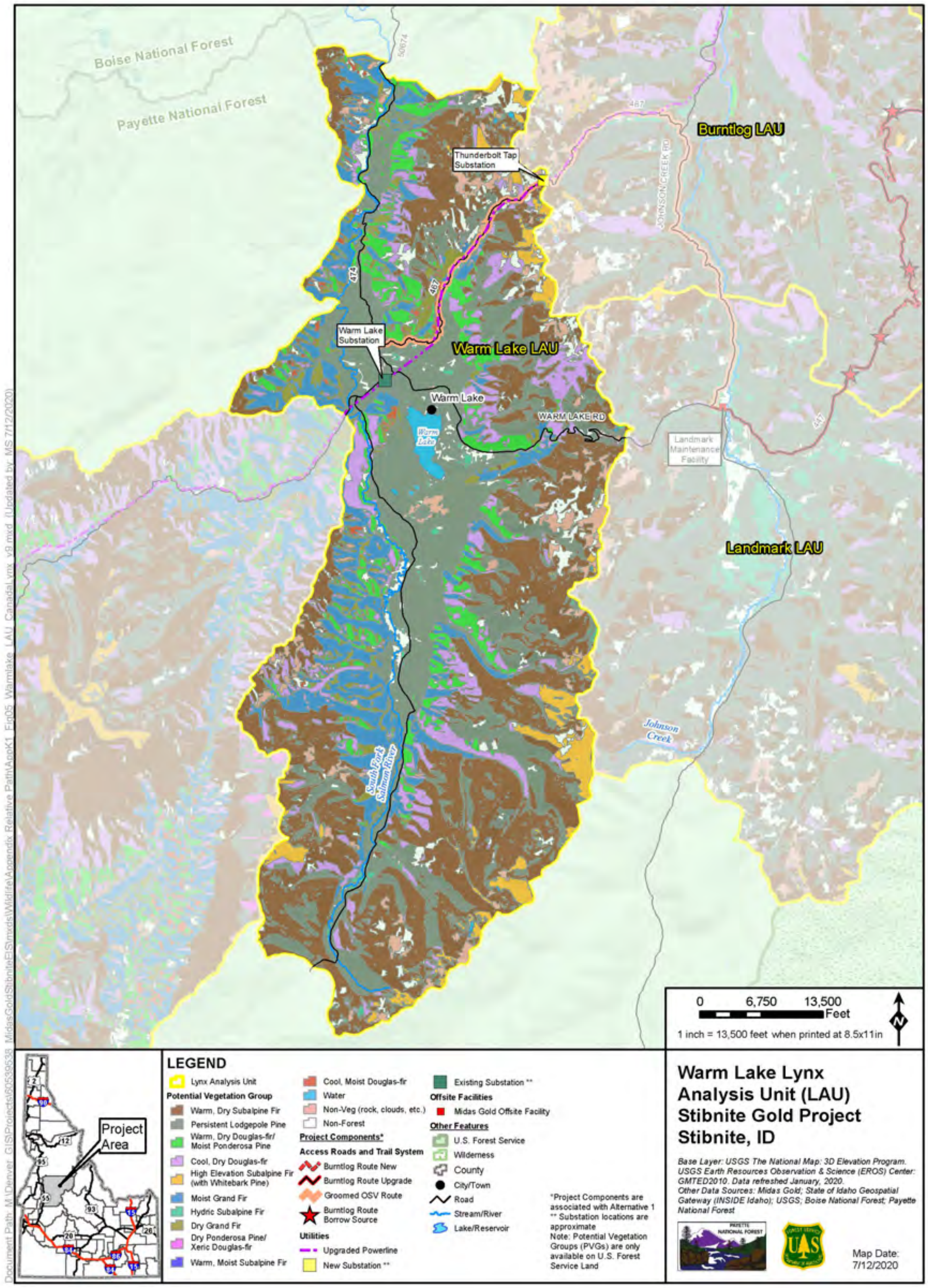

Figure 5 Warm Lake Lynx Analysis Unit (LAU)

1.3.5 East Mountain LAU

The East Mountain LAU contains 28,832 acres of source habitat capacity, of which 25,254 acres are currently in a suitable condition for lynx (**Table 6; Figure 6**). The majority of the LAU consists of subalpine fir, lodgepole pine, Douglas-fir, ponderosa pine, and grand fir. Foraging opportunities are found primarily in mature, multi-storied stands with brush and young trees in the understory. Mature forests with abundant down wood or pockets of down wood provide potential denning habitat.

Currently, 12.4% of the source habitat capacity in the LAU is in an unsuitable habitat condition (**Table 6; Figure 6**). Fewer fires have burned within the LAU over the past 30 years, which has resulted in additional suitable lynx habitat. As is, the East Mountain LAU currently meets the desired condition of less than or equal to 30% unsuitable habitat in Forest Plan Standard TEST15.

Warm Lake Road and smaller road systems are the primary roadways within the LAU. Roads provide access for a variety of motorized vehicles and human uses during the summer and fall months.

Table 6 Summary of Lynx Habitat for East Mountain LAU

LAU Name	Source Habitat Capacity[1] (acres)	Source Habitat[2] (acres)	Percent Suitable[2]	Percent Unsuitable[2]	Meets Desired Condition[3] Percent Unsuitable is ≤30%
East Mountain	28,832	25,254	87.6%	12.4%	Yes

1 Source Habitat Capacity is used interchangeably with ‘potential’ lynx habitat. This represents the potential vegetation groups (PVGs) that could at some point in successional development provide suitable habitat conditions for Canada lynx.

2 Based on mid-scale vegetation data updated in July 2017.

3 Forest Plan Standard TEST15: Unless a broad-scale assessment has been completed that substantiates different historical levels of unsuitable habitat, limit disturbance within each LAU as follows: If more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no additional habitat may be changed to unsuitable habitat as a result of vegetative management projects. Fire use, or fire hazard reduction and associated vegetation management activities within the wildland urban interface watersheds, that develop or maintain fuel profiles needed to reduce the risk of wildfire threats to the wildland urban interface areas, are NOT bound by this standard.

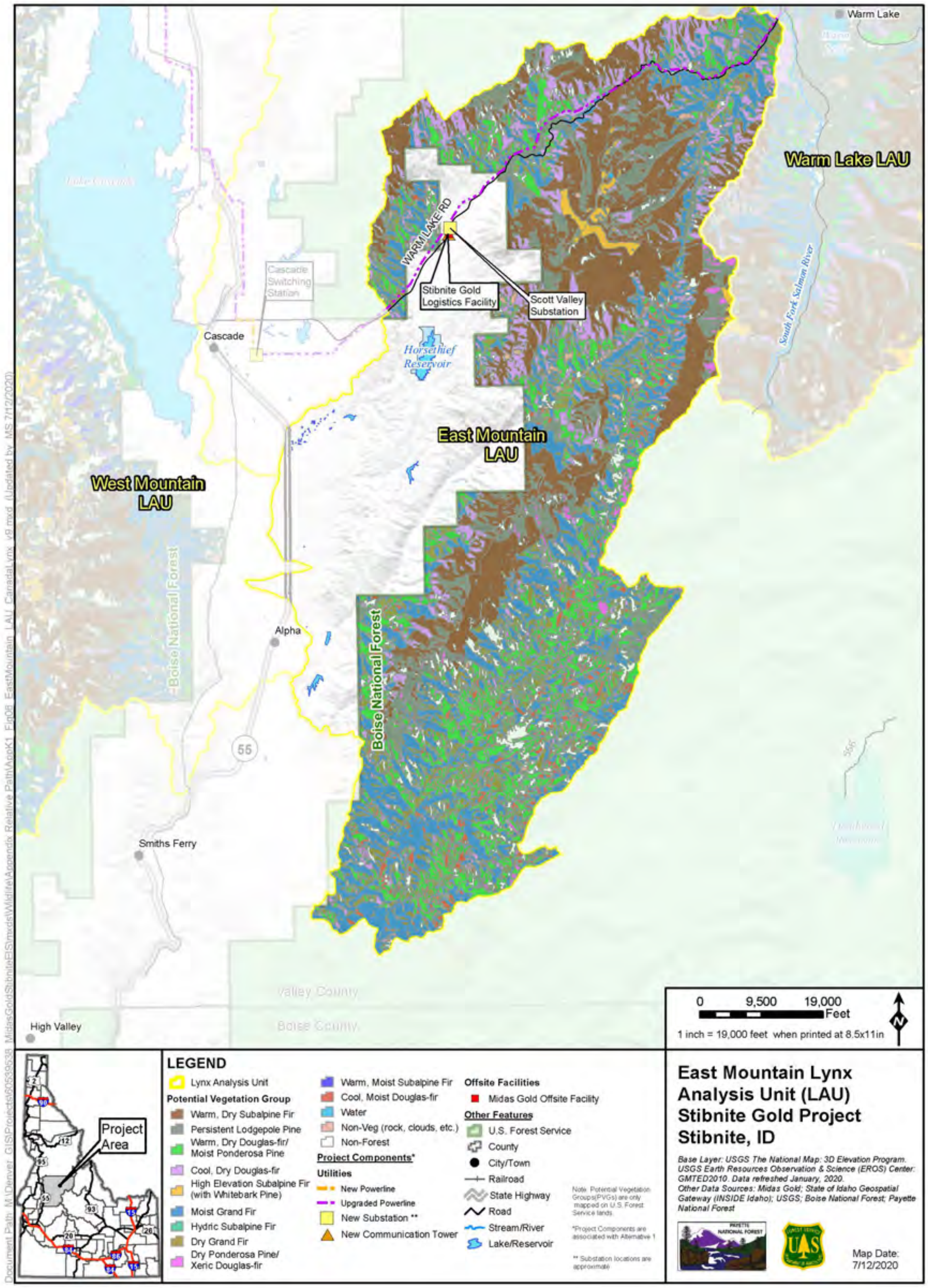

Figure 6 East Mountain Lynx Analysis Unit (LAU)

1.3.6 West Mountain LAU

The West Mountain LAU contains 19,246 acres of source habitat capacity, of which 18,953 acres are currently in a suitable condition for lynx (**Table 7; Figure 7**). This LAU includes Lake Cascade and many private parcels off of the Forest Service lands, so PVGs are not mapped throughout the LAU. Common PVGs within the LAU consist of subalpine fir, lodgepole pine, Douglas-fir, ponderosa pine, and grand fir. Foraging opportunities are found primarily in mature, multi-storied stands with brush and young trees in the understory. Mature forests with abundant down wood or pockets of down wood provide potential denning habitat.

Currently, 1.5% of the source habitat capacity in the LAU is in an unsuitable habitat condition (**Table 7; Figure 7**). Fewer fires have burned within the LAU over the past 30 years, which has resulted in additional suitable lynx habitat. As is, the West Mountain LAU currently meets the desired condition of less than or equal to 30% unsuitable habitat in Forest Plan Standard TEST15.

State Highway 55 and many other road systems around Lake Cascade and within the city of Cascade are the primary roadways within the LAU.

Table 7 Summary of Lynx Habitat for West Mountain LAU

LAU Name	Source Habitat Capacity[1] (acres)	Source Habitat[2] (acres)	Percent Suitable[2]	Percent Unsuitable[2]	Meets Desired Condition[3] Percent Unsuitable is $\leq$30%
West Mountain	19,246	18,953	98.5%	1.5%	Yes

1 Source Habitat Capacity is used interchangeably with ‘potential’ lynx habitat. This represents the potential vegetation groups (PVGs) that could at some point in successional development provide suitable habitat conditions for Canada lynx.

2 Based on mid-scale vegetation data updated in July 2017.

3 Forest Plan Standard TEST15: Unless a broad-scale assessment has been completed that substantiates different historical levels of unsuitable habitat, limit disturbance within each LAU as follows: If more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no additional habitat may be changed to unsuitable habitat as a result of vegetative management projects. Fire use, or fire hazard reduction and associated vegetation management activities within the wildland urban interface watersheds, that develop or maintain fuel profiles needed to reduce the risk of wildfire threats to the wildland urban interface areas, are NOT bound by this standard.

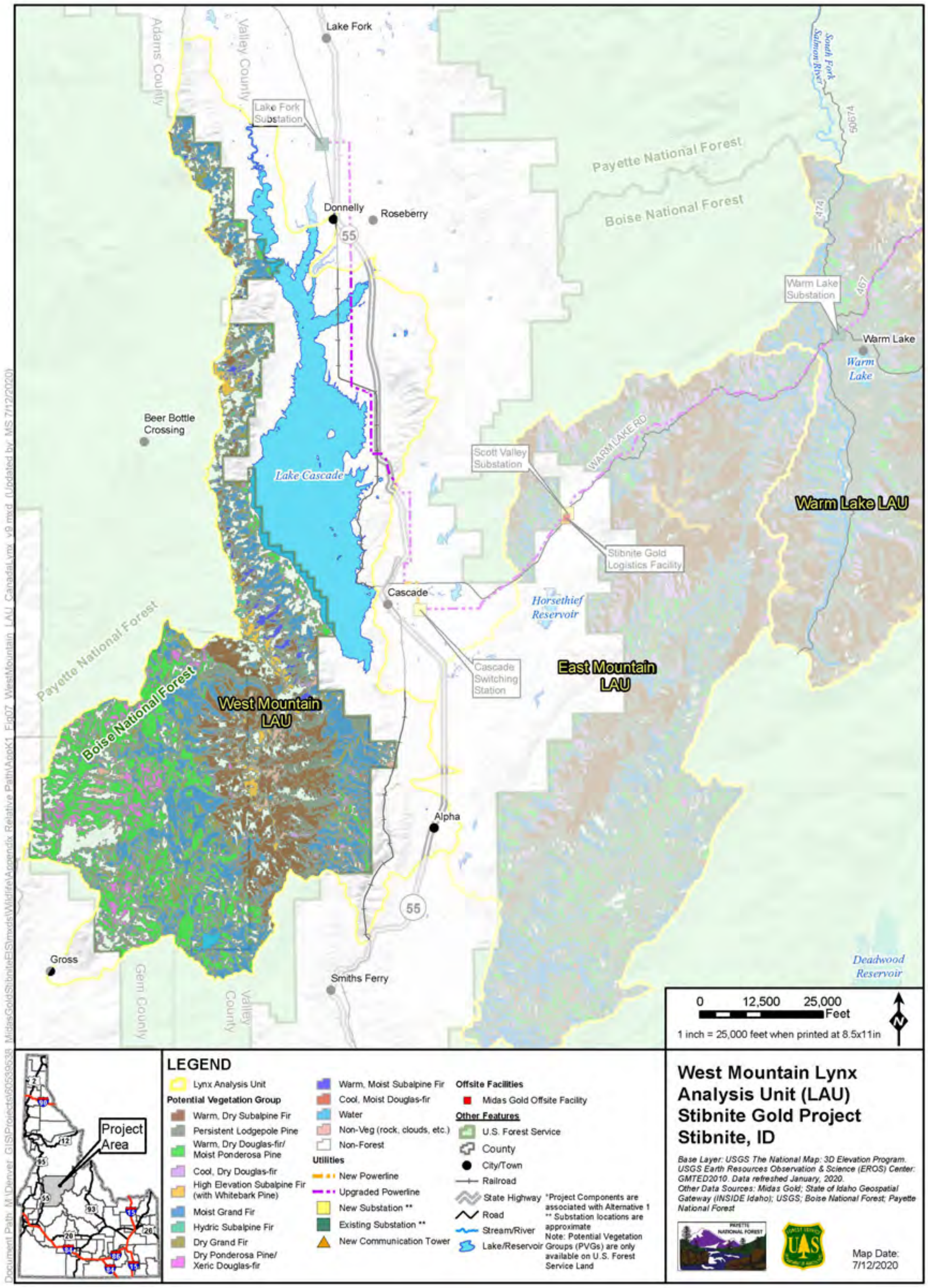

Figure 7 West Mountain Lynx Analysis Unit (LAU)

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K-2: Wildlife Modeling Parameters

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WILDLIFE – APPENDIX K-2

K-2-1.1 Introduction

This appendix to the Wildlife section of the Stibnite Gold Project (SGP) Environmental Impact Statement (EIS) provides additional information about the modeling parameters used for the three threatened and endangered species and 14 focal species analyzed for the SGP.

K-2-1.2 Canada Lynx

Revision of the 2000 Lynx Conservation and Assessment Strategy (LCAS) was initiated in September 2010 and completed in 2013. The 2013 LCAS (Interagency Lynx Biology Team 2013) is a full revision of the 2000 LCAS, incorporating all prior amendments and clarifications, substantial new scientific information that has emerged since 2000, including related parts of the Lynx Recovery Outline, as well as drawing on experience gained in implementing the 2000 LCAS. The 2013 LCAS made several major changes to the 2000 LCAS, including formally stratifying lynx habitat into core areas and secondary/peripheral areas, along with associated conservation measures for those habitat areas. Direction provided in the 2013 LCAS recommends delineation of Lynx Analysis Units (LAUs) only in designated core areas. Therefore, areas identified as secondary areas, such as the entire Ecogroup, consisting of the Payette National Forest (PNF), Boise National Forest (BNF), and Sawtooth National Forest, which share joint Land and Resource Management Plans (LRMPs), would no longer require management of LAUs.

The 2013 LCAS directs habitat management and conservation measures for secondary areas focused on providing a mosaic of habitat components to support snowshoe hare, maintaining connectivity for lynx movement and dispersal across the landscape, and preserving an acceptable amount and distribution of foraging habitat over time. However, until the 2003 Forest Plan is amended, or revised, to directly incorporate the 2013 LCAS direction, any changes in management must comply with existing Forest Plan standards, based on the 2000 LCAS, unless a project-specific Forest Plan amendment is adopted.

Consequently, effects to Canada lynx analyzed in this EIS are based on modeled LAUs. LAUs were also delineated based upon guidance provided in the LOC for “Section 7 Consultation for Lynx Regarding Ongoing Activities / Existing Projects within the Payette National Forest” (dated September 12, 2000, File # 113.000/1-4-00-I-765). The existing habitat model (Appendix WL-A), originally created in 2009, was cross-walked with updated vegetation data and revised in 2017, utilizing the best available science (Galloway and Penny 2017). The 2013 LCAS describes the same basic habitat associations as the 2000 LCAS and vegetative communities capable of providing modeled habitat conditions include PVGs 3, 7, 8, 9, 10, and The source habitat capacity model predicts potential suitable source habitat at the mid-scale level (Forest) by LAU and by the parameters described in the model. Source habitat is expected to contain macrovegetation (i.e., cover types and structural stages) that contribute to stationary and/or positive population growth, and contribute to source environments, a composite of environmental conditions resulting in stationary or positive population growth in specific areas and time ranges (Wisdom et al. 2000). The source habitat capacity model, in this case, predicts potential for overall lynx habitat capacity, including primary (breeding) and secondary habitat. It defines acreages of vegetative communities in selected Potential Vegetation Groups (PVGs), which include preferred habitat types, such as Engelmann spruce, lodgepole pine, and mixed-conifer types with Douglas fir and subalpine fir.

Current or existing suitable habitat, a subset of source habitat capacity, is further defined by parameters such as post-burn habitat (updated to better represent horizontal cover in snowshoe hare habitat on the PNF), road density, and plantation age. Current habitat modeling parameters are based on previously defined relationships among vegetation, snowshoe hares, and lynx.

Although the 2017 model provides an overall estimate of both source habitat capacity and existing habitat at the mid-scale, it is limited by specie's specific data for tree size class and tree canopy cover. It is further limited by lack of finer scale habitat feature data required for primary (breeding) and secondary habitat, such as dead and downed large wood density, snag density, and understory cover estimates. As a result of these limiting factors, some of which are required components for lynx breeding habitat, the model overestimates both current and potential suitable habitat.

Table K-2-1 also lists the Cover Type equivalent(s) from the 2009 Lynx Habitat Model for each of the new Map Units selected. These were simply added in an effort to show what Cover Types from the 2009 model the new Map Unit classifications were taking the place of. The Cover Type equivalents were determined by comparing the definitions and/or descriptions of both the Cover Types (Forest Service 2003a, 2010) and the Map Units (Boise National Forest VCMQ Document 2014). A Geographic Information System (GIS) exercise that intersected the new vegetation layer with the old cover type spatial layer was also used to inform the Cover Type equivalent choices by showing which cover types a Map Unit overlapped with spatially. For most Map Units this resulted in many different cover types occurring within a given Map Unit. However, in most cases there were only a few cover types with meaningful acreages that gave a sense of what Cover Types were now being represented by which Map Units.

The following Map Units are recommended to be used to model source habitat for the Canada Lynx: Douglas Fir, Douglas Fir/Lodgepole Pine, Engelmann Spruce, Lodgepole Pine, Subalpine Fir, Western Larch, Aspen, Riparian Shrublands, Burned Forest Shrublands, and Burned Herbland.

Table K-2-1 Map Units that have the Potential to Provide Lynx Source Habitat Capacity and Source Habitat

Map Unit (MU)	Map Unit Code	Rationale For Inclusion in the Model	Cover Type Equivalent from 2009 Lynx Mid-scale Habitat Model (Hergenrider 2009)
Douglas Fir	DS	Douglas-fir on moist sites identified as both a primary and secondary vegetation providing habitat for lynx (Ruediger et al. 2000).	Douglas Fir (4212), Mixed Subalpine Forest (4270), Lodgepole Pine (4203), Mesic Shrub (3210), Douglas Fir/Lodgepole Pine (4223)
Douglas Fir/Lodgepole Pine	DFL	Douglas-fir on moist sites identified as both a primary and secondary vegetation providing habitat for lynx (Ruediger et al. 2000). Lodgepole pine identified as a primary vegetation type providing habitat for lynx (Ruediger et al. 2000; Rugierro et al. 1999).	Douglas Fir/Lodgepole Pine (4223), Lodgepole Pine (4203), Mixed Subalpine Forest (4270), Douglas Fir (4212)
Engelmann Spruce	ES	Identified as a primary vegetation type providing habitat for lynx (Ruediger et al. 2000; Rugierro et al. 1999).	Engelmann Spruce (4201)*, Lodgepole Pine (4203), Mixed Subalpine Forest (4270)
Lodgepole Pine	LP	Identified as a primary vegetation type providing habitat for lynx (Ruediger et al. 2000; Rugierro et al. 1999).	Lodgepole Pine (4203), Mixed Subalpine Forest (4270), Douglas Fir (4212), Mixed Whitebark Pine Forest (4260)
Subalpine Fir	SA	Identified as a primary vegetation type providing habitat for lynx (Ruediger et al. 2000; Rugierro et al. 1999).	Mixed Subalpine Forest (4270), Lodgepole Pine (4203), Mixed Whitebark Pine Forest (4260), Douglas Fir (4212), Subalpine Fir (4208)
Western Larch	WL	Larch forests are identified as potential lynx habitat when interspersed with subalpine fir (Interagency Lynx Biology Team 2013).	Douglas Fir (4212), Mixed Mesic Forest (4280)
Aspen	AS	Ruediger et al. (2000) noted that aspen may also contribute to lynx habitat when interspersed with primary vegetation (lodgepole pine, subalpine fir, and Engelmann spruce).	Aspen (4101), Broadleaf Forests (4100-4199), Douglas Fir (4212), Mesic Shrub (3210), Mixed Broadleaf/Conifer Forests (4300)
Riparian Shrublands	RSH	Riparian shrublands within the appropriate PVGs are included. Riparian areas are typically narrow bands with dense vegetation that provide important foraging and travel areas for lynx within the context of the larger forested Map Units.	Conifer Riparian (3210), Mesic Shrub (3210), Douglas Fir (4212), Riparian (6000-6999)
Burned Forest Shrubland	BFS	Selection of these MUs within the appropriate PVGs would represent burned forested habitat that will eventually regenerate back in to source habitat at some point in time during succession.	Non-Developed Grasslands (3100-3199), Non-Developed Shrublands (3200-3499), Lodgepole Pine (4203), Mixed Subalpine Forest (4270), Douglas Fir (4212), Douglas Fir/Lodgepole Pine (4223)
Burned Herbland	BHE		

Table Notes:

* There was no data associated with the Engelmann Spruce (4201) Cover Type

Tree Size Class Discussion

Tree size class (TSC) was not specified as a habitat parameter used in the Lynx Mid-scale model (Hergenrider 2009). Any changes to TSC that have occurred since 2007 would be accounted for by using the new 2011 vegetation data and removing fires and plantations >15 years old as specified in the model rationale. No changes to TSC parameters for the Lynx Mid- scale model are recommended.

Tree Canopy Cover Discussion

Tree Canopy Cover classifications for both the 2010 Forest Plan Amendment and New 2011 Vegetation Layer are compared below in **Table K-2-2**.

Table K-2-2 Tree Canopy Cover Class Differences Between 2010 Forest Plan Amendment and New 2011 Vegetation Layer

Tree Canopy Cover Class		
2010 Forest Plan/Appendix A Range	New Vegetation Layer (2011)	Changed or New Classification?
10 – 39% Low	10 – 19% (Low Tree Canopy)	change
	20 – 29% (Low-Medium Tree Canopy)	change
	30 – 44% (Medium Tree Canopy)	change
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	change
	60% (High Tree Canopy)	change
>70% High		

In the 2009 Lynx Mid-scale Model canopy cover class was only used when selecting habitat within PVG 11 habitat types. This was done to exclude the more open areas that had less than 40 percent canopy cover as these areas are generally not expected to have enough contiguous vegetation for lynx or lynx prey. Densities of PVG 11 stands can be highly variable and often grade into patchy krummholz stringers, in part due to the harsh growing conditions and poor soils at these high elevations (Forest Plan, Appendix A). Canopy cover class was only applied to one PVG as a measure to avoid an over-estimation of PVG 11 habitat types in the existing model, and was not a parameter that was necessarily developed from the literature and applied across all PVGs as a habitat constraint. Therefore, canopy cover class will be used in the same capacity for this model update.

It is recommended that tree canopy cover classes Medium-High (45-59%) and High (>60%) be included, and tree canopy cover classes Low (10-19%), Low-Medium (20-29%), and Medium (30-44%) be excluded within PVG 11 habitat types for this update. This would closest resemble the canopy cover class constraints for PVG 11 habitat types from the 2009 model.

Updated Forest Modeling Parameters for Canada Lynx Source Habitat Capacity and Source Habitat

Source Habitat Capacity (SHC)*

1. Use Lynx Analysis Unit (LAU) boundaries, typically at the 5th Hydrologic Unit Code

(HUC) boundary, to depict habitat. 2. Select PVGs 3, 7, 8, 9, 10, and 11.

3. Select the following map units and gridcodes:

MU_CLASS IN ('Aspen', 'Douglas Fir/Lodgepole', 'Engelmann Spruce', 'Forest Shrubland', 'Lodgepole Pine', 'Riparian Herbaceous', 'Riparian Shrubland/Deciduous Tree', 'Subalpine Fir Mix', 'Western Larch', 'Whitebark Pine Mix', 'Douglas Fir') AND gridcode IN(3 , 7 , 8 , 9 , 10)

MU_CLASS IN ('Aspen', 'Douglas Fir/Lodgepole', 'Engelmann Spruce', 'Forest Shrubland', 'Lodgepole Pine', 'Riparian Herbaceous', 'Riparian Shrubland/Deciduous Tree', 'Subalpine Fir Mix', 'Western Larch', 'Whitebark Pine Mix') AND (gridcode IN (11) AND CC_CLASS IN('TC3: Medium Tree Canopy Cover: 30-44%' , 'TC4: Medium-High Tree Canopy Cover: 45-59%' , 'TC5: High Tree Canopy Cover:

>= 60%')

Select high shrub cover where available.

5. Create a cookie cutter (mask):
   a) Identifying **PVGs 7-11** that represent contiguous islands >= 10 acres.
   b) Buffering contiguous islands >= 10 acres by 510 m (2000’).

6. Select poly/pixels falling within cookie cutter.

7. Remove all non-NF lands from #6. The result = Source Habitat Capacity.

Current or Existing Suitable Habitat

(This is a subset of Source Habitat Capacity)

1. Use Source Habitat Capacity grid created above.

2. Remove burned areas (wildfires) $\leq$ 20 yo, to represent fire-induced lodgepole pine habitat with dense, tall US shrub layers.

3. Remove plantations $\leq$ 20 years old. (This will capture GFSS from vegetation management.)

4. Remove a 10-meter buffer of highways and county roads. Validate with aerial imagery and ground-truth, where possible.

* Predicts potential for source habitat, but limited by tree size class, tree and shrub canopy cover, and lack of D/D inventory data.

To more accurately assess the magnitude of effects, the 2013 LCAS describes first and second tier anthropogenic influences on lynx and lynx habitat. First tier influences are those with the potential to impact lynx populations and habitat, such as climate change, vegetation

management, wildland fire, and habitat fragmentation. Second tier influences are those that may impact individual lynx and result in 'take', but not necessarily impact lynx at the population level, such as incidental trapping, recreation, minerals and energy-related activities, illegal shooting, forest / backcountry roads and trails, and domestic grazing.

K-2-1.3 Wolverine

In order to assess potential effects of project activities on wolverine, modeled persistent spring snow cover was utilized (based on Copeland et al. 2010). This model uses moderate-resolution imaging spectroradiometer (MODIS), which classifies daily snow data at 500-meter spatial resolution by terrestrial pixels and measures four cover classes; snow, bare ground, cloud, and night for each year (2009-2015). The model depicts the number of years, out of seven, in which snow cover was present in the spring in selected pixels (April 24-May 15). This time frame generally corresponds to the period of wolverine den abandonment. Most dens were located in areas that were snow covered for 6-7 years out of the total seven years studied, indicating selection for den sites in areas with the highest consistent snow coverage.

The 2009-2015 spring snow layer was updated from Copeland et al. (2010) (2000-2006 data). The spatial data layer represents spring snow cover over southern Idaho, SW Montana, and NW Wyoming for the 7-year period from 2009-2015. To support the Wolverine-Winter Recreation Research Project, the temporal extent was chosen to coincide with dates in which wolverines and winter recreationists were actively monitored and also included areas that exhibited snow cover in selected pixels in years 6-7, which showed the strongest correlation with wolverine locations (Heinemeyer et al. 2017).

K-2-1.4 Northern Idaho Ground Squirrel

Northern Idaho ground squirrel (NIDGS) habitat modeling utilized in this technical report is based on parameters associated with existing and extant NIDGS from the 2007 habitat model developed for the PNF and BNF (Crist and Nutt 2007). Five parameters were utilized to predict potential NIDGS habitat: LANDFIRE Existing Vegetation Types, LANDFIRE canopy cover, landtype/soils, slope, and aspect, with landtype being the Forest Service surrogate for soils information. Cover types were originally selected (2006) to represent vegetative features in colonies, across land ownerships, and included canopy cover classes of <30 and <40 percent in selected classes. Model limitations included: no crosswalk between Forest Service landtypes between Forests, no crosswalk between Natural Resources Conservation Service (NRCS) soils across counties, and no crosswalk between NRCS soils and Forest Service landtypes.

Habitat modeling was based on querying parameters associated with existing and extant NIDGS colonies. Colony information was provided by Diane Evans Mack, Idaho Department of Fish and Game, Nongame Biologist, McCall Subregion and was current as of the end of the 2006 field season. The 2006 NIDGS Habitat Model developed by Carey Crist and Lisa Nutt, Boise National Forest, was the foundation for the 2007 version. Parameters were refined and/or updated based on findings during the 2006 field season and the availability of new data sets (i.e. LANDFIRE).

K-2-1.4.1 Model Parameters

Five parameters were used to predict potential NIDGS habitat: LANDFIRE Existing Vegetation Types (EVTs), LANDFIRE canopy cover, landtype/soils, slope, and aspect. Note that landtype is the Forest Service surrogate for soils information.

Cover types were originally (2006) selected to represent vegetative features in colonies because they are mapped across ownerships (federal and non-federal); represent current vegetation conditions as classified by the 1995 Montana LandSat Satellite Imagery; and because they are likely to be an influential factor in the ability for a NIDGS colony to occupy a site. All cover types were selected for modeling purposes if they had 10 or more pixels within a colony. As of 2007, twenty-one cover types had been identified. These included: 2010, 2020, 3100, 3110, 3180, 3210, 3350, 4101, 4206, 4207, 4212, 4230, 4270, 4280, 4300, 6110, 6120, 6210, 6310, 7300, and 7800. A problem with using cover types was that canopy cover data associated with the 1995 Montana LandSat Imagery was too coarse to be useful for modeling this species' habitat (canopy cover for cover types broken into the following classes for forest only <10 percent, 10-39 percent, 40-69 percent, >70 percent). In 2007, LANDFIRE (Landscape Fire and Resource Management Planning Tools Project) data became available to use. This is an interagency vegetation, fire, and fuel characteristics mapping project that provides coverage for existing vegetation types (EVTs) across the Boise and Payette National Forests and has a canopy cover component that classifies tree, shrub and herb cover in 10 percent intervals. The decision was made to change from cover types to EVTs so that we could use canopy cover in the model. This parameter had been identified by the Northern Idaho Ground Squirrel Technical Team in 2006 as being desired to better refine modeled habitat. There were 14 LANDFIRE EVTs that occurred in the NIDGS colonies that were selected for the model (2159, 2056, 2140, 2145, 2125, 2124, 2227, 2053, 2126, 2065, 2139, 2080, 2220, and 2182). See **Table K-2-3** for definitions of these EVTs.

The parameter for canopy cover had been eliminated from consideration in 2006 due to limitations in accurately identifying canopy closure from the LandSat imagery. However, the advent of LANDFIRE offered a means to better address these limitations so canopy cover was included as a parameter in the 2007 model. Based on NIDGS Technical Team meeting notes from 3/14/2006 that stated the model should try and screen for <30 percent tree canopy cover, the following LANDFIRE canopy cover classes were selected: 100, 101, 102, 103, 111, 112, 113, 114, 115, 116, 121, 122, 123, 124, 125, 126, 127, and 128. Note the canopy cover class of >30 and <40 percent was included in the selected classes. This is slightly higher than the recommendation from the Technical Team; however, some colonies included this level of cover.

Landtypes represent the soils classification on the Forest Service lands for the Boise and Payette National Forests. Contact with the NRCS office in Boise, Idaho was made to secure Valley County, Washington County, and Adams County soils information for private lands. Note that when NIDGS models used landtype information, it was a compilation of the landtypes that colonies occur on, in addition to the NRCS soil types that colonies occur on. A limitation of this model is that there is no crosswalk between NRCS soils across the three counties, no crosswalk between USFS landtypes between Forests, and no crosswalk between NRCS soils and USFS landtypes. This means similar soils are not detected by the model across ownerships. As a result of the different classification systems on adjacent federal and non-federal lands, a line often forms along the administrative boundary where soil types changed. Development of crosswalks to portray like soils is a needed improvement to this habitat model. By linking each county soils map and the federal landtype data we were able to create a soils layer across ownerships. There are no NIDGS colonies in Washington County and a crosswalk between the soil classification in Washington, Adams, or Valley County does not currently exist. At such time that either of these situations changes, the Washington County soils information is ready to be used in habitat modeling efforts. Landtypes included in the model are: 101-1, 101-2, 107-1, 109-1, 109-12, 109-3, 109-4, 113, 130, 130-1, 131, 131-1, 132a, 132b, 132b-1, 132c, 133a-1, 134, and 134-1. NRCS types from Adams County include: 81108, 81133, 81137, 81180, 81181, 81195, 81198, 81199, 81200, 81201, 81207, 81213, 81215, 81234, 81235, 81272, 81273, and 81297. NRCS types from Valley County include: 154145, 154150, 154156, 154157, 154158, 154164, 154175, 154183, 154186, 154192, 154194, and 154196.

Slope and aspect information was calculated across all ownerships. A review of each parameter against all known colonies was completed. We used histograms to assess the range, mean, and median of each parameter. The parameters defined in the 2006 model were substantiated (slope and aspect) and further refined (slope) based on additional colony locations from the 2006 data. A thirty percent slope parameter had been used in the first model but with the addition of newly documented colonies during the 2006 field season, greater than 75% of colony habitats were found to occur on slopes less than 12 percent. We selected a slope parameter of 15 percent or less for the 2007 model. Aspect data from the newly documented 2006 colonies substantiated the aspect parameter and there was no change from the range of 90 to 290 degrees.

K-2-1.4.2 Parameters evaluated but not selected:

Parameters that are not included in the habitat model include Payette National Forest Strata data, PVGs, cover types, and elevation.

Strata was excluded because coverage for that parameter did not exist on any ownership except the PNF and therefore restricted modeling capabilities.

PVGs were also excluded from use in modeling because most of the eleven forested PVGs occurred in NIDGS colonies and the parameter did not appear to be a sensitive enough indicator.

Cover types were originally selected to represent vegetative features in colonies because they are mapped across ownerships (federal and non-federal), represent current vegetation conditions as classified by the 1995 Montana LandSat Satellite Imagery; and because they are likely to be an influential factor in the ability for a NIDGS colony to occupy a site. As described under the selected parameter section, use of cover types with LandSat did not allow for the use of a canopy cover parameter in the model, which was desired by the NIDGS Technical Team, so cover types were replaced with LANDFIRE EVTs.

Elevation was eliminated since the summer 2005 discovery of two NIDGS colonies near the Lick Creek Lookout on the PNF at approximately 7,000 feet (2,000 feet higher than the species was thought to occur at) implies elevation may not be a limiting factor.

Table K-2-3 Crosswalk from PNF Strata Layer to Tree Size Class and Canopy Cover Class Update: 09 June 2011

Strata (PNF Strata Document 2004)		Crosswalk	
Strata	Description	Tree Size Class	Canopy Cover Class
20	Clearcuts	Sapling	Low
21	Partial Cuts –Low Stocking	Medium	Low
22	Partial Cuts – Moderate Stocking	Medium	Moderate
23	Mature/Over-mature – High Stocking	Large	High
24	Mature/Over-mature – Moderate Stocking	Large	Moderate
25	Mature/Over-mature – Low Stocking	Large	Low
26	Partial Cuts (mature/over-mature) Moderate Stocking	Large	Moderate
29	Burned Areas	G/F/S/S	<10%
30	Sapling/Poles – Natural Regeneration	Small	Variable
32	Sapling/Poles - Planted	Small	High
33	Immature/Mature – Low Stocking	Medium	Low
34	Immature/Mature – Moderate Stocking	Medium	Moderate
35	Immature/Mature – High Stocking	Large	High
41	Unsuitable – Low Stocking	Medium	Low
42	Unsuitable – Moderate to High Stocking	Large	Moderate
60	Non-Forest	-	-
61	Non-Forest – Cultivated	-	-
70	Hardwoods or High Brush	-	-
98	Water (noncensus = <40 ac or <120 ft wide)	-	-
99	Water (census = >40 ac or >120 ft wide)	-	-

Table K-2-4 Tree Size Class (2003 PNF, Forest Plan)

Size Class Group	Definition
Grass/forb/Shrub/Seedling	< 4.5 ft tall
Sapling	0.1" to 4.9" DBH
Small Trees	5.0" to 11.9" DBH
Medium Trees	12.0" to 19.9" DBH
Large Trees	>20" DBH

Table Notes:

DBH = Diameter at breast height

Table K-2-5 Canopy Cover Class (2003 PNF, Forest Plan)

Canopy Cover Group	Definition
Low	10 – 39%
Moderate	40 – 69%
High	70 % or more

* Areas with less than 10% canopy cover are considered Non-Forested

K-2-1.5 Black-backed Woodpecker

Mid-scale Modeling Update
for the
Black-backed Woodpecker
March 21, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, Boise National Forest on Detail to the Payette National Forest

The purpose of this document is to update the Black-backed Woodpecker Mid-scale Model developed for the Boise National Forest in 2009 (Nutt et al. 2009), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been ten years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the 2009 model was created and validate selected habitat parameters.

Review of New Species Literature since 2009

The Boise NF mid-scale habitat model for the Black-backed Woodpecker (BBWO) was created in 2005 and revised in 2009 (Nutt et al. 2009). This literature review of published information between 2009 and 2017 was conducted to validate whether model parameters from 2009 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Black-backed Woodpecker Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the habitat model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the “Forest Derived Product.” Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e. “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” Diameter at breast height [DBH]). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant, 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a, Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2009 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2009 model into the 2019 model.

Parameter Review Discussion

The following parameter review discussion describes the vegetation parameters used to model source habitat when under historic range of variability (HRV) conditions.

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the black-backed woodpecker. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-6**.

Table K-2-6 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan/Appendix A Range	New Vegetation Layer (2011)	Changed or New Classification
Grass/Forb/Shrub/Seedling (GFSS) (<4.5’ tall)	Seedling (<4.5’ tall)	change in name only
Sapling (1.0 – 4.9“ DBH)	Sapling (0.1 – 4.9” DBH)	
Small (5.0 – 12.0” DBH)	Small (5 – 9.9” DBH)	change
Medium (12.1 – 20” DBH)	Medium (10 – 19.9” DBH)	change
Large (>20.0” DBH)	Large (20 – 29.9” DBH)	change
	Very Large (> 30" DBH)	new

The literature describes nesting, forage, and roosting habitat to be solidly within the Medium (10-19.9” DBH) Tree Size class (Bonnot et al. 2009; Bull et al. 1986; Dudley 2007; Dudley et al. 2012; Goggans et al. 1989; Saab and Dudley 1998). The new Medium Tree Size class goes down to 10 inches DBH, two inches smaller than what the lower threshold for the Medium Classification was for the 2010 Forest Plan Amendment (12 inches DBH). This is perhaps a better fit for this species as most mean diameters were in the 10 to 14-inch range.

A few studies reported mean diameters of either nesting/foraging trees or the habitat surrounding nesting or foraging sites to be less than 10 inches. Saab and Dudley (1998) reported snags in nest stands to average > 9 inches DBH, while Goggans et al. (1989) reported a mean stem size at nest sites (0.49-ac plot around nest) of 8.0 inches DBH. Although in these instances mean tree sizes dip slightly below the Medium TSC range, inclusion of the next class lower, the Small TSC (5-9.9" DBH), would not accurately represent the larger body of information described in the literature and would overestimate source habitat for this species. Therefore, the Small TSC is not recommended for inclusion in the source habitat model.

There was a large amount of quantitative information on mean tree sizes of nest or forage trees/sites used by BBWOs and the majority reported mean diameters at the lower end of the Medium TSC as described above. However, many references also qualitatively described BBWO nesting, forage, and roosting habitat as occurring within mature or over-mature stands or containing some large living or dead tree component (Bull et al. 1986; Goggans et al. 1989; Tremblay et al. 2016; Wisdom et al. 2000[1], Hutto and Hanson 2009[1], Hoyt and Hannon 2002[1], Nappi and Drapeau 2009[1]). In some cases BBWOs also selected against young stands, logged stands, multi-storied stands (Goggans et al. 1989; Nappi and Drapeau 2009[1]). This implies that BBWOs were actually using those relatively smaller trees (at the lower end of Medium TSC) in stands that contained a large tree component. Because that qualitative description was so prevalent in the literature it is recommended that the model also includes the Large (20-29.9" DBH) and Very Large (≥ 30" DBH) tree size classes to incorporate this important habitat element.

Table K-2-7 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Medium (10-19.9" DBH), Large (20-29.9" DBH), and Very Large (>30" DBH) Tree Size classes be used to model source habitat for the black-backed woodpecker, both for within and outside the Historical Range of Variation (HRV).

Table K-2-7 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Bonnot, T., J. J. Millspaugh, M. A. Rumble. 2009. Multi-scale nest-site selection by black-backed woodpeckers in outbreaks of mountain pine beetles. Forest Ecology and Management. 259 (2009) 220-228. (South Dakota)	(Nesting and Forage) At the nest area scale, used areas averaged a lower mean DBH (x=23 cm (9 in); SE = 1.0 (0.4 in)) and contained higher densities of snags > 15 cm (6 in) DBH. (pg. 224)	Medium – 10-19.9" DBH
Bull, Evelyn L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in	(Nesting) Nests usually occurred in small diameter (<50 cm (20 in) DBH), tall (>15 m), recently dead (<5 yrs) trees.	Medium – 10-19.9" DBH

[1] Reference described in 2009 Black-backed Woodpecker Documentation of Modeling Parameters for Use in Mid- and Fine-Scale Habitat Models (Nutt et al. 2009).

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
northeastern Oregon. PNW-444 Research Note. 19 pp. (Oregon)	Mean DBH of nest trees = 37 cm (SD=21.1) (n = 15) [14.5 in]. The preference for small diameter (<50 cm (20 in) DBH) trees was unusual. This species often excavates nests in sapwood. Trees smaller than 50 cm DBH have a higher percentage of sapwood. (Forage) forage trees (live and dead) averaged 31 cm DBH ± 16 SD [12 in + 6] (n = 133 trees)	
Dudley, Jon. 2005. Home range size and foraging habitat of black-backed woodpeckers. Thesis. Boise State University. 88 p. (Idaho)	(Nesting) Black-backed Woodpeckers generally select nesting habitats that contain high densities of relatively small diameter snags and trees and various levels of log cover. (Forage) Management recommendations: Microhabitats should include 369.9 ± 27.0 snags and trees per ha of recently dead, relatively large (31.3 ± 1.4 cm [12 in + 0.6]) diameter ponderosa pine and Douglas-fir.	Medium – 10-19.9” DBH
Dudley, J. G., V. A. Saab, and J. P. Hollenbeck. 2012. Foraging-habitat selection of black-backed woodpeckers in forest burns of southwestern Idaho. The Condor. 114(2):348-357. (Idaho)	(Foraging) Foraging tree scale – mean DBH = 32.8 cm (3.4) [12.9 in (1.3)] Habitat surrounding forage tree (0.04 ha plot) =24.8 cm (1.2) [9.8 in (0.47)]	Medium – 10-19.9” DBH
(This study has two separate reports that give the same parameter information, both are listed below)	(Nesting) Mean stem size at nests sites (in 0.49-ac plot around nest) was 8.0 inches DBH (SD = 1.5, range 5-11). Mean DBH of	Medium – 10-19.9” DBH
Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Wildlife Program. Technical Report #87-3-02. 44 pp. And Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1988. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Project No. 87-3-02. 103 pp. (Oregon)	nest trees was 11.0 in (SD = 15.9, range = 40-120, n = 33). Mean nest tree height was 70 feet. (Forage) Mean DBH for forage sites in mixed conifer stands = 11.0 inches; mixed con/lodgepole stands = 10.0; Lodgepole stands = 9.0 inches. Mean DBH of trees foraged on = 15.0 inches (SD = 4.9, range 2-39, n = 340) Mean DBH of roost trees was 11.0 inches. Reported selection by radio-tagged individuals for single-story mature and old forests, and against young stands, multi-storied stands, and logged areas. Also noted that BBWOs roost in mature and over-mature sawtimber stands and avoided single storied stands of seedling, sapling, and poles, multi-storied stands, and cut stands.	

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Saab, Vicki and Jon Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas fir forests of southwestern Idaho. USDA Forest Service. Research Paper. RMRS-RP-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 17 p. (Idaho)	(Nesting) Nest trees selected by black-backed woodpeckers averaged the smallest diameter (x = 32.4 cm + 2.8 [12.7" + 1.1]) compared with other cavity nesters. Black-backed woodpeckers excavated the smallest snags available and nested in trees with light to medium decay and intact tops. Black-backed woodpeckers favored the unlogged stands. Tree densities (primarily snags) were highest at nest sites and lowest at random sites (>123 snags [>23 cm DBH] per ha; [>50 snags (>9 inches DBH per acre]).	Medium – 10-19.9" DBH
Tremblay, Junior A., Rita D. Dixon, Victoria A. Saab, Peter Pyle and Michael A. Patten. (2016). Black-backed Woodpecker (Picoides arcticus), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/bkbwoo DOI: 10.2173/bna.509. Accessed February 15, 2017.	Loss of mature and old forest stands are detrimental to the BBWO in potentially two ways (Nappi and Drapeau 2009, Tremblay et al. 2015): 1) reducing amount of suitable unburned habitats in the landscape, and 2) reducing quality of future burned stands as they would contain a greater proportion of small trees and fewer large trees for foraging and nesting. Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.	Medium – 10-19.9" DBH Large – 20-29.9" DBH Very Large >30" DBH

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover Class (CCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-8**.

Table K-2-8 Canopy Cover Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer (Tree Canopy Cover Only)

Tree Canopy Cover Class		
2003 Forest Plan/Appendix A Range	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	change
	20 – 29% (Low-Medium Tree Canopy)	change
	30 – 44% (Medium Tree Canopy)	change

Tree Canopy Cover Class		
2003 Forest Plan/Appendix A Range	**New Vegetation Layer (2011)**	**Changed or New Classification?**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	change
	60% (High Tree Canopy)	change
>70% High		

This species is associated with disturbance events such as mountain pine beetle infestations and wildfire that create areas with high densities of snags and insect prey (Dudley 2005, Tremblay et al. 2016, Wisdom et al. 2000, Hutto and Hanson 2009). Quantitative descriptions of canopy cover were limited in the literature primarily because many studies occurred in burned habitat and so canopy cover was not a factor. However, there were references that looked at BBWO use of unburned stands where mountain pine beetle infestations were the primary disturbance. Goggans et al. (1989) reported a mean canopy cover of 24 percent in uncut stands used for nesting, 40 percent for roosting habitat, and reported that in stands used for foraging canopy cover was less than 60 percent in 74 percent of stands and greater than 60 percent in 26 percent of stands. Bull et al. (1986) reported a mean canopy cover of 46 percent for nesting stands. Dudley (2005) used a study area on the Boise National Forest that contained both burned and unburned habitats, and reported that foraging males selected for stands with 70-100 percent canopy cover and avoided stands in the 10-40 percent range. Dudley (2005) also recommended that habitat patches should have canopy covers generally greater than 40 percent. In South Dakota Vierling et al. (2008) reported that out of 20 BBWO nest sites found after a fire, 11 occurred in stands that had a high (>70%) pre-fire canopy cover, 8 were in stands that had a moderate (40-70%) pre-fire canopy cover, and only one was found in stands with low (<40%) pre-fire canopy cover, indicating a preference for burned stands that had live canopy covers greater than 40 percent before the fire. These studies indicate that BBWOs can utilize a wide range of canopy covers that fall within the Low-Medium, Medium, Medium-High, and High Canopy Cover classifications.

Inclusion of the Medium-High and High Canopy Cover classes is also supported by other sources in the literature. Those studies that occurred in burned sites and didn’t report on canopy cover qualitatively described preferred habitat as having high densities of snags (Hutto and Hanson 2009, Saab and Dudley 1998, Dudley et al. 2012, Rota 2013), implying that the pre-fire stands originally had high densities of trees and likely Medium to High Canopy Covers. Another subset of studies (Bull et al. 1986; Goggans et al. 1989; Hoyt and Hannon 2002; Hutto and Hanson 2009; Nappi and Drapeau 2009; Tremblay et al. 2016; Wisdom et al. 2000) reported preference for mature or over-mature stands, which also likely had canopy cover in the upper range of classes.

While BBWO use of canopy cover in the Low-Medium and Medium classes seems to be supported in the literature, it may be somewhat of a misrepresentation of what live stand structure the species actually uses. The beetle-infested stands where many studies occurred were a result of stands developing dense conditions, which would then cause tree mortality and eventually lead to an outbreak (or wildfire) event that attracted BBWOs. The mortality in those unburned stands would likely cause canopy cover measurements to be less than what the pre-infested stand originally had, and is likely why some studies reported canopy covers that fall within the Low-Medium and Medium classes. In all cases where studies considered pre-disturbance stand conditions live canopy covers before the fire or infestation were found to be greater than 40 percent (Dudley 2005; Russell et al. 2007 ***in*** Hutto and Hanson 2009; Vierling et al. 2008). Selection of the Low-Medium and Medium Canopy Cover classes would have the potential to include stands with lower canopy covers that are within their historical range of variation that wouldn't necessarily be susceptible to stand-replacing fire or MPB outbreaks, and could result in over-estimation of source habitat. To avoid this, the Low-Medium and Medium Canopy Cover classes are not recommended for inclusion in the mid-scale model for black-backed woodpecker.

To assess source habitat, modeling would best approximate the findings of the literature by selecting for forested stands in the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-9 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover classes, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Medium-High (45-59%) and High (>60%) Canopy Cover classes is recommended for modeling black-backed woodpecker source habitat.

Table K-2-9 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Bull, Evelyn L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. PNW-444 Research Note. 19 pp. (Oregon)	Nests occurred in stands with a mean canopy closure of 46 percent.	Medium (30-44%) Medium-High (45-59%)
Dudley, Jonathan G. 2005. Home range size and foraging habitat of black-backed woodpeckers. Thesis. Boise State University. Boise, ID., 88 pp. (Boise NF, Idaho)	(Forage) As a group at the landscape scale, there was strong selection for the 70 - 100 % (high) crown closure category and strong avoidance for 10 - 40 % (low). (pg 49) Mgmt. recommendations: Moderate and high crown closures should comprise 56 ± 4.6 % of cover types in an approximate 3:2 ratio. (pg. 51)	Medium-High (45-59%) High (>60%)
	Habitat patches should be largely characterized by 40-70% and 70-100% crown closures…	

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
(This study has two separate reports that give the same parameter information) Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Wildlife Program. Technical Report #87-3-02. 44 pp. And Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1988. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Project No. 87-3-02. 103 pp. (Oregon)	(Nesting) Mean canopy closure for nests in uncut stands was 24 percent, and for nests in cut stands, 11 percent. (Forage) Canopy closure was less than 60 percent in 74 percent of the stands and greater than 60 percent in 26 percent. (Roosting) Canopy closure in 14 of 18 (78 percent) stands measured at roost sites was less than 60 percent and in 4 stands was greater than 60 percent. Mean canopy closure was 40 percent.	Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59%)
Hoyt, J.S. and S.J. Hannon. 2002. Habitat associations of black-backed and three-toed woodpeckers in the boreal forest of Alberta. Can. J. For. Res. 32: 1881-1888. (Alberta)	Black-backed woodpeckers do occupy unburned old growth forests in the northeastern boreal forests in Alberta. In 2-year post-fire habitats black-backed woodpeckers increased with increasing (tree) densities.	N/A
Hutto, R. L. and C.T. Hanson. July 9, 2009. Letter to U.S. Forest Service Regional Foresters in Regions 1, 2, 4, 5, 6, 9, and 10	Black-backed Woodpeckers select high-severity patches in areas where pre-fire canopy cover and tree density are moderate to high (Russell et al. 2007, Vierling et al. 2008). Russell et al. (2007) also found that 89% of nests were in areas where pre-fire canopy cover was 40-100%, while only 52% of non-nest random locations had 40-100% canopy cover; occurrences are positively associated with an increasing number and diameter of snags. Some data indicate that dense, old forest (unburned) with high levels of snags and downed logs, may help Black-backed Woodpeckers temporarily survive in periods without fire, or	Medium (30-44%) Medium-High (45-59%) High (>60%)
	when fires are too far away (Hoyt and Hannon 2002, Tremblay et al. 2009). Moderate and high suitability habitat for the Black-backed Woodpecker consists of large areas (72-131 ha or larger) of montane and boreal conifer forest wherein most or all trees are killed from a severe fire event (generally, 75-100% mortality) 6	

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	or fewer years earlier, and the area has not been salvage logged. The pre- disturbance forest is mature/old-growth with moderate to high canopy cover.	
Nappi, A., P. Drapeau. 2009. Reproductive success of the black-backed woodpecker (Picoides arcticus) in burned boreal forests: Are burns source habitats? Biological Conservation 142, 1381-1391. (Quebec)	Nest density and reproductive success were higher in areas with high proportions of burned mature forests than in areas dominated by burned young forests. Forest management practices that reduce the amount of mature and over-mature forests can affect the quality of post-fire habitats important to the black-backed woodpecker and other fire-associated species.	N/A
Rota, Christopher T., 2013. Not all forests are disturbed equally: Population dynamics and resource selection of black-backed woodpeckers in the Black Hills, South Dakota. Dissertation. University of Missouri-Columbia. 170 pgs. (South Dakota)	Black-backed Woodpeckers exhibited consistently high probability of using trees situated in relatively high basal area stands.	N/A
Tremblay, Junior A., Rita D. Dixon, Victoria A. Saab, Peter Pyle and Michael A. Patten. (2016). Black-backed Woodpecker (Picoides arcticus), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/bkbwoo DOI: 10.2173/bna.509. Accessed February 15, 2017.	This species is dependent on landscapes that experience regular fire and other large-scale forest disturbances. Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.	N/A
Vierling, K. T., L. B. Lentile, and N. Nielsen-Pincus (2008). Preburn characteristics and woodpecker	Out of 20 nest sites found in burned habitat, 11 occurred in high (>70% canopy cover) pre-fire canopy cover stands, 8 were in moderate (40-	Medium-High (45-59%) High (>60%)
use of burned coniferous forests. Journal of Wildlife Management 72:422–427. (South Dakota)	70%) pre-fire canopy cover stands, and only one was in low (<40% canopy cover) pre-fire canopy cover stands, indicating a preference for burned stands that had >40% canopy cover before the fire (Table 1, pg. 424).	
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the	Burned conifer forests (Caton 1996, Hoffman 1997, Hutto 1995, Marshall 1992, Saab and Dudley 1998) and other insect-infested forests (Goggans and others 1988) provide key conditions necessary for both nesting and foraging. *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	N/A

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).		

Source Habitat Conditions When Outside HRV Discussion

Black-backed woodpeckers can utilize some forested conditions that are not within the historical range of variability in PVGs 3, 4, 6, and 7. These conditions generally consist of higher densities, greater species diversity, and more complex vegetative structure than what would have developed when stands in these PVGs were experiencing historical disturbance processes. These dense conditions would also make stands more susceptible to insect infestations or stand-replacing wildfire which are important to this disturbance-dependent species. For PVGs 3, 4, 6, and 7, when functioning outside HRV, the High canopy cover class should be included when in the Medium, Large, and Very Large tree size classes.

Additional Modeling Parameters

The recommendation is to include areas that have burned within the last 5 years that are greater than 72 ha (178 acres) as an additional modeling parameter to portray black-backed woodpecker source habitat. See *Additional Modeling Parameters* section in *Black-backed Woodpecker Documentation of Modeling Parameters For Use in Mid- and Fine-Scale Habitat Models* document (Nutt et al. 2009) for the rationale in support of this parameter.

Updated Forest Modeling Parameters for Black-backed Woodpecker Source Habitat

The updated mid-scale habitat parameters for the black-backed woodpecker are as follows:

Within HRV
PVGs: 3, 4, 6, 7, 8, 9, and 10
Tree Size Class: Medium, Large*, and Very Large*
Canopy Cover Class: PVGs 3, 4, 6, and 7 =
Medium-High
PVGs 8, 9, and 10 = Medium-High and High

* Large and very large tree size classes do not occur in PVG 10

Outside HRV

PVGs: 3, 4, 6, and 7
Tree Size Class: PVGs 3, 4, 6, and 7 = Medium, Large, and Very
Large Canopy Cover Class: PVGs 3, 4, 6, and 7 = High

Additional Modeling Parameters
Areas outside of those described above that have burned within the last 5 years and are ≥72 hectares (178 acres)

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2017 Black-backed Woodpecker Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

Reference – Tremblay, Junior A., Rita D. Dixon, Victoria A. Saab, Peter Pyle and Michael A. Patten. (2016). Black-backed Woodpecker (*Picoides arcticus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/bkbwoo DOI: 10.2173/bna.509. Accessed February 15, 2017.

This species account was updated in 2016, likely due to recent research on population dynamics and relationships to different types of disturbed habitat. While no new information pertaining to tree size class and canopy cover class needs of the species were updated, the species account did mention in the Conservation and Management section that reductions in mature forest are likely detrimental to species' persistence.

Reference - Bonnot, T., J. J. Millspaugh, M. A. Rumble. 2009. Multi-scale nest-site selection by black- backed woodpeckers in outbreaks of mountain pine beetles. Forest Ecology and Management. 259 (2009) 220-228.

This study was a continuation of a previous study in the same area that looked at nesting success in forests with mountain pine beetle outbreaks (Bonnot et al. 2008). The 2008 study was reviewed for the 2009 Black-backed Woodpecker model. The 2009 study looked at characteristics of habitat around 42 known nest sites at 3 different spatial scales; territory (250 m around nest), nest area (12.5 m radius around nest), and nest tree. The study found that at the territory scale selection was based mostly on food availability (densities of trees infested with mountain pine beetle), at the nesting area scale selection was based on snag densities, and at the nest tree scale aspen and recently killed ponderosa pine were selected for. For the nest area scale, "used areas averaged a lower mean DBH (x = 22.3 cm; SE = 1.0) and contained higher densities of snags $\geq$15 cm DBH (x = 267.8 snags per ha; SE = 30.96) than available areas." The study recognized the often contradictory management goals to harvest stands to curb beetle infestations while attempting to maintain enough snag density to provide forage and nesting habitat for this species. Also had a temporal recommendation for avoiding silvicultural treatments from May 15 – July 31 to reduce direct impacts to food resources during the nesting season.

Reference - Drever, M.C. and K. Martin. 2009. Response of woodpeckers to changes in forest health and harvest: Implications for conservation of avian biodiversity. Forest Ecology and Management. 259 (210) 958-966.

This was a study that looked at correlations between species richness in forest woodpeckers and species richness of all other forest birds, theorizing that management practices that maintained or improved species richness for one group would also improve it for the other. The variables they looked at were primarily tree species and beetle-killed pine, along with harvest. These variables were fairly broad scale and the study didn't offer any nesting or forage-specific vegetation parameters that could be used for this modeling update.

Reference – Dudley, J. G., V. A. Saab, and J. P. Hollenbeck. 2012. Foraging-habitat selection of black- backed woodpeckers in forest burns of southwestern Idaho. The Condor. 114(2):348-357.

This study looked at forage habitat selection in burned forests between 6 and 8 years since the fire at three scales: foraging tree, local habitat surrounding forage tree (0.04 ha), and coarse scale (patches within home ranges 224-778 ha in size). Conclusions were based on 100 radio locations of four adult males. Overall the best model showed that black-backed woodpeckers selected both patches with dense trees and larger diameter trees. Found that fire severity was not important. For salvage logging projects recommends that large diameter snags and weakened trees be retained in clumped distribution to provide long-term foraging habitat for the species. **Table K-2-5** contains summary vegetation data at all three scales and was used to inform this modeling update. While this study was in burned habitat, the vegetation plot data was useful because it showed what size classes and tree densities woodpeckers selected for after a burn, which would need to be present pre-burn.

Reference - Fogg, A. M., L. J. Roberts, and R. D. Burnett. 2014. Occurrence patterns of Black-backed Woodpeckers in green forest of the Sierra Nevada Mountains, California, USA. *Avian Conservation and Ecology* **9**(2): 3. http://dx.doi.org/10.5751/ACE-00671-090203

This study established black-backed woodpecker location data throughout unburned portions of the Sierra Nevada Mountains, collected habitat data at the sites, and then used occupancy models to assess which parameters, if any, were selected for. Analysis found that woodpeckers selected for physiographic variables such as elevation, latitude, and aspect more than habitat structure, although there were weak associations with tree diameter, snag numbers and forest species (lodgepole). In general the study didn't offer any mid-scale parameters for tree size class and canopy cover class that could be used in this update. Recommended that even though the species is typically found in higher densities within recently burned habitat, unburned habitats should not be overlooked during conservation planning efforts for the black-backed woodpecker.

Reference – Latif, Q. S., V. A. Saab, J. G. Dudley, and J. P. Hollenbeck. 2013. Ensemble modeling to predict habitat suitability for a large-scale disturbance specialist. Ecology and Evolution. 3(13):4348- 4364.

This study used habitat suitability models with different combinations of environmental variables (burn severity, topographic slope, and pre-fire canopy cover) to predict where black-backed woodpeckers would occur on the landscape. The only parameter used in these models that was relevant to this update was the pre-fire canopy cover that was used as a proxy for stand density, although it was not clear in the discussion exactly what the parameter used was (proportion of neighborhood over 40 percent).

Reference - Nappi, A., P. Drapeau. 2009. Reproductive success of the black-backed woodpecker (*Picoides arcticus*) in burned boreal forests: Are burns source habitats? Biological Conservation 142, 1381-1391.

This study focused primarily on reproductive and nesting success of black-backed woodpeckers within a 3-year time period following burns. Relative nest success was 84% after first year, 73% after 2^{nd} year, and dropped to just 25% after the 3^{rd} year. The study also found that nest density and reproductive success were higher in areas with high proportions of burned mature forests compared to burned young forests. The authors suggested that mature and over-mature forests need to be maintained across the landscape because they likely increase the quality of post-fire habitats.

Reference – Rota, Christopher T., 2013. Not all forests are disturbed equally: Population dynamics and resource selection of black-backed woodpeckers in the Black Hills, South Dakota. Dissertation. University of Missouri-Columbia. 170 pgs.

This research looked at the role of summer wildfire, fall prescribed fire, and mountain pine beetle (MPB) infestations have in creating source habitat for the BBWO. The study compared adult survival, juvenile survival, and reproductive rates for each of these types in an effort to derive habitat-specific growth rates as a function of those underlying demographic parameters. This allowed the author to assess what roles the three disturbances had on maintaining populations of black-backed woodpeckers (whether a source or sink). The study found that population growth rates were greatest in summer wildfire burned habitat, intermediate in MPB outbreaks, and lowest in fall prescribed burns. Furthermore, MPB infestations were likely sinks and fall prescribed fire was not considered a viable substitute for summer wildfire. BBWOs showed a high probability of using disturbed trees ≥27 cm [10.6 inches] DBH in stands 27.8 m^2 basal area/ha (the mean basal area surrounding used trees). On average, trees ≥ 27 cm DBH constituted 11.1 m^2/ha (approx. 40%) of the basal area surrounding used trees. As a result, the author recommends that at least 40% of the basal area of burned patches/stands be composed of trees ≥27 cm DBH to provide for black-backed woodpecker nesting and forage habitat. Observations of foraging woodpecker showed a preference for relatively large-diameter trees, similar to findings in Dudley et al. 2012.

Reference – Rota, Christopher T., M. A. Rumble, J. J. Millspaugh, C. P. Lehman, D. C. Kesler. 2014. Space- use and habitat associations of black-backed woodpeckers (*Picoides arcticus*) occupying recently disturbed forests in the Black Hills, South Dakota. Forest Ecology and Management. 313 (2014), 161-168.

This is essentially a condensed version of the Rota (2013) dissertation above.

Reference - Rota, C. T., M. A. Rumble, C. P. Lehman, D. C. Kesler, and J. J. Millspaugh. 2015. Apparent foraging success reflects habitat quality in an irruptive species, the black-backed woodpecker. The Condor. 117 (2015), 178-191.

This study was similar to the Rota (2013) dissertation and Rota et al. (2014) paper above. This looked more specifically at forage success, which did include some habitat relationships, but only looked at very specific traits of the foraging tree such as number of insects gleaned, what degree consumed by the burn, and of course which habitat category (summer wildfire, fall prescribed fire, MPB infestation).

Found that foraging success was positively associated with the diameter of burned trees in fire-created habitats, which suggested that relatively large burned trees may be an important foraging resource for this species. However, the paper didn’t offer any specific parameters as far as what “relatively large” trees are, etc., as everything was reported in 95% confidence intervals, so there was no translation into parameters relevant to this update. Findings were, however, consistent with other studies (Dudley et al. 2012; Nappi and Drapeau 2011; Rota et al. 2014), that showed BBWOs selected for relatively large diameter trees within their home range. A guess is that ‘relatively large’ means ≥27 cm, as this was the size recommendation found in both Rota (2013) and Rota et al. (2014).

Reference - Russell, R. E., V. A. Saab, J. J. Rotella, and J. G. Dudley (2009). Detection probabilities of woodpecker nests in mixed conifer forests in Oregon. The Wilson Journal of Ornithology. 121(1):82-88.

This paper reported on detection probabilities of for nesting BBWO and hairy woodpecker. The focus was on the ability of observers to detect nests and didn't offer any habitat characteristics relevant to this modeling update.

Reference - Siegel, Rodney B., Morgan W. Tingley, Robert L. Wilkerson, Christine A. Howell, Matthew Johnson, and Peter Pyle. 2015. Age structure of black-backed woodpecker populations in burned forests. The Auk. 133(1):69-78.

This study looked at the age structure of black-backed woodpecker populations in recently burned habitats. Found that natal dispersal is the primary method that this species uses to colonized burned areas, and that breeding dispersal is uncommon. Also reported that the decline of populations 6-10 years after a burn likely is a function of the lifespan of the birds that colonized the burned area. There were no habitat indicators that would inform this model update.

K-2-1.6 Bighorn Sheep

K-2-1.6.1 Source Habitat Model

The source habitat model for bighorn sheep used in the FSEIS was originally designed by the Hells Canyon Initiative (HCI) (**Table K-2-10**). The HCI is managed by the Hells Canyon Bighorn Sheep Restoration Committee, a State, Federal, and private partnership to restore Rocky Mountain bighorn sheep in the Hells Canyon of Oregon, Idaho, and Washington. Source habitat is defined as those characteristics of macrovegetation that contribute to stationary or positive population growth, which is distinguished from habitats associated with species occurrence since such habitats may or may not contribute to long-term population persistence (Wisdom et al. 2000). The original suitable habitat model was primarily a two-component model that consisted of escape terrain and horizontal visibility. The water sources component was not used in the Payette National Forest version of this model because the criteria used in the HCI model (>3.2 kilometers [km] from a water source) encompassed every portion of the Payette National Forest. The Payette National Forest model also did not include the lambing range.

Table K-2-10 Hells Canyon Initiative bighorn sheep habitat model

Habitat Component	Criteria	Source
Escape terrain		
Slope	31° ≤slope ≤85°	Gudorf et al. 1996; Smith et al. 1991
Buffer	300 meters (m) or land areas ≤1,000 m wide bounded on ≥ sides by escape terrain (500 m)	Gudorf and Sweanor 1996; Smith et al. 1991
Minimum area	1.6 hectares (ha)	Gudorf and Sweanor 1996

Habitat Component	Criteria	Source
Horizontal visibility	Grassland, rock, open shrub, or forest cover <40%, from satellite imagery	Schirokauer 1996
Water sources	≤3.2 km	Smith et al. 1991; Gudorf and Sweanor 1996
Summer range	Suitable habitat within 300 m of escape terrain	Smith et al. 1991; Gudorf and Sweanor 1996; Schirokauer 1996
Winter range	Suitable habitat all aspects below 1,463 m; aspect 135°–225°above 1,463 m	Coggins pers. Comm;.Gudorf and Sweanor 1996; Smith et al. 1991
Lambing range	Escape terrain 45°–315° ≤1 km from water ≥2contiguous ha	Gudorf and Sweanor 1996

Table Source: Hells Canyon Bighorn Sheep Restoration Committee (1997)

The source habitat model used for the DSEIS needed several modifications for the FSEIS. First, the geographic range of the model only covered the Hells Canyon and not the entire Payette National Forest. The second issue concerned the vegetation layer used in the horizontal visibility component of the original model. The HCI model utilized vegetation supervised classification of Thematic Mapper satellite imagery, which was too broad and contained no canopy cover information, resulting in an insufficient level of detail for the vegetation data. To solve the problems of scale and detail, Payette National Forest modelers used a different vegetation dataset for horizontal visibility and included low canopy cover forested cover types. Using forested types is supported by the HCI’s cited literature but was not used by the HCI because of limitations of the supervised classification of TM satellite imagery.

The escape terrain component was found to overmap in areas that met the steepness criterion but lacked the ruggedness to make the area source habitat. To correct this problem, Payette National Forest modelers used a ruggedness ArcGIS script (Sappington et al. 2007) to create a ruggedness surface that was then overlaid with the telemetry and observation data. From this overlay, modelers created a histogram of ruggedness to determine the ruggedness cutoff point for source habitat, which was 310 or less out of a range of 0 to 3455. Adding this new criterion changed the overall amount of mapped source habitat by 2% and reduced the correlation between the source habitat and telemetry data from 92% to 90%.

The winter version of the source habitat model was also modified for the FSEIS. The original HCI model and the version used in the DSEIS restricted the habitat to southern aspects above 4,800 feet or 1,463 m, which grossly overmapped the amount of winter source habitat. However, field reviewers found that most of the areas above 1,463 m are covered by snow and therefore not suitable habitat. To overcome this problem, Payette National Forest modelers used persistent snow data (Copeland et al. 2010) and removed from winter source habitat areas above 1,463 m that were snow covered 2 or more years out of the last 7. This change in mapping dropped the amount of mapped winter source habitat by 18%; however, it only dropped the correlation between winter source habitat and winter telemetry points from 82% to 80%.

The horizontal visibility component used the vegetation dataset from the LANDFIRE project (The National Map LANDFIRE 2006), an interagency effort to map vegetation and fuels data in a consistent fashion and at a scale useful at an incident level nationally. The nonforest vegetation cover types from the HCI model were crosswalked into the LANDFIRE nonforested cover types by Payette National Forest staff. Documentation created by the HCI stated that forested cover types of less than 40% canopy cover can be used in the model; however, they were not used in the actual model because canopy cover was not included in the original supervised classification of TM satellite imagery.

Forested cover types for canopy cover ≤30% were added to the FSEIS model using LANDFIRE. The ≤30% canopy cover for forest cover type was chosen based on review by Payette National Forest staff using the 2004 National Agricultural Imagery Program (NAIP) 1-m full-color photographs. The LANDFIRE data at ≤40% canopy cover in forested types tended to map canopy covers that appeared denser than 40% cover, particularly on the east zone of the Payette National Forest. This discrepancy would have overestimated the amount of source habitat available to bighorn sheep on the eastern portion of the Payette National Forest and may have contributed to some undermapping of source habitat on the western side where the canopy covers better matched photograph images. However, underestimating the habitat in the western side of the Payette National Forest appeared to be less of an error compared to the amount that would have been overmapped in the east. This choice of using a ≤30% canopy cover was also confirmed during a season of field reviews of the habitat data.

Modelers also decided to filter the habitat model to a minimum mapping size of 2.0 hectares. The original HCI model only filtered the escape terrain component to approximately 1.6 hectares. The overall 2.0-hectare minimum mapping area filter was a more appropriate filter because of the nature of the LANDFIRE vegetation data. The final product and the forest cover type/canopy cover choices were verified with NAIP photography and on-the-ground field reviews at several locations throughout a field season.

The source habitat model used for the FSEIS was compared with over 54,000 telemetry and observation points, mainly from Hells Canyon and the Salmon River canyon; 90% of all known bighorn sheep telemetry points fell within the modeled summer source habitat and 80% fell within the winter source habitat. A final review of all source habitat model components and outcomes was completed by the IDT and accepted as adequate to fulfill the needs of this analysis. In one area, the output of the source habitat model was manually edited. In the Lost Valley area, the model was determined to be overmapping the presence of source habitat, leading to an overestimate in the risk of contact analysis. This manual change was also accepted by the IDT. Detailed information on each input and function for bighorn sheep summer source habitat in the Hells Canyon and the Payette National Forest is found in **Table K-2-11**. **Table K-2-12** shows winter source habitat for bighorn sheep in Hells Canyon and the Payette National Forest. **Table K-2-13** describes the LANDFIRE cover types.

Table K-2-11 Summer habitat model

Name	Explanation[1]
CON selection of nonforest cover types	This command creates the nonforested input for the horizontal visibility portion of the Bighorn Sheep Summer Source Habitat model. The input data is Existing Vegetation Type downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con (F:\Bighorn\Landfire\33677953\33677953 in {12, 31, 2001, 2006, 2079, 2080, 2081, 2106, 2123, 2124, 2125, 2126, 2127, 2134, 2135, 2139, 2140, 2142, 2143, 2144, 2145, 2153, 2169, 2181, 2182, 2183, 2220, 2062, 2065, 2144, 2070, 2017, 2115, 2165},1)".
CON selection of forest cover types and canopy covers	This command creates the forested input for the horizontal visibility portion of the Bighorn Sheep Summer Source Habitat model. The input data are Existing Vegetation Type and Existing Vegetation Cover downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con ((F:\Bighorn\Landfire\33677953\33677953 in {2008, 2009, 2011, 2012, 2016, 2018, 2019, 2020, 2035, 2036, 2037, 2038, 2039, 2041, 2042, 2045, 2046, 2047, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2060, 2061, 2063, 2154, 2156, 2157, 2158, 2161, 2166, 2167, 2173, 2174, 2178, 2200, 2203, 2205, 2206, 2208, 2227, 2228, 2232} and F:\Bighorn\Landfire\30745420\30745420 in {101, 102}), 1)". The canopy covers from LANDFIRE are as follows: 101, Tree Cover ≥10 and <20%; 102, Tree Cover ≥20 and <30%.
MERGE of forested and nonforest selections	This command merges the forested and nonforest components of the horizontal visibility component of the Bighorn Sheep Summer Source Habitat model. The map algebra for this command is "merge (nonforest, forest)".
Project Raster from Albers to Universal Transverse Mercator (UTM)	This command changes the projection of the combined forested and nonforested vegetation components. The LANDFIRE projection was Albers NAD83, which was projected to the local projection of UTM Zone 11 NAD83.
Region Group for minimum mapping size	This Region Group command is the first step in filtering for a minimum mapping unit. This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group.
CON selection of minimum mapping size of 5 acres	This command selects from the grouped input groups of cell 5 acres or larger. The map algebra for this command is "con (F:\Bighorn\Landfire\hor_vis_rg.count ≥23,1)".
"Slope ≥31 and ≤85 degrees" CON	This CON function selects slopes from the slope grid derived from the National Elevation Dataset elevation grid. The slopes selected are equal to or greater than 31° and less than or equal to 85° and roughness index of ≤310. This selection is as follows "C:\Projects\BHS_Final\Data\Elevations\deg_slp ≥31 AND C:\Projects\BHS_Final\Data\Elevations\deg_slp ≤85" and C:\Projects\BHS_Final\Data\Elevations\ruf_10000 ≤310.
Region Group	This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group.
CON & ZONALAREA (Single Output Map Algebra)	This command selects from the grouped input groups of cell 16000 or larger. The map algebra for this command is "con (zonalarea (slpgp) ≥16000, 1)".
CON & EUCDISTANCE LE 300 (Single Output Map Algebra)	This CON function calculates the straight line distance from the input then selects all cells ≤300 m. The map algebra for this command is "con (eucdistance (escslp) ≤300, 1)".
CON & EUCDISTANCE GT 500 (Single Output Map Algebra)	This CON function calculates the straight line distance from the input then selects all cells greater than 500 m. The map algebra for this command is "con (eucdistance (escslp) > 500, 1)".
CON & EUCDISTANCE GE 500 (Single Output Map Algebra)	This CON function calculates the straight line distance from the input then selects all cells ≥500 m. The map algebra for this command is "con (eucdistance (gt500) ≥500, 1)".

Name	Explanation[1]
CON & ISNULL (Single Output Map Algebra)	This CON function erases the "buff300" from "wi500" to create the final output for the escape terrain component. The map algebra for this function is "con (isnull (buff300), con (wi500 == 1, 1), 1)".
CON combines the two model components	This CON command combines the two model components so that on the cell and overlap from the two inputs appear in the final output.

Table Notes

1 See **Table K-2-13** for descriptions of the LANDFIRE cover types

Table K-2-12 Winter Habitat Model

Name	Explanation[1]
CON selection of nonforest cover types	This command creates the nonforested input for the horizontal visibility portion of the Bighorn Sheep Winter Source Habitat model. The input data is Existing Vegetation Type downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con (F:\Bighorn\Landfire\33677953\33677953 in {12, 31, 2001, 2006, 2079, 2080, 2081, 2106, 2123, 2124, 2125, 2126, 2127, 2134, 2135, 2139, 2140, 2142, 2143, 2144, 2145, 2153, 2169, 2181, 2182, 2183, 2220, 2062, 2065, 2144, 2070, 2017, 2115, 2165},1)".
CON selection of forest cover types and canopy covers	This command creates the forested input for the horizontal visibility portion of the Bighorn Sheep Winter Source Habitat model. The input data are Existing Vegetation Type and Existing Vegetation Cover downloaded from LANDFIRE on May 2, 2007. The map algebra command is "con ((F:\Bighorn\Landfire\33677953\33677953 in {2008, 2009, 2011, 2012, 2016, 2018, 2019, 2020, 2035, 2036, 2037, 2038, 2039, 2041, 2042, 2045, 2046, 2047, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2060, 2061, 2063, 2154, 2156, 2157, 2158, 2161, 2166, 2167, 2173, 2174, 2178, 2200, 2203, 2205, 2206, 2208, 2227, 2228, 2232} and F:\Bighorn\Landfire\30745420\30745420 in {101, 102}), 1)". The canopy covers from LANDFIRE are as follows: 101, Tree Cover ≥10 and <20%; 102, Tree Cover ≥20 and <30%.
MERGE of forested and nonforest selections	This command merges the forested and nonforest components of the horizontal visibility component of the Bighorn Sheep Winter Source Habitat model. The map algebra for this command is "merge (nonforest, forest)".
Project Raster from Albers to Universal Transverse Mercator (UTM)	This command changes the projection of the combined forested and nonforested vegetation components. The LANDFIRE projection was Albers NAD83, which was projected to the local projection of UTM Zone 11 NAD83.
Region Group for minimum mapping size	This Region Group command is the first step in filtering for a minimum mapping unit. This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group.
CON selection of minimum mapping size of 5 acres	This command selects from the grouped input groups of cell 5 acres or larger. The map algebra for this command is "con (F:\Bighorn\Landfire\hor_vis_rg.count ≥23,1)".
"Slope ≥31 and ≤85 degrees" CON	This CON function selects slopes from the slope grid derived from the National Elevation Dataset elevation grid. The slopes selected are equal to or greater than 31° and ≤85° and roughness index of ≤310. This selection is as follows "C:\Projects\BHS_Final\Data\Elevations\deg_slp ≥31 AND C:\Projects\BHS_Final\Data\Elevations\deg_slp ≤85" and C:\Projects\BHS_Final\Data\Elevations\ruf_10000 ≤310.
Region Group	This command takes the input and groups the cells based on if they touch and then gives all the touching cells the total count for that group.

Name	Explanation[1]
CON & ZONALAREA (Single Output Map Algebra)	This command selects from the grouped input groups of cell 16000 or larger. The map algebra for this command is "con (zonalarea (slpgp) ≥16000, 1)".
CON & EUCDISTANCE LE 300 (Single Output Map Algebra)	This CON function calculates the straight line distance from the input then selects all cells ≤300 m. The map algebra for this command is "con (eucdistance (escslp) ≤300, 1)".
CON & EUCDISTANCE GT 500 (Single Output Map Algebra)	This CON function calculates the straight line distance from the input then selects all cells greater than 500 m. The map algebra for this command is "con (eucdistance (escslp) > 500, 1)".
CON & EUCDISTANCE GE 500 (Single Output Map Algebra)	This CON function calculates the straight line distance from the input then selects all cells ≥500 m. The map algebra for this command is "con (eucdistance (gt500) ≥500, 1)".
CON & ISNULL (Single Output Map Algebra)	This CON function erases the "buff300" from "wi500" to create the final output for the escape terrain component. The map algebra for this function is "con (isnull (buff300), con (wi500 == 1, 1), 1)".
CON combines the two model components	This CON command combines the two model components so that on the cell and overlap from the two inputs appear in the final output.
Southern Aspects above 4,800 feet excluded	The Map Algebra expression creates a grid that masks out area above 4,800 feet that are not on southern aspect. "con ((c:\Projects\BHS_Final\Data\Elevation\large_elev le 1463.04) OR ((c:\Projects\BHS_Final\Data\Elevation\large_elev gt 1463.04) and (c:\Projects\BHS_Final\Data\Elevation\large_asp ge 135 and c:\Projects\BHS_Final\Data\Elevation\large_asp le 225)), 1)"
Perennial Snow Areas excluded	The Map Algebra expression masks out, of the southern aspect mask, areas that are covered by persistent snow. "con((win_area1 eq 1) and (pere_snow le 1),1)"
Merge winter exclusions with the escape terrain and horizontal visibility	This CON command combines the winter exclusions with the escape terrain and horizontal visibility components so that only the areas that overlap between components are the only areas in the final output.

Table Notes:

1 See **Table K-2-13** for descriptions of the LANDFIRE cover types

Table K-2-13 LANDFIRE Cover Types

No.	Type of Vegetation
12	Snow/Ice
31	Barren
2001	Inter-Mountain Basins Sparsely Vegetated Systems
2006	Rocky Mountain Alpine/Montane Sparsely Vegetated Systems
2008	North Pacific Oak Woodland
2009	Northwestern Great Plains Aspen Forest and Parkland
2011	Rocky Mountain Aspen Forest and Woodland
2012	Rocky Mountain Bigtooth Maple Ravine Woodland
2016	Colorado Plateau Pinyon-Juniper Woodland
2017	Columbia Plateau Western Juniper Woodland and Savanna
2018	East Cascades Mesic Montane Mixed-Conifer Forest and Woodland

No.	Type of Vegetation
2019	Great Basin Pinyon-Juniper Woodland
2020	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland
2035	North Pacific Dry Douglas-fir Forest and Woodland
2036	North Pacific Hypermaritime Sitka Spruce Forest
2037	North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest
2038	North Pacific Maritime Mesic Subalpine Parkland
2039	North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest
2041	North Pacific Mountain Hemlock Forest
2042	North Pacific Mesic Western Hemlock-Silver Fir Forest
2045	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
2046	Northern Rocky Mountain Subalpine Woodland and Parkland
2047	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest
2049	Rocky Mountain Foothill Limber Pine-Juniper Woodland
2050	Rocky Mountain Lodgepole Pine Forest
2051	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Wood
2052	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland
2053	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
2054	Southern Rocky Mountain Ponderosa Pine Woodland
2055	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
2056	Rocky Mountain Subalpine Wet-Mesic Spruce-Fir Forest and Woodland
2057	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
2060	East Cascades Oak-Ponderosa Pine Forest and Woodland
2061	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland
2062	Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland
2063	North Pacific Broadleaf Landslide Forest and Shrubland
2065	Columbia Plateau Scabland Shrubland
2070	Rocky Mountain Alpine Dwarf-Shrubland
2079	Great Basin Xeric Mixed Sagebrush Shrubland
2080	Inter-Mountain Basins Big Sagebrush Shrubland
2081	Inter-Mountain Basins Mixed Salt Desert Scrub
2106	Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
2115	Inter-Mountain Basins Juniper Savanna
2123	Columbia Plateau Steppe and Grassland
2124	Columbia Plateau Low Sagebrush Steppe
2125	Inter-Mountain Basins Big Sagebrush Steppe
2126	Inter-Mountain Basins Montane Sagebrush Steppe
2127	Inter-Mountain Basins Semi-Desert Shrub-Steppe

No.	Type of Vegetation
2134	Columbia Basin Foothill and Canyon Dry Grassland
2135	Inter-Mountain Basins Semi-Desert Grassland
2139	Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland
2140	Northern Rocky Mountain Subalpine-Upper Montane Grassland
2142	Columbia Basin Palouse Prairie
2143	Rocky Mountain Alpine Fell-Field
2144	Rocky Mountain Dry Turf
2145	Rocky Mountain Subalpine-Montane Mesic Meadow
2153	Inter-Mountain Basins Greasewood Flat
2154	Inter-Mountain Basins Montane Riparian Systems
2156	North Pacific Lowland Riparian Forest and Shrubland
2157	North Pacific Swamp Systems
2158	North Pacific Montane Riparian Woodland and Shrubland
2161	Northern Rocky Mountain Conifer Swamp
2165	Northern Rocky Mountain Foothill Conifer Wooded Steppe
2166	Middle Rocky Mountain Montane Douglas-fir Forest and Woodland
2167	Rocky Mountain Poor-Site Lodgepole Pine Forest
2169	Northern Rocky Mountain Subalpine Deciduous Shrubland
2173	North Pacific Wooded Lava Volcanic Flowage
2174	North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest
2178	North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest
2181	Introduced Upland Vegetation—Annual Grassland
2182	Introduced Upland Vegetation—Perennial Grassland and Forbland
2183	Introduced Upland Vegetation—Annual and Biennial Forbland
2200	Pseudotsuga menziesii-Quercus garryana Woodland Alliance
2203	Juniperus occidentalis Woodland Alliance
2205	Tsuga mertensiana-Abies amabilis Woodland Alliance
2206	Pseudotsuga menziesii Giant Forest Alliance
2208	Abies concolor Forest Alliance
2220	Artemisia tridentata ssp. vaseyana Shrubland Alliance
2227	Pseudotsuga menziesii Forest Alliance
2228	Larix occidentalis Forest Alliance
2232	Abies grandis Forest Alliance

K-2-1.7 Dusky Grouse

Mid-scale Modeling Update
for the
Dusky Grouse (Summer)
March 21, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, Boise National Forest on Detail to the Payette National Forest

The purpose of this document is to update the Dusky Grouse (Summer) Mid-scale Model developed for the Boise National Forest in 2008 (Geier-Hayes et al. 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the 2008 model was created and validate selected habitat parameters.

Review of New Species Literature since 2008

The Boise NF mid-scale habitat model for the Blue Grouse (summer) was created in 2005 and revised in 2008 (Geier-Hayes et al. 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Dusky Grouse (summer) Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the "Forest Derived Product." Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of

many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e. “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (Redmond et al. 1998; USDA Forest Service 2003a). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the Blue Grouse (summer). No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-14**.

Table K-2-14 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A Range	New Vegetation Layer (2011)	Changed or New Classification?
Grass/Forb/Shrub/Seedling	Seedling (<4.5' tall)	**change in name only**
Sapling (0.1 – 4.9 " DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large ($\geq$ 30" DBH)	**new**

Blue grouse (BLGR) nest on the ground and forage on seeds, berries, and insects. In the spring and summer BLGR utilize lush forbs and grasses for both food and concealment of nests and early broods until these food and cover sources begin to dry up, after which they gradually move into more woody shrub and tree habitats. Areas of homogenous grass are generally avoided (Cade and Hoffman 1990).

While use of herblands, grasslands, and shrublands (mountain mahogany, choke-cherry, serviceberry, rose, bitterbrush, sagebrush) is commonly described as summer habitat, use of these habitats primarily occurs when they are within or adjacent to forested stands, typically within open ponderosa pine or Douglas fir habitat types (Cade and Hoffman 1993; Caswell 1954; Mussehl et al. 1963, Pelren and Crawford 1999; Stauffer and Peterson 1986; Wisdom et al. 2000). For example, Mussehl et al. (1963) found broods in the Judith Mountains of Montana primarily in bunchgrass-balsamroot-low shrub adjacent to coniferous forest and that broods in the Bitterroot area ranged across the bunchgrass-balsamroot types into semi-open ponderosa pine stands. Mussehl et al. (1963) also stated that broods were more often found within 50 yards of shrub or tree cover. Beer (1943) noted that BLGR moved to lower elevations in the spring (March and April) where there are openings in the forest suitable for rearing young, and Popper et al. (1996) reported that 23 of 25 radio-collared birds used summer daytime roosts within 50 meters of suitable roost trees, indicating a presence of some kind of forested overstory.

Wisdom et al. (2000) described BLGR summer source habitat as contrast habitat that occurs on the interface between forest and openings and generally at lower elevations than in winter. These openings, whether natural or created by harvest or fire, can develop an inter-mix of herb, shrub, and/or seedling vegetation that provides cover and forage for BLGR, and yet are still within the larger matrix of a later seral forest.

While few literature sources discussed specific tree size class preferences for BLGR summer habitat, much of the literature generally characterizes summer nesting and roost habitat as having a tree component. However, there is no indication of a preference for any given size class. Within the recommended PVGs (1, 2, and 5), seral or climax shrubs or some residual live conifers were likely present in all growth stages under the historical fire regime. Therefore, all tree size classes have the potential to provide the herb, shrub, and tree contrast habitats described in the literature and should be included in the source habitat model.

Table K-2-15 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Seedling (4.5' tall), Sapling (0.1-4.9" DBH), Small (5-9.9" DBH, Medium (10- 19.9" DBH), Large (20-29.9" DBH), and Very Large (> 30" DBH) Tree Size classes be used to model summer source habitat for the Blue Grouse.

Table K-2-15 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Beer, J. 1943. Food habits of the blue grouse. Journal of Wildlife Management. Vol. 7(1): 32-44	Blue grouse are found mainly in the "Douglas-fir belt". During the last of March and in April the blue grouse leave their winter homes in the firs on the high ridges and migrate to lower country where the snow has melted and there are **openings in the forest** suitable for rearing the young.	---
Cade, B.S.; Hoffman, R.W. 1993. Differential migration of blue grouse in Colorado. The Auk 110(1): 70-77. (Colorado)	Summer--breeding areas: open coniferous, aspen, mountain-shrub.	---
Caswell, E.B. 1954. A preliminary study on the life history and ecology of the blue grouse in west central Idaho. Master's Thesis, Moscow, ID: University of Idaho, University of Idaho Graduate School. 105 pages (Central Idaho)	Solid stands of Douglas-fir on north slopes were not used as heavily as **more open stands or small dense** stands on other aspects.	---
Mussehl, T.W. 1963. Blue grouse brood cover selection and land-use implications. Journal of wildlife management. 27(4): 547-555.	A key component was the mosaic of various lifeforms, which provided a high degree of concealment. Broods were most often found within **50 yards of shrub or tree cover**. As the chicks matured, woody cover became more important for resting, feeding on berries, and escape. Broods in the Judith Mountains were found primarily in bunchgrass-balsamroot-low shrub **adjacent to coniferous forest**. Broods in the Bitterroot area ranged across much more area from the bunchgrass-balsamroot into the semi-open **ponderosa pine stands**.	---

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Pelren, Eric C. and Crawford, John A. (1999) "Blue Grouse nesting parameters and habitat associations in northeastern	"Blue Grouse in northeastern Oregon frequently nest in parkland habitats," suggesting **open forested** conditions.	---
Oregon," *Great Basin Naturalist*: Vol. 59: No. 4, Article 9. (northeastern Oregon)		
Popper, Kenneth J.; Pelren, Eric C.; and Crawford, John A. (1996) "Summer nocturnal roost sites of Blue Grouse in northeastern Oregon," *Great Basin Naturalist*: Vol. 56: No. 2, Article 11. (Northeastern Oregon)	Twenty-three of 25 radio-equipped birds were within 50 m of potentially useful **roost trees**. During daytime, radio-equipped birds were seldom located in trees (<1% of 614 observations, July-August 1991 through 1993; E. Pelren unpublished data). However, almost all birds flushed during the day landed in trees, and conifer needles were found in crops of birds taken from the study area in August and September 1981 and 1982 (Crawford et al. 1986). These descriptions of roost habitat indicate that there is a forested component of BLGR summer habitat.	---
Stauffer, D.F.; Peterson, S.R. 1986. Seasonal microhabitat relationships of blue grouse in southeastern Idaho. Great Basin Naturalist. Vol. 46(1): 117-122. (Southeastern Idaho)	Habitats are open, but the presence of some trees indicates that **areas with at least some taller cover were preferred**. Mountain mahogany sites were used spring through autumn and had the highest tree cover of all "open" sites. Blue grouse selected sites within the mixed shrub type that had **higher than average woody cover of small trees and shrubs**. In the maple vegetation type, percent coniferous cover and deciduous cover was lower at sites used in the spring, than summer. Blue grouse selected sites with relatively high herbaceous cover. **Clumps of small trees and shrubs may enhance brood habitat** by providing nesting sites and site protection.	Sapling (0.1 – 4.9" DBH) Small (5-9.9" DBH)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management	Spring and summer habitats are generally at lower elevations than winter. In the summer, blue grouse uses contrast habitats that occur on the interface between forest and openings, particularly **forest and open shrubby areas**. Source habitat in summer includes **all forested vegetation stages except stem exclusion** in the following covertypes: Interior Douglas-fir, Interior Ponderosa pine, and	All Tree Size Classes

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	Western Larch; all stages in Aspen; all stages in Chokecherry-serviceberry-rose, Antelope bitterbrush, and Wheatgrass. Source Habitat from Appendix 1, Volume 3, Table 1, pages 437-440 Cover types/structural stage for summer: Interior Douglas-fir, Western Larch, Interior Ponderosa pine/old multi-story, old single-story, unmanaged young multi- story, managed young multi-story, understory re-initiation, stand initiation. Aspen/old multi-story, unmanaged young, managed young, understory re- initiation, stem exclusion closed canopy, stand initiation; Chokecherry- serviceberry-rose/open tall shrub, open low-medium shrub, closed low-medium shrub; Antelope bitterbrush/closed low-medium shrub; Wheatgrass/closed herbland.	

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-16**.

Table K-2-16 Tree Canopy Cover Class Differences Between 2003 Forest Plan Appendix A and New 2011 Vegetation Layer

Tree Canopy Cover Class		
2003 Forest Plan Appendix A Range	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

Most of the literature describes “open” forest or the herb/shrub-interface as important for summer nesting, young rearing, and forage habitat for this species (Stauffer and Peterson 1986, Wisdom et al. 2000, Cade and Hoffman 1993, Beer 1943, Caswell 1954, Pelren and Crawford 1999). These open or edge conditions are typically associated with some level of overhead tree canopy. Mussehl (1963) stated that a key component of summer habitat is the mosaic of various life forms, including the interface between forest and openings, which provides a high degree of concealment. This kind of mosaic commonly occurs in the lower range of tree canopy covers. Stauffer and Peterson (1986), a study in southeastern Idaho, reported mean tree canopy covers for four open vegetation types of 8 percent (sagebrush), 37 percent (mountain mahogany), 8 percent (mixed shrub), and 24 percent (maple), percentages which included both coniferous and deciduous trees. The values from this study and the many qualitative descriptions noted above support inclusion of the Low and Low-Medium Tree Canopy Cover Classes. These classes would allow ample light to reach the ground, necessary for development of the herb and shrub layer, and would maintain the overstory tree canopy structure which is important for overhead concealment and shade, especially towards the end of summer when forbs and grasses become desiccated. Inclusion of the Medium tree canopy cover class, especially the upper end, would not likely be open enough to develop dense herb and shrub components, and as a result, is not recommended for inclusion in the model.

To assess source habitat, modeling would best approximate the findings of the literature by selecting for forested stands in the Low (10-19%) and Low-Medium (20-29%) Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-17 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Low (10-19%) and Low-Medium (20-29%) Tree Canopy Cover classes is recommended for modeling Blue Grouse (Summer) source habitat.

Table K-2-17 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Zwickel, Fred C. and James F. Bendell. (2005). Dusky Grouse (Dendragapus obscurus), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/dusgro DOI: 10.2173/bna.15a Accessed on April 12, 2017.	Nest sites are extremely variable but almost always on ground. May be on recent burns with little cover (Figure 33) and in virtually all community types occupied in breeding season. Most nests have overhead cover (Caswell 1954), but a single dead twig may suffice. Among 612 nests, <2% had no overhead cover (Zwickel and Bendell 2004). On breeding range, territorial males feed mainly within confines of their territories. Those with arboreal song-posts tend to feed within trees from which they sing. In spring, hens may be attracted to clearings for foraging. Hens with young broods often select open areas, often mesic sites with lush vegetation, perhaps owing to insect abundance (Wing 1947, Mussehl 1963a). In mid to late summer, broods, especially, may move to more mesic sites or those with greater canopy cover as	---

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	vegetation in open areas desiccates (Marshall 1946 , Zwickel 1973).	
Stauffer, D.F.; Peterson, S.R. 1986. Seasonal microhabitat relationships of blue grouse in southeastern Idaho. Great Basin Naturalist. Vol. 46(1): 117-122. (Southeastern Idaho)	Habits are **open**, but the presence of some trees indicates that areas with at least some taller cover were preferred. Table 2, pg. 119. – Mean tree canopy cover for 4 open vegetation types were **8%** (sagebrush), **37%** (mnt. mahogany), **8%** (mixed shrub), and **24%** (maple). These values reflect both coniferous and deciduous trees. These open types provide suitable habitat for hooting by male blue grouse. Lewis (1961) reported **tree cover of 6.6%** and canopy height of 3.3 m at hooting sites on Vancouver Island. In Montana, Martinka (1972) found a **tree crown cover of 30%** at male display sites and Maestro (1971) noted that breeding blue grouse preferred areas of **41%-50% tree cover** in Utah.	Low (10-19%) Low-Medium 20-29%) Medium (30-44%)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	In the summer, blue grouse uses **contrast habitats** that occur on the **interface between forest and openings**, particularly forest and open shrubby areas. Most often found in areas with **a high abundance of shrubs** used for cover and foraging. This includes shrubby areas that have developed post-fire or from other management activities that create **early seral shrub conditions adjacent to later seral forest stages.** *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	---

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Mussehl, T.W. 1963. Blue grouse brood cover selection and land-use implications. Journal of wildlife management. 27(4): 547-555.	Relatively **high canopy coverage** was a physical requirement of herbaceous cover. JF: *Moderate or high tree canopy cover would not provide enough sunlight to the ground to develop high herbaceous or shrub cover.* This study found that high herbaceous cover was more important to early brood concealment than shrub or	---
	tree vegetation and didn't mention tree canopy cover at all, but also reported that young were most often found within 50 yards of brush or tree cover, or both, indicating that there was a tree canopy component to brood rearing habitat.	
Cade, B.S.; Hoffman, R.W. 1993. Differential migration of blue grouse in Colorado. The Auk 110(1): 70-77. (Colorado)	Summer--breeding areas: **open coniferous**, aspen, mountain-shrub. **Open habitats** used for breeding occurred at lower elevations than wintering habitats.	---
Beer, J. 1943. Food habits of the blue grouse. Journal of Wildlife Management. Vol. 7(1): 32-44	During the last of March and in April blue grouse leave their winter homes in the firs on the high ridges and migrate to lower country where the snow has melted and there are **openings in the forest** suitable for rearing the young. Animal food made only 1.7 percent of the adult diet, but is very important to the young grouse. It is probably for this reason that the blue grouse **usually nest in the open** where there is an abundant supply of insects.	---
Caswell, E.B. 1954. A preliminary study on the life history and ecology of the blue grouse in west central Idaho. Master's Thesis, Moscow, ID: University of Idaho, University of Idaho Graduate School. 105 pages (Central Idaho)	Solid stands of Douglas-fir on north slopes were not used as heavily as **more open stands** or small dense stands on other aspects.	---

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Pelren, Eric C. and Crawford, John A. (1999) "Blue Grouse nesting parameters and habitat associations in northeastern Oregon," *Great Basin Naturalist*: Vol. 59: No. 4, Article 9. (northeastern Oregon)	"Blue Grouse in northeastern Oregon frequently nest in **parkland habitats**," suggesting **open forested** conditions.	Low (10-19%) Low-Medium 20-29%) (*inferred from "parkland habitats" description*)

Source Habitat Conditions When Outside HRV Discussion

None

Additional Modeling Parameters

None.

Model Limitations

This species is documented in the literature as being a contrast species, requiring the juxtaposition of habitats used for foraging and concealment. This juxtaposition occurs from the adjacency of non-forest cover types and forested PVGs or from the arrangement of successional community types within PVGs. The model cannot take this need for juxtaposed habitats into account and therefore will overestimate the amount of source habitat for this species.

Updated Forest Modeling Parameters for Blue Grouse (Summer) Source Habitat

The updated mid-scale habitat parameters for the Blue Grouse (Summer) are as follows:

Within HRV
PVGs: 1, 2, 3, 5, and 6
Tree Size Class: Seedling, Sapling, Small, Medium, Large, and
Very Large Tree Canopy Cover Class: Low and Low-Medium

Note: This species is documented in the literature as being a contrast species, requiring the juxtaposition of habitats used for foraging and concealment. This juxtaposition occurs from the adjacency of non-forest covertypes and forested PVGs or from the arrangement of successional community types within PVGs. The model cannot take this need for juxtaposed habitats into account and therefore will overestimate the amount of source habitat for this species.

Source habitat is defined by those characteristics of macro-vegetation *that contribute to stationary or positive population growth*.

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 Blue Grouse (Summer) Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

The literature search found no new references more recent than 2008 that pertained to habitat preferences. A summary of relevant habitat information from *The Birds of North America* online account was also included because it is a good synthesis of all available habitat information for this species.

Reference – Zwickel, Fred C. and James F. Bendell. (2005). Dusky Grouse (*Dendragapus obscurus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/dusgro DOI: 10.2173/bna.15a

Accessed on April 12, 2017.

The following excerpts from the Birds of North America (BNA) online account are pertinent to this update:

Nesting

Almost certainly variable, but little direct study. Sites range from coastal old-growth forest (humid sites) to xeric shrub/steppe (hot, dry sites), to subalpine habitats (cold sites).

Extremely variable but almost always on ground; 2/620 on stumps. May be on recent burns with little cover (Figure 33) and in virtually all community types occupied in breeding season. Most nests have overhead cover (Caswell 1954), but a single dead twig may suffice. Among 612 nests, <2% had no overhead cover (Zwickel and Bendell 2004).

Foraging

From Wing et al. 1944 , Armleder 1980 , Bendell and Elliott 1967 , and others as noted. On breeding range, territorial males feed mainly within confines of their territories. Those with arboreal song-posts tend to feed within trees from which they sing. In spring, hens may be attracted to clearings for foraging. Hens with young broods often select open areas, often mesic sites with lush vegetation, perhaps owing to insect abundance (Wing 1947 , Mussehl 1963a). In mid to late summer, broods, especially, may move to more mesic sites or those with greater canopy cover as vegetation in open areas desiccates (Marshall 1946 , Zwickel 1973).

The following reference from 1999 was also used to inform this model update but was not referenced in the original 2008 model, even though it would have been available at the time.

Reference - Pelren, Eric C. and Crawford, John A. (1999) "Blue Grouse nesting parameters and habitat associations in northeastern Oregon," *Great Basin Naturalist*: Vol. 59: No. 4, Article 9.

This study looked at nesting habitat characteristics in northeastern Oregon. The study collared 27 blue grouse hens and followed them from spring 1992 through spring 1997. Mean hatch date was May 31. While there were no relationships found between nesting success and hatch date or habitat parameters, there was a relationship detected for the presence of overhead logs. All ten nests that were under logs were successful, whereas only 10 of 17 nest that didn’t have overhead structure were successful. This was the only habitat feature that was related to nesting success. There were no quantitative parameters given to use for this model update, as nesting habitat was highly variable, but the researchers reported qualitatively that blue grouse in this study frequently nest in **parkland habitats**,” suggesting **open forested** conditions.

K-2-1.8 Boreal Owl

Mid-scale Modeling Update
for the
Boreal Owl
March 21, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, Boise National Forest on Detail to the Payette National Forest

The purpose of this document is to update the Boreal Owl Mid-scale Habitat Model developed for the Boise National Forest in 2009 (Nutt et al. 2009), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been ten years since the original mid-scale species model for the Boise National Forest’s modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2009 model was created and validate selected habitat parameters.

Review of New Species Literature since 2010

The Boise NF mid-scale habitat model for the Boreal Owl was created in 2005 and last revised in 2009 (Nutt et al. 2009). This literature review of published information between 2009 and 2017 was conducted to validate whether model parameters from 2009 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Boreal Owl Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the “Forest Derived Product.” Forest Derived Products are Forest-level updates of the contractor provided

maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e. “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant, 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a, Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2009 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2009 model into the 2019 model.

Parameter Review Discussion

PVG Discussion

No new information was found during the literature review. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-18**.

Table K-2-18 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (1.0 – 4.9 " DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (> 30" DBH)	**new**

Table K-2-19 shows the crosswalk between Tree Size Class parameters found in the literature and the new Tree Size Class breakouts.

Hayward et al. 1993 and Hayward 1994 appear to be only sources from which modeling parameters can be drawn from, and both papers essentially represent the same study. Hayward 1994 was used as the primary source for this exercise because it summarized findings and offered additional information on roosting habitat parameters. Several other later papers mention data and results from Hayward 1994, but none offer any new details on boreal owl nesting, roosting, or foraging habitat specifics, including tree size preferences. Many sources also mention mature or old forest but don't quantify what that means (Hayward 1997, Hayward and Hayward 1993, Wisdom et al. 2000). There is no question that the literature still supports including the Large Tree and Very Large size classes for modeling nesting and forage habitat. However, inclusion of the Medium Tree size class needs revisited due to the slight expansion of this class down to 10 inches DBH from the original 12.1 inches DBH. The Medium Tree size class is now 10-19.9 inches DBH.

Characterizations of study parameters from Hayward 1994c described the area surrounding documented winter roosting sites as having approximately 67 trees per acre (tpa) for trees over 9 inches DBH, 84 tpa for trees over 9 inches DBH at summer roosting sites, and 23 (±6.5) tpa for trees greater than 15 inches DBH at nesting sites. These habitat parameters indicate the importance of the medium tree component within Boreal Owl nesting and roost/forage[2] habitat. In addition, some references suggest that a complex or multi-layered canopy is important for nesting habitat (Hayward et al. 1993; Hayward 1994c; Wisdom et al. 2000; Groves et al. 1997). Medium Tree size class stands often have multi-layered canopies with larger trees mixed in that could provide snag recruitment for nesting structures.

It is recommended that Medium (10 – 19.9" DBH), Large (20 – 29.9" DBH), and Very Large ((> 30" DBH) Tree Size classes be used to model source habitat for the boreal owl, both for within and outside the Historical Range of Variation (HRV).

Table K-2-19 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Hayward, Gregory D. 1994c. Review of technical knowledge: Boreal owls. In: Hayward, G.D.; Verner, J., tech. eds. 1994. Flammulated, boreal, and great gray owls in the United States: a technical conservation assessment. Gen. Tech. Rep. RM-253. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 92-127.	(nesting) Density of trees at nest site = 398 + 162 trees/ha for trees 2.5-23 cm DBH translates to 161 + 66 tpa for trees 1-9" DBH. Nest sites averaged 57 (+16) trees/ha over 38 cm DBH (nesting) = 23 (+6.5) tpa over 15 in. DBH (roosting/forage) 430 roosts from 24 collared owls winter roosts - 1,620 trees/ha with trees 2.5-23 cm and 165 trees/ha >23.1 cm translates to 656 tpa with trees 1-9" DBH and 67 tpa for trees > 9" DBH Summer roosts - 2,618 trees/ha with trees 2.5-23 cm and 208 trees/ha > 23.1 cm translates to 1,060 tpa with trees 1-9" DBH and 84 tpa for trees > 9" DBH.	Medium – 10-19.9" DBH Large – 20-29.9" DBH Very Large - > 30" DBH

[2] Hayward 1994c noted that while forage habitat data was very limited in their study, they were able to document many roost sites, and that roost sites likely represented the end of the previous night's foraging activity. As a result, the area around the roost site could be used to characterize forage habitat.

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Hayward, Greg D., P.H. Hayward and E.O. Garton. 1993. Ecology of boreal owls in the northern Rocky Mountains. Wildlife Monographs. 124: 1-59.	This paper was the original study publication, but didn't summarize the findings pertaining to tree size as thoroughly as Hayward 1994c. Around nest sites density of trees larger than 23.1 cm **(9")** DBH averaged 212 ± 86/ha, or **86 ± 35 tpa** Qualitative descriptions of habitat such as "Nest sites restricted to mature and old forest stands with complex physical structure." and "best foraging habitat was associated with older spruce-fir stands."	Medium – 10-19.9" DBH Large – 20-29.9" DBH Very Large - ≥ 30" DBH

K-2-1.8.1 Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-20**.

Table K-2-20 Canopy Cover Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer (Tree Canopy Cover Only)

Tree Canopy Cover Class		
2003 Forest Plan Appendix A Range	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

The study by Hayward et al. 1993 (also Hayward 1994c) is the only source that quantitatively describes nesting and roosting/foraging habitat parameters for the boreal owl. In this study they describe the area around nest sites as having roughly 30 percent canopy cover for trees with heights greater than 8 meters in the canopy (Table 4, page 24). However, this is not the total canopy cover. If all of the canopy cover values for each canopy layer are added, the total canopy cover would be 79%, although this does not take into account crown overlap. Regardless, total canopy cover would still be substantially more than the 30 percent value for just the dominant canopy layer. Hayward et al. (1993) also found that within the 0.1-acre plot surrounding 19 nest sites canopy cover averaged 55 percent +/- 7.7, solidly within the Medium-

High tree canopy cover class (TCCC). The study also described the area surrounding winter roost sites (0.1- acre plot) with roughly 58 percent canopy cover, at the high end of Medium-High TCCC, and summer roost sites with 63 percent canopy cover, within the High TCCC.

Selecting forested stands in the Medium-High (45-59%) and High (≥ 60%) Tree Canopy Cover classes is recommended for modeling boreal owl source habitat, both within and outside HRV. The Medium Tree Canopy Cover Class was not selected because it would likely overestimate suitable habitat at this modeling scale.

Table K-2-21 below shows the crosswalk between Tree Canopy Cover class parameters found in the literature and the new Tree Canopy Cover class breakouts by reference.

Table K-2-21 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Hayward, Gregory D. 1997. Forest management and conservation of boreal owls in north America. J. Raptor Research 31(2): 114-124.	"In Idaho forest structure at summer roost sites had a high canopy cover…"	>=60% (High)
Hayward, Greg D., P.H. Hayward and E.O. Garton. 1993. Ecology of boreal owls in the northern Rocky Mountains. Wildlife Monographs. 124: 1-59.	Central Idaho Study – Frank Church RNRW From Table 4, page 24 (n=33) – Nest and calling sites averaged **30% (±4.3)** overstory (>8m above ground) canopy cover (not actual canopy cover but cover of upper canopy). From Table 5, page 25 – Average canopy cover for areas around 19 nest sites in FCRNR Wilderness was **55% ± 7.7**. (area measured was 0.1- acre) From Table 7, page 27 - Forest stands used for winter roosts (n=189) averaged **58.5% (±1.91) canopy cover**. Summer roosts (n=241) averaged **63.5% (±1.54) canopy cover**. (area measured was a tenth- acre plot surrounding roost site)	45 – 59% (Medium-High) >=60% (High)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Hayward, Gregory D. 1994c. Review of technical knowledge: Boreal owls. In: Hayward, G.D.; Verner, J., tech. eds. 1994. Flammulated, boreal, and great gray owls in the United States: a technical conservation assessment. Gen. Tech. Rep. RM-253. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 92-127.	Same as Hayward et al. 1993	45 – 59% (Medium-High) >=60% (High)

K-2-1.8.2 Updated Forest Modeling Parameters for Boreal Owl Source Habitat

The updated mid-scale habitat parameters for the boreal owl are as follows:

Within HRV
PVGs: 3, 4, 7, 8, 9, and 11
Tree Size Class: Medium, Large, and Very Large
Canopy Cover Class: PVGs 3, 4, 7, and 11 = Medium-High
PVGs 8 and 9 = Medium-High and High

Outside HRV
PVGs 3, 4, 7, and 11
Tree Size Class: Medium, Large, and Very
Large Canopy Cover Class: High
Additional Modeling Parameters
Parameters described above at >= 5,000 feet elevation

K-2-1.8.3 New Literature Sources

Below is a list of all new literature reviewed for this 2019 Boreal Owl Mid-scale Model Update that was not already used in the original modeling paper *Boreal Owl Documentation of Modeling Parameters for Use in Mid- and Fine-Scale Habitat Models, Boise National Forest* (Nutt et al. 2009). Some references that were reviewed did not provide useful habitat information but are listed below to inform the next literature review and/or model update and to document the entire literature review process.

The results of the literature review completed by the Payette National Forest for this species in 2015 for its modeling update was used for this update in order to avoid duplicating efforts. Only one reference, summarized below, was listed in their review. I was not able to access this reference when finalizing this modeling update document due to a problem with the reference's web site.

Reference - Niemi, G. J. 2015. Boreal Owl: Its habitat and prey in the Superior National Forest. Final Report to USDA/Forest Service, Superior National Forest.

Study in Minnesota. Notes "A secondary cavity nester (Mikkola 1983), the Boreal Owl is dependent on species such as the Pileated Woodpecker (*Dryocopus pileatus*) and Northern flicker (*Colaptes auratus*) and forest processes (e.g., pathogens and forest insects) that create and maintain large cavity trees (Hayward 1997)."

K-2-1.9 Fisher

Mid-scale Modeling Update
for the
Fisher
April 3, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, Boise National Forest on Detail to the Payette National Forest

The purpose of this document is to update the Fisher Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Nutt et al. 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid-scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

<u>Review of New Species Literature since 2008</u>

The Boise NF mid-scale habitat model for the Fisher was created in 2005 and last revised in 2008 (Nutt et al. 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Fisher Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the “Forest Derived Product.” Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e. “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a, Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

The following parameter review discussion describes the vegetation parameters used to model source habitat when under historic range of variability (HRV) conditions.

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the fisher. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-22**.

Table K-2-22 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (1.0 – 4.9 " DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (≥ 30" DBH)	**new**

Fisher use a variety of forest age classes, stand densities, and structure for denning, resting, and foraging activities throughout the year. Jones (1991) conducted a study in north-central Idaho on the nearby Nez Perce National Forest, and because it is the still the most comprehensive local work to date in the vicinity of the Boise National Forest, it provides the basis for habitat parameters used in this mid-scale model update. The study characterized the complexity of fisher habitat use which was presented in the context of summer and winter habitat.

In summer, mature and old growth forests made up 92 and 74 percent of resting and hunting sites, respectively, and non-forest and pole-sapling types were avoided. These older stands had more large diameter trees (>18.5 inches DBH), snags (13.5 – 20.5 inches DBH), and logs (13.5 – 21.5 inches DBH) relative to available habitat, and would be well represented by the Medium, Large, and Very Large Tree Size classes.

In winter fisher preferred younger stands mostly for hunting and in some cases resting. However, even though these stands were classified as young forest they contained remnant large trees and snags commonly associated with older forests, and fisher sought this large structure out within these younger stands. These stands had a higher availability of live trees greater than 18.5 inches DBH, snags greater than 20.5 inches, and logs greater than 18.5 inches DBH than surrounding habitat. Most denning also occurred in winter. Large logs used for dens had a median diameter (at the small end) of 21 inches.

While young stands were generally preferred in winter, mature and old growth forests were also used for resting sites presumably for their thermal cover value and potentially firmer snow conditions (for better mobility). Similar to summer habitat, stands with the preferred large structure used in winter would also fit well into the Medium, Large, and Very Large Tree Size classes.

Other studies in Idaho, Montana, California, Washington, and British Columbia also characterize fisher habitat as requiring medium and large diameter live trees, snags, and logs (Schwartz et al. 2013, Purcell et al. 2009, Zielinski et al. 2004, Aubrey et al. 2013, Wisdom et al. 2000). While some of these studies may have included Coastal habitats or were in areas that typically have trees species and conditions that grow larger trees than what's available in Central Idaho (many of the California and Washington studies), they were included because they show the preference of this species for large trees, especially for resting and denning, and in nearly every case fishers used larger structure than what was available. As a result, it is recommended that the Medium, Large, and Very Large Tree Size classes be used to model fisher source habitat.

Table K-2-23 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Medium (10-19.9" DBH), Large (20-29.9" DBH) and Very Large (> 30" DBH) Tree Size classes be used to model source habitat for the fisher, both for within and outside the Historical Range of Variation (HRV).

Table K-2-23 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Jones, Jeffrey L. 1991. Habitat use of fisher in north-central Idaho. M.S. Thesis. Univ. of Idaho, Moscow. 146 pp. *(Jones and Garton (1994) was developed from this reference)* (Idaho)	(Summer Habitat) During summer**, mature and old growth forests** occupied 92 percent and 74 percent of **resting and hunting** sites, respectively. Old growth was characterized by dense canopies, high densities of large diameter trees, snags and logs, high coniferous understory cover, and moderate deciduous understory cover. Fisher selected **mature to old-growth** grand fir **forests in summer**; particularly those with a relatively high composition of pacific yew, moderate to large-diameter spruce, and large diameter Douglas-fir. These stands had more large-diameter trees (>47 cm or	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	18.5 inches DBH), snags (34.3-52.1 cm or **13.5-20.5 inches DBH**), and logs (34.3-54.6 cm or **13.5-21.5 inches DBH**) relative to available habitat. Summer habitat had significantly less 11.4-21.6 cm (4.5 to 8.5 inches) DBH grand fir and 11.4-47.0 cm (4.5 to 18.5 inches) DBH lodgepole and ponderosa pine when compared to random sites. (Winter Habitat) For 39 observations during winter, young forests were preferred, whereas they were avoided in summer. These stands had a higher availability of trees >47 cm (**18.5 inches**) DBH, snags >52.1 cm (**20.5 inches**) DBH, and logs >47.0 cm (**18.5 inches**) DBH relative to plots 50 m away. Large logs were used as temporary **dens** in winter. Even though sites were classed as young forest, they contained characteristics commonly associated with older forests (47.0-62.2 cm (**18.5 to 24.5 inches**) DBH trees exceeding 27.2/ha and 34.3-52.1 cm (**13.5 to 20.5 inches**) DBH snags exceeding 19.8/ha. Snags used as rest sites had a median diameter of 34 inches DBH.	
	In winter habitat, when compared to random sites, there was significantly less 21.6-47.0 cm (8.5 to 18.5 inches) DBH grand fir, 11.4-21.6 cm (4.5 to 8.5 inches) DBH lodgepole and >47 cm (18.5 in) DBH subalpine fir.	
Schwartz, M.K., DeCesare, N.J., Jimenez, B.S., Copeland, J.P., Melquist, W.E., 2013. Stand-and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho. Forest Ecology and Management 305, 103–111. (Idaho and Montana)	The study found that female fishers consistently selected large trees at both the stand and landscape scales (large trees were considered > 38 cm (**15 inches**) DBH).	Medium (10-19.9” DBH) Large (20-29.9” DBH) Very Large (>30” DBH)
Purcell, K.L., Mazzoni, A.K., Mori, S.R., Boroski, B.B., 2009. Resting structures and resting habitat of fishers in the southern Sierra Nevada, California. Forest Ecology and Management 258, 2696–2706. (California)	(Resting) Mean DBH of 57 live resting trees were 95 cm (**37 inches**) (SD = 29 cm); mean DBH of 12 resting snags was 117 cm (**46 inches**) (SD = 47 cm).	Very Large (>30” DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Zielinski, W.J., Truex, R.L., Schmidt, G.A., Schlexer, F.V., Schmidt, K.N., Barrett, R.H., 2004. Resting habitat selection by fishers in California. J. Wildl. Manag. 68: 475–492. (California)	(Resting) Tree size class 5 (>61.0-cm DBH) (**24 inches DBH**) was the most frequent tree size class surrounding resting sites in the Coastal area, whereas class 4 (28.0– 61.0 cm) (**11 – 24 inches**) was the most frequent class in the Sierra study area. Most resting structures at both of our study areas were in standing trees, and most of these were large (*mean* > 100-cm or **39 inches DBH**).	Medium (10-19.9” DBH) Large (20-29.9” DBH) Very Large (>30” DBH)
Aubry, K.B., Raley, C.M., Buskirk, S.W., Zielinski, W.J., Schwartz, M.K., Golightly, R.T., Purcell, K.L., 2013. Meta-analysis of habitat selction at resting sites by fishers in the pacific coastal states and provinces. J. Wildl. Manage 77 (5). (WA, OR, CA, BC)	Fisher consistently selected resting sites with denser overhead cover and larger diameter of conifers and hardwoods than were available. Three sites reported mean DBH of live conifers (≥ 4 inches) greater than 20 inches and the remaining 7 sites had mean DBHs of between 10 and 20 inches, and at all but one site fishers used trees larger than what was available.	Medium (10-19.9” DBH) Large (20-29.9” DBH) Very Large (>30” DBH)
Weir, R.D., M. Phinney, E. C. Lofroth. 2009. Big, sick, and rotting: Why tree size, damage, and decay are important to fisher reproductive	All den sites were either aspen (*Populus tremuloides*) or balsam poplar trees (*Populus balsamifera spp. Balsamifera*), so may not be very comparable to the BNF,	Large (20-29.9” DBH) Very Large (>30” DBH)
habitat. Forest Ecology and Management. 265: 230-240. (British Columbia)	even though the BNF does have some aspen (relative to northeastern BC): aspen with a mean DBH of 50 cm, SD = 11, n = 20) (20 inches) or balsam poplar trees with a mean DBH of 58 cm, SD = 11, n = 11) (23 inches).	
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	Source habitat for fishers includes late-seral stages of the montane community group and unmanaged young forests. Unmanaged young forests contain **sufficient large-diameter snags and logs.** *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	N/A

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Groves, Craig R., Bart Butterfield, Abigail Lippincott, Blair Csuti and J. Michael Scott. 1997. Atlas of Idaho's Wildlife: Integrating Gap Analysis and Natural Heritage Information. Idaho Dept. Fish and Game. Boise, Idaho. (Idaho)	In Idaho, prefers mature or old-growth coniferous forests (forested riparian habitats in spring, summer and fall, and younger-aged forests in winter).	N/A

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-24**.

Table K-2-24 Canopy Cover Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer (Tree Canopy Cover Only)

Tree Canopy Cover Class		
2003 Forest Plan Appendix A Range	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

As in the tree size class discussion above, the Jones (1991) study from north-central Idaho was used as the primary reference for determining canopy cover class parameters for this mid-scale model update. The study documented that fisher generally avoided areas with less than 40 percent canopy cover in both summer and winter. More specifically, resting fisher preferred stands with greater than 61 percent canopy cover in summer, and stands with less than 40 percent canopy cover were rarely used for hunting. Similarly, in winter resting fisher also preferred canopy covers greater than 61 percent, while hunting fisher preferred stands with greater than 81 percent. Based on the study's results, the author recommended maintaining canopy cover above 79 percent to maintain quality summer and winter fisher habitat, although how much or at what scale was unclear. These findings and recommendations firmly fall within the Medium-High and High Canopy Cover classes. Stands with Medium-High and High Canopy Cover would be more likely to develop complex structure and multiple canopy layers that provide habitat for a diverse prey base, thermal cover, deflect snow build up for easier mobility in winter, and ample resting structure.

Use of the Medium-High and High Canopy Cover classes is also supported by other studies that reported preference for canopy covers at or above 60 percent (Aubrey et al. 2013; Purcell et al. 2009; Zielinski et al. 2004). Preference for high canopy cover was fairly universal across all study sites from the Sierra Nevada range in California, north into Washington and British Columbia. The one outlier was a study in the Chilcotin Plateau, an interior plain in central British Columbia (Davis 2009). In this study mean canopy cover was substantially lower (less than 40 percent) compared to all other studies found in the literature. The author explained that the difference could be because of the extremely poor soils and harsh growing conditions in this particular area that reduced productivity, and posited that fisher were possibly selecting habitat based on something other than canopy cover. Regardless, the vast majority of the literature describe fisher using relatively high canopy covers.

As a result, modeling would best approximate the findings of the literature by selecting for forested stands in the Medium-High and High Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-25 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover classes, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes is recommended for modeling fisher source habitat.

Table K-2-25 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Jones, Jeffrey L. 1991. Habitat use of fisher in north-central Idaho. M.S. Thesis. Univ. of Idaho, Moscow. 146 pp. *(Jones and Garton (1994) was developed from this reference)* (Idaho)	In both summer and winter habitat, fisher avoided more open areas with <40 percent crown cover. **In summer, resting fishers preferred stands with ≥61 percent canopy cover**. Stands with less than 40 percent crown closure were rarely used for hunting. In winter, **resting fishers also preferred canopy closures of ≥ 61 percent**; while **hunting fishers preferred stands with ≥81 percent canopy cover** but used other canopy classes randomly. Of 39 observations in young forest in winter, 25 percent had canopy cover exceeding 73 percent.	Medium-High (45-59%) High (≥ 60%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	Mgmt. recommendation: to maintain quality summer and winter fisher habitat provide ample stands with canopy cover **>79 percent** (pg. 116).	
Aubry, K.B., Raley, C.M., Buskirk, S.W., Zielinski, W.J., Schwartz, M.K., Golightly, R.T., Purcell, K.L., 2013. Meta-analysis of habitat selction at resting sites by fishers in the pacific coastal states and provinces. J. Wildl. Manage 77 (5). (WA, OR, CA, BC)	Fisher consistently selected resting sites with denser overhead cover and larger diameter of conifers and hardwoods than were available. Seven of the 9 sites reported mean overhead cover **> 60 percent**.	Medium-High (45-59%) High (≥ 60%)
Purcell, K.L., Mazzoni, A.K., Mori, S.R., Boroski, B.B., 2009. Resting structures and resting habitat of fishers in the southern Sierra Nevada, California. Forest Ecology and Management 258, 2696–2706. (California)	"Management practices that support the growth and retention of greater numbers of large trees and snags, while maintaining a minimum of **61%** (based on moosehorn) or **56%** (generated via Forest Vegetation Simulator) **canopy cover** and a complex horizontal and vertical forest structure, can improve and provide for future fisher habitat."	High (≥ 60%)
	Mean canopy cover at 61 resting sites was **73.7 percent** (SD = 12.5) versus 55.3 percent at 154 random sites,	
Zielinski, W.J., Truex, R.L., Schmidt, G.A., Schlexer, F.V., Schmidt, K.N., Barrett, R.H., 2004. Resting habitat selection by fishers in California. J. Wildl. Manag. 68: 475–492. (California)	"Maintaining dense canopy in the vicinity of large trees, especially if structural diversity is increased, will improve the attractiveness of these large trees to fishers." Habitat characteristics at resting sites for 21 fishers had an average canopy closure of **93.4 percent** versus 88.8 percent at random sites. This shows that even though there was high canopy closure everywhere, fishers still selected for the highest that was available. Most resting and random sites at both study areas were in the Dense CWHR canopy category **(>60% canopy closure**).	High (≥ 60%)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-	Fishers in Idaho avoided stands with <40 percent canopy cover (Jones 1991, Jones and Garton 1994).	Medium-High (45-59%) High (≥ 60%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).		

Source Habitat Conditions When Outside HRV Discussion

Fisher can utilize some forested conditions that are not within the historical range of variability under PVGs 3 and 6. For PVGs 3 and 6, when in the High Canopy Cover class, would potentially develop higher tree densities, more decadent large snags and logs (denning and resting substrate), and more complex vegetative structure than what would have developed when stands in these PVGs were experiencing historical disturbance processes.

Additional Modeling Parameters

This species is documented in the literature as being associated with riparian habitats and drainages (Jones 1991). Special habitat features for fishers include down logs for denning and resting (Buskirk and Powell 1994; Raphael and Jones 1997). Snags are also a special habitat feature. The model cannot take these parameters into account and, therefore, will overestimate the amount of suitable habitat for this species.

Updated Forest Modeling Parameters for Fisher Source Habitat

The updated mid-scale habitat parameters for the Fisher are as follows:

Within HRV
PVGs: 3, 6, 8, 9, and 10
Tree Size Class: Medium, Large*, and Very Large*
Canopy Cover Class: PVGs 3 and 6 = Medium-High
PVGs 8, 9, and 10 = Medium-High and High

Outside HRV
PVGs: 3 and 6
Tree Size Class: Medium, Large, and Very Large
Canopy Cover Class: High
Model Limitations: This species is documented in the literature as being associated with riparian habitats and drainages (Jones 1991). Special habitat features for fishers include down logs for denning and resting (Buskirk and Powell 1994, Raphael and Jones 1997). Snags are also a special habitat feature. The model cannot take these parameters into account and, therefore, will overestimate the amount of suitable habitat for this species.
* Large and very large tree size classes do not occur in PVG 10

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 Fisher Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

References from Idaho and Idaho/Montana

Reference – Olson, L. E., J. D. Sauder, N. M. Albrecht, R. S. Vinkey, S. A. Cushman, M. K. Schwartz. 2013. Modeling the effects of dispersal and patch size on predicted fisher (*Pekania [Martes] pennanti*) distribution in the U.S. Rocky Mountains. Biological Conservation. 169: 89-98.

This study looked at how climate change, available habitat, rate of habitat change combine to affect future fisher distribution in Idaho and Montana. Canopy closure was used as an input to the models and was taken from LandFire cover data set, but this study didn't report on what specific canopy closures were preferred by fisher as the habitat results were a combination of many variables including climatic, topographic, and vegetation. The results indicated that tree height was the best predictor of fisher habitat, which is closely correlated with canopy closure. However, there was no specific crosswalk between tree height and canopy closure categories, so it is unclear what canopy closure parameters were preferred by fisher.

Reference - Schwartz, M.K., DeCesare, N.J., Jimenez, B.S., Copeland, J.P., Melquist, W.E., 2013. Stand- and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho. Forest Ecology and Management 305, 103–111.

The purpose of this study was to examine environmental features selected by fishers at both the stand and landscape scales. The study found that female fishers consistently selected large trees at both scales (large trees were considered ≥ 38 cm (15 inches) DBH). Unfortunately, no specific parameters were given. For canopy cover, the study reported that the most supported model was a landscape model with lots of stands in the high canopy cover class, but again, no specific parameters were given. At the stand level modeling did not detect a preference, but this could be because habitat in the study area generally had canopy cover over 50 percent and so selection was difficult to detect.

One important conclusion was that “while fishers can be detected in riparian stringers that bisect open landscapes, this habitat may not be sufficient for persistence,” and the large tree component needs to be fairly abundant on the landscape. Furthermore, “Forest activities that promote the growth of multi- stage stands with ample structure and variation in tree widths and ages will provide the best habitat for fishers.”

Reference - Sauder, J.D., Rachlow, J.L., 2014. Both forest composition and configuration influence landscape-scale habitat selection by fishers (*Pekania pennanti*) in mixed coniferous forests of the Northern Rocky Mountains. For. Ecol. Manage. 314, 75–84.

This study looked at fisher habitat selection regarding forest composition and configuration (patterns) at broad spatial (landscape) scales. Results indicated “fishers selected landscapes for home ranges with larger, more contiguous patches of mature forest and reduced amounts of open areas. Landscapes that had ≥50% mature forest arranged in connected, complex shapes with few isolated patches, and open areas comprising ≤5% of the landscape characterized a forest pattern selected by fishers in our study.” The take-away from this study is that fisher strongly selected for large patches of contiguous mature forest that were closer together and that had limited amounts of open areas, but “that were arranged in complex, highly connected patterns.” This study was comparing models at the landscape scale and looked at habitat selection from more of a patch and pattern perspective and not necessarily from a habitat structure perspective, although there were some structure covariates, and so did not offer any specific habitat parameters that would inform this model update. It also actually warned that “high canopy cover is not the best metric to use in evaluating fisher habitat; the proximity index of mature forest, or even the abundance of mature forest would be more appropriate. If canopy cover must be used, we encourage forest managers to be aware of and explore potentially confounding issues associated with the metric.” However, for this model update canopy cover is one of the three metrics we must use.

Reference - Sauder, J.D., Rachlow, J.L., 2015. Forest heterogeneity influences habitat selection by fishers (*Pekania pennanti*) within home ranges. For. Ecol. Manage. 347, 49-56.

This study compared two hypotheses about habitat selection within home ranges where fishers select core use areas based on 1) abundant and contiguous mature forest or 2) variability and diversity of habitats. Results showed that core use areas had intermediate amounts of landscape edge and high canopy cover forest, suggesting that the heterogeneity of habitat is as or more important than strictly high canopy cover. While the study determined that canopy cover was still an important habitat component for fisher, it didn't necessarily quantify what the thresholds were for the parameter for the purposes of this model update, other than reporting that the 55.8 percent of the median home range was made up of mature forest. Mature forest was assumed to be represented by the 25-50 m canopy height category and not defined by canopy cover, although the two are closely correlated.

References that Collectively Encompass the Pacific Coastal States and Provinces Region (BC, WA, OR, CA)

Reference -Aubry, K.B., Raley, C.M., Buskirk, S.W., Zielinski, W.J., Schwartz, M.K., Golightly, R.T., Purcell, K.L., 2013. Meta-analysis of habitat selction at resting sites by fishers in the pacific coastal states and provinces. J. Wildl. Manage 77 (5).

This study analyzed habitat selection by fishers at 8 study areas in the Pacific Northwest, including British Columbia south to California. The study assessed the importance of 9 habitat variables typically associated with fisher resting sites. The study found that summary effect sizes were statistically significant for all 9 attributes measured. Specific to canopy cover and tree size, fisher consistently selected resting sites with denser overhead cover and larger diameter of conifers and hardwoods than were available. The results gave mean differences between use and availability, which clearly indicate a selection. Mean overhead cover (percent cover of veg $\geq$2m above ground) and mean DBH of live conifers $\geq$10 cm (4 inches) values were listed in the Appendix by study area.

Mean overhead covers (used vs. available in percent) for all sites were 39.8/34.4; 61.4/49.9; 83.1/67.4; 78.5/82.4; 89.6/76.5; 94.6/84.0; 73.7/55.7; and 92.6/86.6. Seven of the 9 sites reported mean overhead cover > 60 percent. Mean DBH of live conifers > 10 cm (4 inches) (used vs. available in cm) for all sites was 38.0/32.3; 51.6/31.7; 36.5/33.8; 39.9/35.3; 46.0/33.5; 79.7/66.4; 31.4/34.0; and 58.5/51.5. Three sites reported mean DBH of live conifers ($\geq$ 4 inches) greater than 20 inches and the remaining 7 sites had mean DBHs of between 10 and 20 inches, but at all but one site fishers used trees larger than what was available.

References from British Columbia

Reference – Weir, R.D., M. Phinney, E. C. Lofroth. 2009. Big, sick, and rotting: Why tree size, damage, and decay are important to fisher reproductive habitat. Forest Ecology and Management. 265: 230-240.

This study looked at factors affecting den site selection by female fishers in boreal mixed-wood forests of British Columbia. The paper reported on tree size parameters for den sites, but all den sites were either aspen or balsam poplar trees, so may not be very comparable to the BNF, even though the BNF does have some aspen (relative to northeastern BC). All dens occurred in internal cavities in large, diseased, and decaying trembling aspen (*Populus tremuloides*) with a mean DBH of 50 cm, SD = 11, n = (**20 inches**) or balsam poplar trees (*Populus balsamifera spp. Balsamifera*) with a mean DBH of 58 cm, SD = 11, n = 11) (**23 inches**).

Reference – Weir, R.D., Corbould, F.B., 2010. Factors Affecting Landscape Occupancy by Fishers in North-Central British Columbia. J. Wildl. Manag. 74 (3), 405–410.

This study looked at the factors that affected the probability of fisher occupying habitat in British Columbia. The probability of a home range being occupied decreased with the increase of wetlands and logging activity. Home range habitat with canopy (tree) cover ≥ 30 percent was selected for in this study. However, such a large range of canopy cover does not provide meaningful habitat parameters for this model update. There was no information on tree size.

Reference – Davis, Larry R. 2009. Denning ecology and habitat use by fisher (*Martes pennanti*) in pine dominated ecosystems of the Chilcotin Plateau. Thesis. Dept. of Biological Sciences, Simon Fraser University. 124 pg.

This study reported very low canopy cover, termed tree cover in the study, compared to all other references found in the literature. The author cited that the cause may be because of the harsh growing conditions in this particular area which caused low productivity, and also hypothesized that fisher could just be selecting for something else and that forest structure may be more important in this study area. “Percent Tree Cover” ranged from 5 percent to 40 percent within the study area for 18 fisher. ‘Tree cover’ was defined as the percentage cover of trees ≥12.5 cm (5 inches) DBH measured in an 11.28-m radius plot. Tree sizes were generally much lower as well, but fisher selected the largest trees available.

References from California

Reference – Purcell, K.L., Mazzoni, A.K., Mori, S.R., Boroski, B.B., 2009. Resting structures and resting habitat of fishers in the southern Sierra Nevada, California. Forest Ecology and Management 258, 2696– 2706.

This study looked at resting habitat and structure for fishers in the Sierra Nevada range of California. The study reported that “resting structures were found primarily in live trees (76%) and snags (15%). Trees used by fishers for resting were among the largest available and frequently had mistletoe infestations.

Ponderosa pines were used more often than expected and incense cedars less than expected. Snags were also large and in fairly advanced stages of decay. Habitat at fisher resting sites had higher canopy cover, greater basal area of snags and hardwoods, and smaller and more variable tree sizes compared to random sites.” Recommendations were “Management practices that support the growth and retention of greater numbers of large trees and snags, while maintaining a minimum of 61% (based on moosehorn) or 56% (generated via Forest Vegetation Simulator) canopy cover and a complex horizontal and vertical forest structure, can improve and provide for future fisher habitat.”

Mean DBH of 57 live resting trees were 95 cm (37 inches) (SD = 29 cm); mean DBH of 12 resting snags was 117 cm (46 inches) (SD = 47 cm).

Mean canopy cover at 61 resting sites was 73.7 percent (SD = 12.5) versus 55.3 percent at 154 random sites, while average DBH of trees surrounding 61 resting sites was 29.7 cm (12 inches) (SD = 7.1 cm) versus 33.2 cm (13 inches) (SD = 11.6 cm) at 154 random sites.

Reference – Purcell, K.L.; C. M. Thompson, and W. J. Zielinski. 2012. Chapter 4: Fishers and American Martens, *in* North, Malcolm, ed. 2012. Managing Sierra Nevada forests. Gen. Tech. Rep. PSW-GTR-237. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 184 p.

This reference summarized habitat information from available literature on Fisher (and marten) from the Sierra Nevada range in California. Listed habitat preferences include the following:

- Trees and snags used as rest sites are typically among the largest available, often >35 in diameter at breast height (DBH) (range 13 to 71 in) (89 cm; range 34 to 180 cm) (Martin and Barrett 1991, Purcell et al. 2009, Spencer 1987, Zielinski et al. 2004).
- Habitat conditions in the immediate vicinity of resting structures (resting sites) are characterized by complex vertical and horizontal structure, dense canopy cover, large trees, and snags (Purcell et al. 2009, Spencer et al. 1983, Zielinski et al. 2004).
- Canopy cover is consistently the most important variable distinguishing resting sites from available sites for fishers, with results suggesting a minimum canopy cover target of approximately 60 percent (Purcell et al. 2009).

Reference – Zielinski, W.J., Truex, R.L., Schmidt, G.A., Schlexer, F.V., Schmidt, K.N., Barrett, R.H., 2004. Resting habitat selection by fishers in California. J. Wildl. Manag. 68: 475–492.

This study looked at the resting habitat ecology of fishers in two disjunct populations in California; the northwestern coastal mountains and southern Sierra Nevada range. Collared 45 fishers and documented 599 resting locations. Study found that “resting structures were among the largest diameter trees available, averaging 117.3 ± 45.2 (mean ± SE) cm (**46 inches**) for live conifers, 119.8 ± 45.3 for conifer snags, and 69.0 ± 24.7 for hardwoods. Females used cavity structures more often than males, while males used platform structures significantly more than females.” Authors recommended that “managers can maintain resting habitat for fishers by favoring the retention of large trees and the recruitment of trees that achieve the largest sizes. Maintaining dense canopy in the vicinity of large trees, especially if structural diversity is increased, will improve the attractiveness of these large trees to fishers.” Habitat characteristics at resting sites was average canopy closure for 21 fishers was reported as 93.4 percent versus 88.8 percent at random sites. This shows that even though there was high canopy closure everywhere, fishers still selected for the highest that was available.

Most resting and random sites at both study areas were in the Dense CWHR canopy category (**>60% canopy closure**). Tree size class 5 (>61.0-cm DBH) (**24 inches DBH**) was the most frequent tree size class at resting sites in the Coastal area, whereas class 4 (28.0–61.0 cm)

(**11 – 24 inches**) was the most frequent class in the Sierra study area. Most resting structures at both of our study areas were in standing trees, and most of these were large (*mean* > 100-cm or **39 inches DBH**).

Reference – Zielinski, W.J., Dunk, J.R., Yaeger, J.S., LaPlante, D.W., 2010. Developing and testing a landscape-scale habitat suitability model for fisher (*Martes pennanti*) in forests of interior northern California. For. Ecol. Manage. 260 (9), 1579–1591.

The purpose of this study was to develop a landscape-scale suitability model to predict fisher occurrence and identify fisher habitat. The models used a total of seven variables, and the Medium and Large Tree, Mammalian Prey, and Structurally Complex Forest were the three variables that had positive relationships with predicted values. One vegetation component in the models was the California Wildlife Habitat Relationships (CWHR) value that was a rating based on combinations of cover type, canopy closure, and tree size class. Because these parameters were bunched into a suitability rating and then inserted into the model, it was unclear exactly what parameters were used to determine habitat suitability. As a result, there were no habitat parameters relevant to this model update.

Reference – Sweitzer, R.A., B.J. Furnas, R.H. Barrett, K.L. Purcell, C.M. Thompson. 2016. Landscape fuel reduction, forest fire, and biophysical linkages to local habitat use and local persistence of fishers (*Pekania pennanti*) in Sierra Nevada mixed-conifer forests. Forest Ecology and Management. 361: 208- 225.

This study assessed the persistence of fisher following fuel reduction and forest fire disturbances and how habitat linkages could be impacted by those events. While those relationships aren't necessarily relevant to this model update, this study did report on some qualitative habitat descriptions for canopy cover class. Reported that probability of detecting fisher during surveys was higher in high canopy cover stands and that fisher occupancy was positively related to high canopy cover. Overall, fisher preferred forest habitats with relatively high canopy cover.

For modeling purposes, a covariate that included an index of canopy cover based on proportions of cell with canopy closure classes of M (40-59%) or D (60-100%) was used. Predicted fisher occupancy was higher in forest cells with more areas of moderate (M) and dense (D) canopy cover. They described the use of the denMD covariate and what it equals, but it was not clear if this is the threshold that fishers were selecting or was just an example. It appeared from the data that fisher were selecting for cells where the index was 0.80 or more, and these cells represented a one km^2 cell with 80 percent of the cell in either M or D canopy closure class. So, while the parameters were not that definable for the purposes of this model update, I think it would be accurate to say that fisher were either selecting for greater than 40 percent canopy cover within this study or at least more likely to be found within those cells.

In addition, this study noted that relatively high canopy closure was important for foraging fishers, which was already known for both resting and denning fishers (Purcell et al. 2009; Zhao et al. 2012).

Because it was not clear how the index related to actual fisher selection, I did not use this reference for the model update.

The article (Sweitzer, R.A., B.J. Furnas. 2016. Data from camera surveys identifying co-occurrence and occupancy linkages between fishers (*Pekania pennanti*), rodent prey, mesocarnivores, and larger predators in mixed-conifer forests. Elsevier. Data in Brief. 783-792.) was developed from this study and used the same data set and variables.

References from Washington

Reference – Halsey, S.M., W.J. Zielinski, R.M. schiller. 2015. Modeling predator habitat to enhance reintroduction planning. Landscape Ecol. 30:1257-1271.

This study's objective was to develop a predictive model that would identify where reintroduction would be most successful in southern Washington. The model needed to incorporate habitat needs of fisher as well as its primary predator (bobcat) habitat. This study didn't develop any new parameter information, but it did choose to use a canopy cover of **>60 percent** to depict suitable fisher habitat (based on research conducted by Zielinski et al. 2004) for use in the model. Otherwise, this study contained no relevant habitat parameter information for use in the model update.

K-2-1.10 Flammulated Owl

Mid-scale Modeling Update
for the
Flammulated Owl
March 26, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the Flammulated Owl Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Nutt et al. 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

Review of New Species Literature since 2010

The Boise NF mid-scale habitat model for the Flammulated Owl was created in 2005 and revised in 2008 (Nutt et al. 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Flammulated Owl Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the “Forest Derived Product.” Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e., “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a, Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the flammulated owl. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-26**.

Table K-2-26 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (1.0 – 4.9" DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (> 30" DBH)	**new**

For modeling nesting habitat, the majority of literature sources support selecting the Medium (10-19.9" DBH), Large (20 – 29.9" DBH) and Very Large (>= 30" DBH) Tree Size classes (Barnes 2007; Powers et al. 1996; Moore and Frederick 1991; Groves et al. 1997; Goggans 1986; McCallum and Gelbach 1988; Bull et al. 1990), as tree size parameter measurements in those studies were largely from the nest trees themselves. These and other studies also quantitatively described tree size characteristics within habitat beyond just the nest tree, including habitat surrounding the nest tree and/or owl location sites (Moore and Frederick 1991; Groves et al. 1997), at location sites (including forage and roost sites) within home ranges established by radio-collared individuals (Goggans 1986), and within observed roosting habitat (Barnes 2007). These additional habitat characterizations collectively reported preferred tree size parameters solidly within the Medium Tree Size class.

It is recommended that Medium (10-19.9” DBH), Large (20-29.9” DBH), and Very Large (>30” DBH) Tree Size classes be used to model source habitat for the flammulated owl.

Table K-2-27 shows the crosswalk between Tree Size class parameters found in the literature and the new Tree Size Classes.

Table K-2-27 Table Showing Crosswalk Between Parameters Found in the Literature and New TSC Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Barnes, Keith P. 2007. Ecology, Habitat Use, and Probability of Detection of Flammulated Owls in the Boise National Forest (Idaho). Boise State University, Boise, ID. M.S. Thesis. 96 p. (Idaho)	PIPO were selected in larger size classes than available (peak of distribution **21-28”** DBH) For day roosts medium-sized trees were selected (peak distribution **9-13”** DBH). Nest tree (n=14) DBH ranged from **11-46”**, with a **mean** DBH **of 23+10”**	Medium – 10-19.9” DBH Large – 20-29.9” DBH Very Large - >30” DBH
Powers, L.R., A. Dale, P.Q. Gaede, C. Rodes, L. Nelson, J.J. Dean and J.D. May. 1996. Nesting and food habits of the flammulated owl (Otus flammeolus) in southcentral Idaho. J. Raptor Res. 30(1): 15-20 p. (Idaho but not in PP hab)	Mean DBH of 13 nest trees was **19.6 inches** (SD=7.4).	Medium – 10-19.9” DBH Large – 20-29.9” DBH
Moore, Teresa L. and G.D. Frederick. 1991. Distribution and habitat of flammulated owls (*Otus flammeolus*) in west-central Idaho. Idaho Dept. Fish and Game, Boise. 28pp. (Idaho)	Mean DBH was 32 cm (SD=5) [**13 inches**].	Medium – 10-19.9” DBH
Goggans, Rebecca. 1986. Habitat use by flammulated owls in northeastern Oregon. Corvallis, OR: Oregon State University. M.S. Thesis. 54 pp. (northeastern Oregon)	Owls used forested stands with trees 30- 50 cm DBH [**12-20 inches DBH**]. Characteristics at 20 nests showed a mean tree diameter was 56.3 cm (SD=11.9, Range= 22-80) [**22 inches DBH**].	Medium – 10-19.9” DBH Large – 20-29.9” DBH Very Large - >30” DBH
Groves, Craig, T. Frederick, G. Frederick, E. Atkinson, M. Atkinson, J. Shepherd, and G. Servheen. 1997. Density, distribution, and habitat of flammulated owls in Idaho. Great Basin Naturalist 57(2): 116-123. (Idaho)	In Nez Perce and Payette NF study sites mean DBH for all trees within habitat plots was 32 cm (**13”**) and 31 cm (**12”**), respectively.	Medium – 10-19.9” DBH

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
McCallum, D.A. and F.R. Gehlbach. 1988.Nest-site preferences of flammulated owls in western New Mexico. Condor. 90 (3): 653- 661. (western New Mexico)	Mean DBH for 17 nests was 46.2 <u>+</u> 10.7 cm DBH [**18 <u>+</u> 4 inches DBH**].	Medium – 10-19.9” DBH Large – 20-29.9” DBH
Bull, Evelyn L., A. Wright, and M. Henjum. 1990. Nesting habitat of flammulated owls in Oregon. Journal of Raptor Res. 24(3): 52-55. (Oregon)	Average nest tree DBH was 72 cm (SD=16.1, range 40-97) [**28 in**] Important nesting habitat included large-diameter dead trees with cavities at least as large as a northern flicker cavity…in mature trees (>50 cm DBH) [**20 inches**] in older stands of PIPO/PSME forest types or grand fir types with PIPO in the overstory. Stands with trees >50cm DBH [**20 inches**] were preferred nest sites.	Large – 20-29.9” DBH Very Large - <u>></u>30” DBH

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-28**.

Table K-2-28 Canopy Cover Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer (Tree Canopy Cover Only)

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
>70% High	60% (High Tree Canopy)	**change**

A review of the literature shows that there is strong support for selection of the Medium (30-44%) and Medium-High (45-59%) Tree Canopy Cover classes. Studies that measured canopy covers for nesting sites had canopy covers of 29 percent (Barnes 2007) and 55 percent (Bull et al. 1990) immediately surrounding the nest tree. Other studies that measured habitat within the larger context of a breeding territory or along calling transects reported canopy covers of 45 percent (Barnes 2007), 52-64 percent (Groves et al. 1997), 64 percent (Moore and Frederick 1991), and less than 50 percent (Goggans 1986). Goggans (1986) also measured selected roost habitat and found the majority of roost sites to be within canopies greater than 50 percent.

Inclusion of canopy cover classes below 30 percent would include more open forested communities that may not provide multi-storied canopies important for roosting and forage for this species, while inclusion of canopy cover classes above 59 percent would include habitats generally too dense for even forage or roost habitat and likely overestimate source habitat overall. Selection of the Medium and Medium-High Canopy Cover classes is expected to encompass the broad range of habitats used by this species, from stands with complex, multi-storied canopies that are used for nesting and roost habitat to those more open-canopied stands at the lower end of the canopy cover range that provide small openings and edge habitat used for forage.

Selecting forested stands in the Medium (30-44%) and Medium-High (45-59%) Canopy Cover classes is recommended for modeling flammulated owl source habitat.

Table K-2-29 shows the crosswalk between parameters found in the literature and the new Tree Canopy Cover Classes.

Table K-2-29 Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Barnes, Keith P. 2007. Ecology, Habitat Use, and Probability of Detection of Flammulated Owls in the Boise National Forest (Idaho). Boise State University, Boise, ID. M.S. Thesis. 96 p. (Idaho)	Canopy cover at nest trees was **29.1 ± 23.6%** and canopy cover within foraging scale territories (n=17) was **45.0±10.0%.**	Medium (30-44%)
Groves, Craig, T. Frederick, G. Frederick, E. Atkinson, M. Atkinson, J. Shepherd, and G. Servheen. 1997. Density, distribution, and habitat of flammulated owls in Idaho. Great Basin Naturalist 57(2): 116-123. (Idaho)	Mean percent canopy cover at 17 locations along calling transects ranged from **52-64 percent**.	Medium-High (45-59)
Moore, Teresa L. and G.D. Frederick. 1991. Distribution and habitat of flammulated owls (*Otus flammeolus*) in west- central Idaho. Idaho Dept. Fish and Game, Boise. 28pp. (Idaho)	Canopy cover was **64 percent** (SD =12) where owls were located in forested areas.	Medium-High (45-59)
Goggans, Rebecca.1986. Habitat use by flammulated owls in northeastern Oregon. Corvallis, OR: Oregon State University. M.S. Thesis. 54 pp. (northeastern Oregon)	Forest stands used by owls were characterized by canopies with **less than 50%** closure… High foliage density was a key component for day roost selection. Seventy-four percent of roosts (n=37) had canopies greater than **50 percent.** Owls avoided stands with high stem density likely due to lack of ground vegetation (which would affect the diversity and abundance of ground dwelling arthropods) and decreased maneuverability (density of limbs and stems).	Medium (30-44%) Medium-High (45-59)
Bull, Evelyn L., A. Wright, and M. Henjum.1990. Nesting habitat of flammulated owls in Oregon. Journal of Raptor Res. 24(3): 52-55. (Oregon)	Nest tree sites had a canopy closure of **55%** (20.1)	Medium-High (45-59)

Updated Forest Modeling Parameters for Flammulated Owl Source Habitat

The updated mid-scale habitat parameters for the flammulated owl are as follows:

PVGs: 2, 3, 5, and 6
Tree Size Class: Medium, Large, and Very Large
Tree Canopy Cover Class: Medium and Medium-High

New Literature Sources Reviewed But Not Relevant to 2016 Mid-scale Modeling Update

Below is a list of all new literature reviewed for this 2019 Flammulated Owl Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

Reference – Linkhart, Brian D. and D. Archibald McCallum. (2013). Flammulated Owl (*Psiloscops flammeolus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/flaowl DOI: 10.2173/bna.93. Accessed September 2016.

The species account was last updated in 2013. However, there were no new habitat parameters reported in the updated species account by the authors. The literature cited section was also scanned for new references that could be used in this update.

Reference – Arsenault, David P., 2010. Flammulated Owl (*Otus flammeolus*). Chapter 28 ***in*** Raptors of New Mexico, Jean-Luc E. Cartron editor. 728 p.

Good overview of species natural history with great photos, including habitat photos, but no qualitative parameters for habitat characteristics.

Reference – Carlisle, Jay, Jack Stenger, and Robert Miller. 2011. 2010 breeding season surveys for flammulated owls on the Sawtooth National Forest and BLM Shoshone Field Office in southcentral Idaho. 2010 Annual Report. *Prepared for* Idaho Dept. of Fish and Game, Conservation Sciences Program; BLM Shoshone Field Office; and U.S. Fish and Wildlife Division of Migratory Birds and Habitat Programs. *Prepared by* Idaho Bird Observatory. 45 p.

This is a summary of the survey effort conducted on Sawtooth NF, Sawtooth NRA, and BLM Shoshone Field Office lands. The paper had limited habitat data with respect to canopy cover, and no tree size data. Canopy cover was a parameter collected within 50 meters of the calling point, but I couldn't find this parameter listed or summarized anywhere in the document. There was a reported "Forest Cover" but this was a parameter collected within 300 meters of each point, so it was not presumably the same as canopy cover as it is being used in this modeling update. It wasn't clear if the habitat sampling plots were collected around the detection site or the estimated owl singing site.

Reference – Mika, M. 2010. Phylogeography and landscape genetics of the Flammulated Owl: Evolutionary history reconstruction and metapopulation dynamics. Ph.D. dissertation, Las Vegas, University of Nevada.

Ph.D. dissertation on flammulated owl genetics. No habitat information.

Reference – Nelson, M. D., D. H. Johnson, B. D. Linkhart and P. D. Miles. 2010. Flammulated Owl (*Otus flammeolus*) breeding habitat abundance in ponderosa pine forests of the United States. In Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics.

Study used FIA plot data to assess current and historic extent of PP and Jeffrey pine that is flammulated owl habitat across 11 western states. Found that these forest types have decreased 14 percent overall in the past two decades. Also estimated the amount of breeding habitat using three different data sets (FIA, LANDFIRE, and GAP). The study only used a few habitat parameters such as forest type, stand age class, percent stocking class, and average DBH class, so there wasn't anything useful for this modeling update.

Reference – Scholer, Micah N.; Leu, Matthias; and Belthoff, James R. (2014). "Factors Associated with Flammulated Owl and Northern Saw-Whet Owl Occupancy in Southern Idaho". *Journal of Raptor Research, 48*(2), 128-141. http://dx.doi.org/10.3356/JRR-13-00049.1

This work developed distribution models for FLOW and saw whet owls to explore associations between habitat factors and owl occupancy. Habitat data at three different scales (0.4 km, 1 km, and 3 km) was used. The relationships specific to flammulated owls that resulted were that flams occurred in areas with higher proportions of Douglas fir at the 0.4 km scale, used less diverse land cover types at the 1 km scale, and used south-facing slopes at the 3 km scale. Also found that canopy cover was not a strong predictor of occurrence. The models that were developed identified occupancy variables at scales greater than the home range size for flams as being important predictors for occupancy, which means that the species should be managed at scales beyond their home range. Wasn't any useful habitat data though that could be used in our mid-scale models.

Reference – Seidensticker, Mathew T., "Nest Site Characteristics and Breeding Biology of Flammmulated Owls in Missoula Valley" (2011). *Theses, Dissertations, Professional Papers.* Paper 698.

This study (thesis) looked at nest site characteristics and breeding biology of flams in Montana, near Missoula. The study only found four nests in 3 nest trees (2 nests were in the same tree in different years), so the sample size is pretty low. The study focuses on the nest cavities, nest trees, roost sites, and cavity-bearing trees within the breeding territories, and takes measurements of all mentioned, but doesn't measure the habitat surrounding these sites. As a result, it doesn't provide useful habitat parameters for this model update other than size of nesting substrate.

Reference – Seidensticker, Mathew T; Holt, Denver W; Larson, Matthew D. Breeding status of flammulated owls in Montana. *Northwestern Naturalist;* Winter 2013; 94, 3; ProQuest Natural Science Collection. pg. 171

Same general study as Seidensticker 2011, only with a couple more nest sites. Still only measured nest tree characteristics and not the larger habitat area, so no habitat parameters that would inform this model update.

Reference – Waterbury, B., S. Ehlers, and J. Runco. 2009. Flammulated owl (*Otus flammeolus*) occurrence in east-central Idaho 2007-08. Final Report. Idaho Department of Fish and Game, Salmon, ID.

Even though this reference is dated 2008 I reviewed it anyway looking for new relevant information. However, the survey work was done in east-central Idaho where ponderosa pine is lacking so all the

habitat types flams were found in were Douglas fir dominated, which is probably not too relevant for our PP habitat types here in west-central Idaho were DF fir is more of a secondarily preferred habitat type and usually when mixed with PP.

K-2-1.11 Great Gray Owl

Mid-scale Modeling Update
for the
Great Gray Owl
March 26, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, Boise NF, on Detail to the PNF

The purpose of this document is to update the Great Gray Owl Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Nutt et al. 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

Review of New Species Literature since 2008

The Boise NF mid-scale habitat model for the Great Gray Owl (GGOW) was created in 2005 and last updated in 2008 (Nutt et al. 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and tree canopy cover class (TCCC) were listed in the Crosswalk tables in the TSC and TCCC sections. All new literature reviewed for this 2019 Great Gray Owl Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or TCCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the "Forest Derived Product." Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger

unit on the ground (i.e., "stands"), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9" DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the

Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a; Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

The following parameter review discussion describes the vegetation parameters used to model source habitat when under historic range of variability (HRV) conditions.

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the great gray owl. No change is recommended.

Tree Size Class Discussion

Tree Size Class classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-30**.

Table K-2-30 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification?
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (0.1 – 4.9 " DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (≥ 30" DBH)	**new**

For modeling nesting habitat, the literature solidly supports selecting the Large and Very Large Tree Size classes (Franklin 1988; Bull et al. 1988; Bull and Henjum 1990; Wu et al. 2015), as most of these references reported mean nest tree sizes greater than 19 inches DBH. There is also some support for including the Medium Tree Size class for nesting habitat. While Franklin (1988) reported the mean DBH for twelve total nest trees at nearly 21 inches, the mean for the five of those that were stick nests was inches. Bull and Henjum (1990) also reported a subset of nests (26 percent) that occurred in stands with trees between 12 and 19 inches DBH. Even though the majority (74 percent) of nests in that study occurred in stands with trees greater than 19 inches DBH, GGOWs did use stands with trees between 12 and 19 inches DBH and selected against stands with less than 12-inch trees (Bull and Henjum 1990). Natural nest trees generally need to be large in order to have limbs sufficient to support a stick nest or have enough bole surface area to accommodate a family of large owls (Bull and Henjum 1990). However, stands in the Medium Size class can also develop stand characteristics that include large diameter broken topped trees or mistletoe clumps used for nesting platforms and downed wood that fledglings can use as escape or perch structure. The Medium Size class also provides habitat for the goshawk, which is the primary source of stick nests that are commonly used by the GGOW.

While forage habitat for GGOWs is largely described as associated with open meadow complexes, two studies reported that GGOWs used and in some cases preferred forested stands for foraging. Bull et al. (1988) described foraging stands as generally open with hunting perches in trees having a mean DBH of 27 cm (11 inches), largely within the Medium Size class. Bull and Henjum (1990) reported that foraging bouts usually occurred in mature forested stands with an open understory, which likely correlate to the Medium and Large Size classes. These Medium and Large Size class stands have the potential to provide complex stand structure and high levels of down wood material that are important for prey species, and roosting structure.

As a result, it is recommended that the Medium, Large, and Very Large Tree Size classes be used to model GGOW source habitat.

Table K-2-31 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size classes, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Medium (10-19.9" DBH), Large (20-29.9" DBH) and Very Large (>30" DBH) Tree Size classes be used to model source habitat for the great gray owl, both for within and outside the Historical Range of Variation (HRV).

Table K-2-31 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class (TSC) Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Franklin, Alan B. 1988. Breeding biology of the great gray owl in southeastern Idaho and northwestern Wyoming. *The Condor* 90:689-696. (Idaho and Wyoming)	(Nesting) Mean nest tree DBH was recorded by nest type; the range displayed is from 38.6 to 71.8 cm (n = 31) [**15.1-28.6 DBH**) (Table 1, pg. 691).	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)
Bull, Evelyn L., M.G. Henjum, and R.S. Rohweder. 1988. Nesting and foraging habitat of great gray owls. *J. Raptor Res*. 22 (4): 107-115. (NE Oregon)	(Nesting) The majority of stick nests were in ≥50 cm (**20 in**) DBH live western larch; while the majority of nests in broken-topped trees were in large diameter PIPO at least 7m tall. Mean DBH of stick nest trees was 58 cm (**23**	Large (20-29.9" DBH) Very Large (>30" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	in). The mean DBH of broken-topped nest trees was **31 in**. Stick nests: 68 percent made by northern goshawks, 12 percent by red-tail hawks. (Foraging) Open stands of mature forest were used most for foraging, while sub-climax and dense over-mature stands and clearcuts were used less frequently.	
Bull, Evelyn L. and Mark G. Henjum. 1990. Ecology of the Great Gray Owl. USDA Forest Service Pacific Northwest Research Station. PNW-GTR-265. 39pp. (Oregon)	(Nesting) Seventy-four percent of nests occurred in stands with trees greater than 49 cm DBH [**>19 inches DBH**]; 26 percent occurred in stands with trees 30-49 cm DBH [**12-19 inches DBH**]; no nests occurred in stands of trees less than 30 cm DBH [<12 inches DBH]. Trees chosen for nests were large in diameter because the top had to be wide enough to accommodate a family of owls. Nests in broken-topped trees were 49-64 cm DBH [**19-25 inches DBH**] and 6-18 m tall [20-60 feet].	Medium (10-19.9” DBH) Large (20-29.9” DBH) Very Large (>30” DBH)
Wu, J. X., R. B. Siegel, H. L. Loffland, M. W. Tingley, S. L. Stock, K. N. Roberts, J. J. Keane, J R. Medley, R. Bridgman, C. Stermer. 2015. Diversity of great gray owl nest sites and nesting habitats in California. Journal of Wildlife Mgmt. 79(6): 937-947. (Sierra Nevada, California)	(Nesting) Mean DBH of nest trees was 100.5 + SD 30.3 cm (**40 inches**) and that nest trees were significantly larger than reference trees.	Large (20-29.9” DBH) Very Large (>30” DBH)
Bryan, T, and E. D. Forsman. 1987. Distribution, abundance, and habitat of great gray owls in southcentral Oregon. The Murrelet. 68:45-49. (Oregon)	All forests in which Great Gray Owls were located were old-growth (45 sites) or mature (18 sites) stands characterized by relatively large overstory.	N/A

Table Notes:

DBH = diameter at breast height

New references shaded green

Tree Canopy Cover Discussion

Tree Canopy Cover classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-32**.

A review of the literature shows the GGOW is strongly associated with high canopy covers in nest stands, as most studies reported nest stand densities of greater than 60 percent (Bull et al. 1988; Bull and Henjum 1990; Wu et al. 2015). Bryan and Forsman (1987) reported a mean canopy cover of 46.5 percent, within the Medium-High class. Fledgling juveniles also preferred high canopy covers (≥60%) after leaving the nest as these sites afford overhead and lateral hiding cover from predators.

Table K-2-32 Tree Canopy Cover Class Differences Between 2003 Forest Plan Appendix A and New 2011 Vegetation Layer

<table>
<tr><th colspan="3">Tree Canopy Cover Class</th></tr>
<tr><th>2003 Forest Plan Appendix A</th><th>New Vegetation Layer (2011)</th><th>Changed or New Classification?</th></tr>
<tr><td rowspan="3">10 – 39% Low</td><td>10 – 19% (Low Tree Canopy)</td><td>change</td></tr>
<tr><td>20 – 29% (Low-Medium Tree Canopy)</td><td>change</td></tr>
<tr><td>30 – 44% (Medium Tree Canopy)</td><td>change</td></tr>
<tr><td rowspan="2">40 – 69% Moderate</td><td>45 – 59% (Medium-High Tree Canopy)</td><td>change</td></tr>
<tr><td rowspan="2">60% (High Tree Canopy)</td><td rowspan="2">change</td></tr>
<tr><td>>70% High</td></tr>
</table>

As mentioned in the tree size class section, forage habitat for GGOWs is largely described as associated with open meadow complexes. However, Bull et al. (1988) reported that GGOWs used and in some cases preferred forested stands for foraging, and other references also qualitatively describe foraging habitat as occurring in open forested stands with scattered trees or forest margins (Wisdom et al. 2000, Groves et al. 1997). These literature sources indicate that forested stands should also be considered potential GGOW foraging habitat, in addition to meadows. The Bull et al. (1988) study assessed canopy cover associations in three categories; <10 percent, 11-59 percent, and ≥60 percent. Foraging males preferred stands with 11-59 percent canopy cover and avoided stands with greater than 60 percent. In addition to foraging preferences, males most often roosted (71 percent of the time) in stands with 11-59 percent canopy cover (but also used ≥60 percent canopy cover stands 29 percent of the time). The 11-59 percent category spans across four of the new canopy cover classes, including Low, Low-Medium, Medium, and Medium-High. All of these classes, in addition to the High Canopy Cover class, play a role in the life cycle of this species. GGOWs utilize open stands with little understory for foraging (Low, Low-Medium, and into the Medium classes), somewhat denser stands for some nesting and roost habitat (Medium-High), and dense stands for nearly all nesting and most roost habitat (High). As a result, modeling would best approximate the findings of the literature by selecting for forested stands in the Low, Low-Medium, Medium, Medium-High, and High Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Canopy cover will vary by PVG. For PVGs 8, 9, and 10 and within HRV, the Medium-High and High Canopy Cover classes (>45 percent) should be used. For PVGs 3, 7 and 11 within HRV, the Low, Low-Medium, Medium, and Medium-High Canopy Cover classes (11-59 percent) should be included.

Table K-2-33 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Low (11-19%), Low-Medium (20-29%), Medium (30-44%), Medium- High (45-59%), and High (>60%) Tree Canopy Cover classes is recommended for modeling great gray owl source habitat.

Table K-2-33 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class (TCCC) Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
	(Nesting) For 46 nest sites, 63 percent had canopy closure <u>></u> **60%**, while 30 percent had canopy closure between **11-59%**.	
	Perches used the first week after the young left the nest had an average canopy closure of **50%** (S.D. = 22.16) and were all within 200 m of the nest.	
Bull, Evelyn L., M.G. Henjum, and R.S. Rohweder. 1988. Nesting and foraging habitat of great gray owls. *J. Raptor Res*. 22 (4): 107-115. (NE Oregon)	Within 2 weeks after fledging juveniles gradually became more mobile but generally stayed within forest stands with **<u>></u> 60% canopy closure**. (Foraging) Males (n = 5) preferred stands with **11-59% canopy closure** and avoided clearings. Four of those males **avoided stands with <u>></u> 60% canopy closure**.	Low (10-19%) Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59%) High (<u>></u> 60%)
	(Roosting) Males roosted during the day most often (71% of the time) in stands with **11-59% canopy closure** and 29% of the time in stands with **<u>></u> 60% canopy closure**.	
	83% of 62 roost sites were in mature or older stands with 2 or more canopy layers. *For reference, the 0-10% class comprised openings; the 11-59% class contained relatively open stands, many or which had been selectively logged; the <u>></u> 60% class was primarily unlogged, overmature forest stands.*	
Bull, Evelyn L. and Mark G. Henjum. 1990. Ecology of the Great Gray Owl. USDA Forest Service Pacific Northwest Research Station. PNW-GTR-265. 39pp. (Oregon)	Of 49 nests most had canopy closure **<u>></u> 60 percent**. Juvenile, foraging, and roosting canopy density preferences same as Bull et al. (1988) above. The areas used most often for nesting were unlogged, mature or older stands, and usually contained a fairly open understory facilitating easy flight, yet a	Low (10-19%) Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59%) High (<u>></u> 60%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
	fairly dense overstory (more than **60 percent canopy closure**) providing shade and concealment from above.	
Wu, J. X., R. B. Siegel, H. L. Loffland, M. W. Tingley, S. L. Stock, K. N. Roberts, J. J. Keane, J R. Medley, R. Bridgman, C. Stermer. 2015. Diversity of great gray owl nest sites and nesting habitats in California. Journal of Wildlife Mgmt. 79(6): 937-947. (California)	(Nesting) Canopy cover within 50 meters of nest trees was **85.1** (+ 16.4) percent and was significantly greater than at reference sites.	High (≥ 60%)
Bryan, T, and E. D. Forsman. 1987. Distribution, abundance, and habitat of great gray owls in southcentral Oregon. The Murrelet. 68:45-49. (Oregon)	Mean canopy closure at 11 nest sites was **46.5 percent**.	Medium (30-44%) Medium-High (45-59%) High (≥ 60%)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol.	Stand-initiation habitats and herb-tree regeneration are primarily used for foraging habitat as well as open forested stands (**11-59 percent cover** (Bull and Henjum 1990)). *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	Low (10-19%) Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59%)
(Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).		
Groves, C.R., B. Butterfield, A. Lippincott, B.Csuti, and J.M. Scott. 1997. Atlas of Idaho's Wildlife: Integrating Gap Analysis and Natural Heritage Information. Idaho Dept. Fish and Game, Nongame Wildlife Program. Boise, Idaho. (Idaho)	Forages in open areas where scattered trees or forest margins provide suitable sites for visual searching.	Low (10-19%) Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59%)

Table Notes:

New references shaded green

Source Habitat Conditions When Outside HRV Discussion

Great gray owls can utilize some forested conditions that are not within the historical range of variability under PVGs 3, 7, 8, 9, 10 and 11. For PVGs 3, 7, and 11, when in the High tree canopy cover class, these conditions generally consist of higher tree densities and more complex vegetative structure than what would have developed when stands in these PVGs were experiencing historical disturbance processes.

For PVGs 8, 9, and 10, when in the Low, Low-Medium, Medium tree canopy cover classes, conditions outside HRV consisted of lower canopy covers, low tree densities, and less complex stand structure than what would have developed under HRV.

Additional Modeling Parameters

This species is documented in the literature as being a contrast species, requiring the juxtaposition of habitats used for foraging and for nesting and roosting. The model cannot take this need for juxtaposed habitats into account and therefore will overestimate the amount of suitable habitat for this species.

Model Limitations

This species is documented in the literature as being a contrast species, requiring the juxtaposition of habitats used for foraging and for nesting and roosting. The model cannot take this need for juxtaposed habitats into account and therefore will overestimate the amount of suitable habitat for this species.

Updated Forest Modeling Parameters for Great Gray Owl Source Habitat

The updated mid-scale habitat parameters for the Great Gray Owl are as follows:

Updated Forest Modeling Parameters for Fisher Source Habitat

The updated mid-scale habitat parameters for the Fisher are as follows:

Within HRV
PVGs: 3, 6, 8, 9, and 10
Tree Size Class: Medium, Large*, and Very Large*
Canopy Cover Class: PVGs 3 and 6 = Medium-High
PVGs 8, 9, and 10 = Medium-High and High

Outside HRV
PVGs: 3 and 6
Tree Size Class: Medium, Large, and Very Large
Canopy Cover Class: High
Model Limitations: This species is documented in the literature as being associated with riparian habitats and drainages (Jones 1991). Special habitat features for fishers include down logs for denning and resting (Buskirk and Powell 1994, Raphael and Jones 1997). Snags are also a special habitat feature. The model cannot take these parameters into account and, therefore, will overestimate the amount of suitable habitat for this species.
* Large and very large tree size classes do not occur in PVG 10

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 Fisher Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

References from Idaho and Idaho/Montana

Reference – Olson, L. E., J. D. Sauder, N. M. Albrecht, R. S. Vinkey, S. A. Cushman, M. K. Schwartz. 2013. Modeling the effects of dispersal and patch size on predicted fisher (*Pekania [Martes] pennanti*) distribution in the U.S. Rocky Mountains. Biological Conservation. 169: 89-98.

This study looked at how climate change, available habitat, rate of habitat change combine to affect future fisher distribution in Idaho and Montana. Canopy closure was used as an input to the models and was taken from LandFire cover data set, but this study didn't report on what specific canopy closures were preferred by fisher as the habitat results were a combination of many variables including climatic, topographic, and vegetation. The results indicated that tree height was the best predictor of fisher habitat, which is closely correlated with canopy closure. However, there was no specific crosswalk between tree height and canopy closure categories, so it is unclear what canopy closure parameters were preferred by fisher.

between 750 and 2,250 m (Winter 1986). In central Oregon, meadow systems associated with coniferous forests (Forsman and Bryan 1987). In ne. Oregon, all forest types sampled had nests, with 50% in fir forests (Bull and Henjum 1990). In Idaho and Wyoming, over 90% of sightings of this species in lodgepole pine (*Pinus contorta*)/Douglas-fir (*Pseudotsuga menziesii*)/aspen (*Populus tremuloides*) zone (Franklin 1987).

Winter range is generally the same as breeding habitat, except at lower elevation with thinner snow cover in ne. Oregon (Bull and Henjum 1990) and in Yosemite National Park, CA (J. Winter pers. comm.).

Nesting

Broken-topped dead trees (snags), old raptor nests (most frequent) (e.g., abandoned Osprey, Goshawk, Raven nests; Voous 1988b), mistletoe brooms, or human-made platforms. Use of snags as nest sites increases in lower latitudes (Franklin 1987).

Reference - Jepsen, P.B., J. J. Keane, and H. B. Ernest. 2011. Winter distribution and conservation status of the Sierra Nevada great gray owl. Journal of Wildlife Management. 75(8): 1678-1687.

This study that looked at winter ecology of the GGOW. It used winter observation data and remotely sensed habitat variables, including canopy cover, to inform a predictive model that identified distribution of the species through probability of occurrence classes. Crown diameter was used as one of the model inputs instead of tree DBH, which was not useful for this model update. Canopy closure was used to help the model identify potential habitat, but overall was not the strongest predictor of habitat. Elevation was the strongest predictor for the model. The study only reported whether a variable had a positive or negative correlation and did not quantify those variables or define any kind of threshold that was preferred. The paper noted at the end that “Radio-telemetry studies are needed to investigate micro- and macro-habitat associations of wintering great gray owls”, inferring that that was not the focus of this study.

Reference – Kalinowski, R. S., M. T. Johnson, A. C. Rich. 2014. Habitat relationships of great gray owl prey in meadows of the Sierra Nevada Mountains. Wildlife Society Bulletin. 38(3): 547-556.

This study looked at habitat relationships between GGOW and prey species (voles and pocket gophers) in meadow habitat and did not consider forage habitat outside of the wet meadows. GGOW forage habitat is primarily associated with open meadows and not forested habitat. GGOW source habitat is a combination of forested habitat used for nesting, roosting, and young rearing and open meadow habitat used for foraging. One weakness of the mid-scale GGOW model is that it cannot account for this juxtaposition of habitat. Because this study only looked at meadow habitat and not the forested component of GGOW habitat, it was not relevant to the model update.

Reference – van Riper III, C., J. J. Fontaine, J. W. van Wagtendonk. 2013. Great gray owls (*Strix nebulosa*) in Yosemite National Park: on the importance of food, forest structure, and human disturbance. Natural Areas Journal. 33(3): 286-295.

This study found that owl presence was tied to habitat type (red fir), the presence of meadows, prey densities, and snag availability. Also looked at how human presence influenced owl use of habitat. There were preferences shown for mid-elevation red fir and dry meadows that provide small mammal prey.

The study didn't really look at forested habitat parameters other than snag availability, so there was no relevant habitat information regarding tree size or canopy cover class.

Reference – Wu, J. X., R. B. Siegel, H. L. Loffland, M. W. Tingley, S. L. Stock, K. N. Roberts, J. J. Keane, J R. Medley, R. Bridgman, C. Stermer. 2015. Diversity of great gray owl nest sites and nesting habitats in California. Journal of Wildlife Mgmt. 79(6): 937-947.

This study compiled all known nest site data since 1973 and collected habitat data on 47 of the 56 total sites. Study found that mean DBH of nest trees was 100.5 + SD 30.3 cm (40 inches) and that nest trees were significantly larger than reference trees. Also, canopy cover within 50 meters of nest trees was 85.1 + 16.4 percent and was significantly greater than at reference sites. Also looked at distance to meadows (forage habitat) and reported that at higher elevations most nests were within 250 m from the nearest meadow while at lower elevations 31 percent of nests were greater than 750 m from a meadow. Management recommendations included retaining at least 4 snags greater than 40 inches DBH per hectare near meadows. These TSC and TCCC parameters were used for the GGOW mid-scale model update.

Of note is that tree species prevalent within the study area were ponderosa pine, black oak, incense cedar, sugar pine, Douglas fir, white fir, red fir, lodgepole pine, and Jeffrey pine, some of which are very different from what occurs on the Boise NF. While many of these species and habitat types may be different, the general habitat preferences regarding structure and density were considered to still be relevant to the model update.

Reference – Keane, J. J., H. B. Ernest, and J. M. Hull. 2011. Conservation and management of the great gray owl 2007-2009: assessment of multiple stressors and ecological limiting factors. National Park Service, Yosemite National Park and U.S. Forest Service, Pacific Southwest Research Station Interagency Report, Davis, California, USA.

This report is a summarization of all great gray owl research completed in Yosemite NP between 2007 and 2009. Keane and Ernest (2011), a reference reviewed for this update, was summarized in this report. This report did not review or discuss any habitat parameters relevant to this model update.

The following reference was also used to inform this model update but was not referenced in the original 2008 model, even though it would have been available at the time.

Reference - Bryan, T, and E. D. Forsman. 1987. Distribution, abundance, and habitat of great gray owls in southcentral Oregon. The Murrelet. 68:45-49.

This study looked at the distribution, abundance, and habitat of great gray owls in southcentral Oregon in 1984 and 1985. Habitat data was recorded at response and nest sites. Canopy “closure” was estimated visually, and tree density was measured for a 0.25 ha circular plot from the nest tree. Of 63 sites where owls were located, 60 were less than 0.3 km from a meadow and the other 3 were in forested stands between 0.3 and 0.8 km from a meadow. Fifty-nine of those sites were in stands dominated by lodgepole or a lodgepole/ponderosa pine mix, and all of the sites were within either “old growth” or “mature” stands. Forty-three sites had had some kind of selective logging or firewood cutting in the past 20 years. Of the 11 nests that were found, 6 were old NOGO nests in lodgepole pine, 4 were old red-tailed hawk nests in ponderosa pine, and one was in a cavity in a large broken-topped ponderosa pine. Eight nests were in live trees and the other 3 were in snags. Canopy ‘closure’ at nest sites was reported to be **46.5 percent** (SD = 21.50).

K-2-1.12 Lewis’s Woodpecker

Mid-scale Modeling Update
for the
Lewis’s Woodpecker
March 21, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the Lewis’s Woodpecker Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Nutt et al. 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest’s modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

Review of New Species Literature since 2008

The Boise NF mid-scale habitat model for the Lewis’s Woodpecker (LEWO) was created in 2005 and revised in 2008 (Nutt et al. 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the

Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Lewis's Woodpecker Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the "Forest Derived Product." Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e. "stands"), to meet the minimum map unit of 5 acres for most polygons, and to

reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9" DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a; Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the Lewis's woodpecker. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-34**.

Table K-2-34 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification?
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (0.1 – 4.9" DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (≥ 30" DBH)	**new**

The species conservation assessment completed by Abele et al. (2004) of various studies from Idaho, Colorado, Wyoming, and California found mean nest tree DBH was 18.5, 44, 19, and 26 inches, respectively. In another Idaho study, Saab et al. (2009) also reported a mean DBH of 20 inches compared to other available snags. These reported size classes fall in the upper end of the Medium Tree Size class and in the Large and Very Large Tree Size classes.

Examples in the literature that show use of the full range of the Medium Tree Size class are generally lacking, the exception being a study by Linden (1994) who reported LEWOs nesting in trees as small as 13 inches DBH. Three more recent studies in Utah, South Dakota, and Idaho reported mean nest tree sizes of 14, 15, and 16 inches, respectively; however, these studies occurred in either aspen or other habitat types with generally smaller maximum tree sizes than what occurs in central Idaho (Vande Voort 2011; Vierling et al. 2009; Newlon and Saab 2011) and as a result may not be comparable. It is important to note that all three of these studies reported that LEWOs selected the largest size available in their respective study areas. Several other references used in this model update also noted that same preference (Saab et al. 2009; Saab and Dudley 1998; Wisdom et al. 2000; Vierling 1997). Actual use, however, depends on species composition (ponderosa pine and grand fir) and the presence of rot in dead or dying trees, conditions which larger trees tend to provide for a longer period of time. For central Idaho where most tree species attain diameters of 20 inches or more, use of just the Large and Very Large Tree Size classes would be more appropriate and would more accurately represent the large tree preference for this species. Even though LEWOs can make use of snags in the Medium Tree Size class, inclusion of the Medium Tree Size class in the model would likely result in an overestimation of source habitat as the majority of the literature appears to support size classes only at the upper end of the range of this class.

Table K-2-35 shows the crosswalk between tree size class parameters found in the literature and the new recommended tree size class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Large (20-29.9" DBH) and Very Large (>30" DBH) Tree Size classes be used to model source habitat for the Lewis's woodpecker.

Table K-2-35 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Vierling, Kerri T., Victoria A. Saab and Bret W. Tobalske. (2013). Lewis's Woodpecker (*Melanerpes lewis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/lewwoo DOI:	Average diameter of trees at nests 50.47 cm ± 0.97 SE (**20 inches dbh**) vs. 26.26 cm ± 2.45 (10 inches) at non-nest random tree	Medium (10-19.9" DBH) Large (20-29.9" DBH)
10.2173/bna.284. Accessed on March 31, 2017.		
Saab, V., R. Brannon, J. Dudley, L. Donohoo, D. Vanderzanden, V. Johnson, H. Lachowski. 2002. Selection of fire-created snags at two spatial scales by cavity-nesting birds. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. (Idaho)	Mean nest tree DBH (cm) in Idaho of 47.5 + 1.1 SD (n=115) [**18.5 inches**].	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)
Abele, S.C., V.A. Saab, and E.O. Garton. (2004, June 29). Lewis' Woodpecker (*Melanerpes lewis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http: //www.fs.fed.us/r2/projects/scp/ assessments/lewiswoodpecker. pdf [November 5, 2007]	*USDA Forest Service Region 2 Conservation Assessment of Lewis's woodpecker. Compiled literature on habitat characteristics of nest sites of Lewis's woodpeckers in western North America (Table 2).* Mean nest tree DBH (cm) in Idaho 47.5 + 1.1 SD (n=115) [**18.5 inches**]; in Colorado 112.6 + 39 SD (n=47) [**44 inches**]; in Wyoming 48 + 8 SD (n=35) [**19 inches**]; and California 66.5 (n=37) [**26 inches**].	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	Sources of mean nest tree DBH info: Idaho: Saab and Dudley 1998, Saab et al 2002; Colorado: Tashio-Vierling 1994, Vierling 1997; Wyoming: Linder 1994, Linder and Anderson 1998; California: Raphael and White 1984 (nest tree).	
Linder, K.A. 1994. Habitat utilization and behavior of nesting Lewis' woodpeckers (*Melanerpes lewis*) in the Laramie Range, Southeastern Wyoming. Master's Thesis. Laramie, WY: University of Wyoming, Department of Zoology and Physiology. 98 pages. (Wyoming)	Most of the nest trees were dead (92%). Minimum DBH was 33 cm (13 in), mean DBH was 48 cm (**19 inches**).	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)
Raphael, M.G.; White, M. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. Wildlife Monographs No. 86: 1-66. (California)	Mean dimensions for Lewis's woodpecker nest trees: DBH=66.5 cm (**26.2 inches**); tree diameter at hole=52.2 cm (**20.6 inches**) Characteristics of Lewis's woodpecker nest trees in one specific area in the	Large (20-29.9" DBH) Very Large (>30" DBH)
	study (Sagehen Creek): mean DBH: 66.5 cm (**26 in**); min DBH: 56 cm (**22 in).**	
Saab, V. A., R. E. Russell, and J. G. Dudley. 2009. Nest-site selection by cavity-nesting birds in relation to postfire salvage logging. Forest Ecology and Management 257:151–159. (Idaho) (including Foothills Fire on the BNF)	LEWOs selected snags with a mean DBH of around 50 cm (**20 inches**) compared to much smaller snags sizes in the vicinity of the nest site.	Large (20-29.9" DBH) Very Large (>30" DBH)
Saab, V.A.; Dudley, J.G. 1998. Responses of cavity-nesting birds to stand–replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. Research Paper RMRS-RP-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 pages. (Southwest Idaho)	**For nest sites, selected the most open areas**, but with highest tree densities of large trees compared to controls. **Used larger**, heavily decadent **trees in greater proportion than available**. Mean nest tree DBH (cm) in Idaho 47.5 ± 1.1 SD (n=115) [**18.5 inches**]	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of	Source habitat includes old-forest stages of the montane, lower montane and riparian woodlands terrestrial community groups. Structural stages vary by covertype but include old-forest single and multi-storied. Snags and trees used for nesting are generally the largest and softest of those available. Saab and Dudley found Lewis's nesting in areas of recent, large (>100,000 acre)	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	stand-replacing fire. Nested in areas with “clumpy” snag distributions; **snags 9 inches DBH** averaged 24/acre; **snags 21 inches DBH** averaged 6.3/acre. Sites recently burned by stand-replacing fire seem to provide more productive source habitats than unburned sites. *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	
Vierling, K.T. 1997. Habitat selection of Lewis’ woodpeckers in southeastern Colorado. Wilson Bull., 109(1): 121-130. (Colorado)	**Nest trees were taller and of larger diameter than random trees** in the sample area. Nest trees at both sites were larger in diameter than random trees (112.6 cm + 38.8 vs 63.6 cm + 54.9) (**44 inches** vs. 25 inches)	Very Large (>30” DBH)
Vierling, K.T., D.J. Gentry, A.M. Haines. 2009. Nest Niche Partitioning of Lewis's and Red-headed Woodpeckers in Burned Pine Forests. The Wilson Journal of Ornithology. (121(1):89-96. (South Dakota)	LEWOs preferred trees or snags that were larger and taller than available at random. Mean DBH of nest trees n=46) was 38.2 + 1.09 (**15 inches**) versus 31.1 + 1.07 (12 inches) at random sites.	Medium (10-19.9” DBH)
Newlon, K.R., and V.A. Saab. 2011. Nest-site selection and nest survival of Lewis’s woodpecker in aspen riparian woodlands. The Condor. 113()1):183-193. (south-central Idaho)	The study found that LEWOs selected nest trees that were larger than random trees within the study area Mean DBH of nest trees (aspen) was found to be 41.3 cm + 15.3 (**16 inches**).	Medium (10-19.9” DBH)
Vande Voort, Amy M., "Habitat Characteristics and Occupancy Rates of Lewis's Woodpecker in Aspen" (2011). *All Graduate Theses and Dissertations.* Paper 922. (Utah)	Mean nest tree DBH of 35.79 + 5.89 cm (**14 inches**). All nest trees in aspen.	Medium (10-19.9” DBH)

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-36**.

Table K-2-36 Tree Canopy Cover Class Differences Between the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

Most literature sources generally describe Lewis's Woodpecker nesting and foraging habitat as occurring in "open" forest conditions (Saab and Rich 1997; Vierling 1997; Linder 1994; Saab and Dudley 1998; Wisdom et al. 2000). LEWOs generally use clumps of trees/snags for nesting, roosting, and perching habitat. These clumps are commonly found within a matrix of more open habitat, either in open- canopied forested stands or in burned areas, which provides forage habitat for the species. Open conditions not only provide for maneuvering but also a robust shrub layer that is conducive to producing large populations of insects. The preference for open canopy conditions is also supported by Saab and Dudley (1998) who found that Lewis's woodpeckers occurred in large numbers in burned areas where existing tree numbers had been reduced from salvage harvesting.

There was limited quantitative information on canopy cover as a habitat parameter in the literature, likely because most studies occurred in burned habitat which would presumably have little to no canopy cover. A few sources did quantitatively address canopy cover, however. Abele et al. (2004) reported a mean canopy cover of 5.2 percent (n=115) in an Idaho study and 27.3 percent (n=35) in a Wyoming study. Vande Voort (2011) reported a mean canopy cover of 29 percent within aspen stands in Utah.

Saab and Dudley (1998) reported that LEWOs used stands that had moderate (40-70 percent) pre-fire canopy cover that would have presumably become low canopy cover following wildfire. Similarly Vierling et al. (2008) found that four of six nest sites were in areas that had Low (<40 percent) pre-fire canopy cover and the other two were in stands with moderate (40-70 percent) pre-fire canopy cover; again, areas that would likely become low canopy cover following a wildfire.

Because those studies that reported mean canopy covers all had values below 30 percent, and because most of the other references generally described source habitat as open-canopied or burned, use of the Low (10-19%) and Low-Medium (20-29%) tree canopy cover classes in the model would be expected to reasonably estimate LEWO source habitat. Inclusion of the Medium (30-44%) Tree Canopy Cover class, especially the upper end, would not likely facilitate the growth of a shrub layer that could provide invertebrate prey habitat, and would likely be too dense to allow the aerial foraging activity this species is known for. As a result, inclusion of the Medium Tree Canopy Cover class would likely result in an overestimate of source habitat at the mid-scale level and is not recommended for inclusion in this habitat model.

To assess source habitat, modeling would best approximate the findings of the literature by selecting for forested stands in the Low (10-19%) and Low-Medium (20-29%) Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-37 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Low (10-19%) and Low-Medium (20-29%) Tree Canopy Cover classes is recommended for modeling Lewis's woodpecker source habitat.

Table K-2-37 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Abele, S.C., V.A. Saab, and E.O. Garton. (2004, June 29). Lewis' Woodpecker (*Melanerpes lewis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http: //www.fs.fed.us/r2/projects/scp/ assessments/lewiswoodpecker.pdf [November 5, 2007]	*USDA Forest Service Region 2 Conservation Assessment of Lewis's woodpecker. Compiled literature on habitat characteristics of nest sites of Lewis's woodpeckers in western North America (Table 2).* **Mean canopy cover in Idaho 5.2 $\pm$ 5.6 SD percent** (n=115); in Wyoming **27.3 $\pm$ 13 SD percent** (n=35) Sources of canopy cover info: Idaho: Saab and Dudley 1998, Saab et al 2002; Wyoming: Linder and Anderson 1998.	Low (10-19%) Low-Medium 20-29%)
Saab, V., R. Brannon, J. Dudley, L. Donohoo, D. Vanderzanden, V. Johnson, H. Lachowski. 2002. Selection of fire-created snags at two spatial scales by cavity-nesting birds. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. (Idaho)	LEWOs selected stands that preburn were moderate crown closure stands of ponderosa pine and Douglas-fir, and that post burn were moderately dense stands of snags with relatively large diameters. This characterized nest-site selection by Lewis's woodpecker at the microhabitat and landscape scales. (*JFoust) - While the snag density was moderate in the burned stand, the canopy cover would have presumably been* ***Low*** *due to the burned condition of what was originally a moderate canopy cover stand prior to the burn.)* Burned landscapes used by nesting Lewis's woodpeckers were primarily composed of closely distributed, small to medium-sized stands of ponderosa pine/moderate crown closure (pre-fire).	Low (10-19%) Low-Medium 20-29%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	Regardless of cover type or treatment, moderate crown closure in a burned condition was the most important characteristic of a landscape feature in predicting the presence of a Lewis's woodpecker nest.	
Vande Voort, Amy M., "Habitat Characteristics and Occupancy Rates of Lewis's Woodpecker in Aspen" (2011). *All Graduate Theses and Dissertations.* Paper 922. (Utah)	The study reported a percent canopy cover of **29 percent**. The logistic models showed that crown cover was negatively associated with nest occurrence, indicating that less crown cover is favorable. The results indicated that LEWO selects large diameter trees in areas with **< 30 percent canopy cover**. (*all nests were in aspen*)	Low (10-19%) Low-Medium 20-29%)
Vierling, K. T., L. B. Lentile, and N. Nielsen-Pincus. 2008. Preburn characteristics and woodpecker use of burned coniferous forests. Journal of Wildlife Management 72:422–427. (South Dakota)	Of 6 LEWO nests, 4 were located in areas that had **Low (<40%) prefire canopy cover**, and two were located in areas that had Medium (40-70%) prefire canopy cover.	Low (10-19%) Low-Medium 20-29%) Medium (30-44%)
Linder, K.A. 1994. Habitat utilization and behavior of nesting Lewis' woodpeckers (*Melanerpes lewis*) in the Laramie Range, Southeastern Wyoming. Master's Thesis. Laramie, WY: University of Wyoming, Department of Zoology and Physiology. 98 pages. (Wyoming)	Author stated that **open canopy**, abundant down and dead greater than 1 inch, and availability of perches were the primary characteristics related to nesting habitat selection.	---
Saab, V.A.; Dudley, J.G. 1998. Responses of cavity-nesting birds to stand–replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. Research Paper RMRS-RP-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 17 pages. (Southwest Idaho)	For nest sites, selected the most **open areas**, but with highest tree densities of large trees compared to controls. Lewis's Woodpeckers used the most **open nest sites** with a **mean** of 24.7 k 2.3 trees [>9" dbh] per acre. Lewis's Woodpecker is an aerial insectivore requiring openings for foraging maneuvers, which might explain why their nest sites were relatively open.	---
Vierling, K.T. 1997. Habitat selection of Lewis' woodpeckers in southeastern Colorado. Wilson Bull., 109(1): 121-130. (Colorado)	Nest in **open areas**—do not nest near dense tree stands. Speculation that dense stands impede foraging maneuverability as well as insect visibility.	---

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Vierling, K.T., D.J. Gentry, A.M. Haines. 2009. Nest Niche Partitioning of Lewis's and Red-headed Woodpeckers in Burned Pine Forests. The Wilson Journal of Ornithology. (121(1):89-96. (South Dakota)	Sites were more likely to be used for nests if they had larger and taller snags, a higher density of shrubs, and **fewer tree and snag stems** compared to random sites.	---
Saab, V.A.; Rich, T.D. 1997. Large-scale conservation assessment for Neotropical migratory land birds in the interior Columbia basin. Gen. Tech. Rep. PNW-GTR-399. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 56 pages. (uigley, T.M. [ed] Interior Columbia Basin Ecosystem Management Project Scientific Assessment)	Lewis's woodpecker use **open, mature** coniferous forest and post-fire forests as primary nesting habitats. Lewis's woodpecker associated with **open ponderosa pine** and other fire-adapted habitats. *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	---
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW- GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	Nest sites are generally associated with an abundance of flying insects, **open canopy** or tree clumps, snags, and dense ground covers. Nesting sites often associated with recently burned pine forests. Openings created by stand-replacing fire may provide greater opportunity for foraging due to increased space, ground cover, and insects. *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	---
Newlon, K.R., and V.A. Saab. 2011. Nest-site selection and nest survival of Lewis's woodpecker in aspen riparian woodlands. The Condor. 113()1):183-193. (south-central Idaho)	Lewis's Woodpecker nest sites differed from random non-nest sites by having **more trees**, fewer woody stems, and less bare ground.	---

Source Habitat Conditions When Outside HRV Discussion

None

Additional Modeling Parameters

None.

Model Limitations

This species is documented in the literature to be associated with recent fires; adequate numbers of large, soft ponderosa pine or grand fir/white fir snags in clumps; and herb-shrub-dead/down material that provide large numbers of insects. The mid/fine-scale model cannot take these needs into account and therefore will overestimate the amount of suitable habitat for this species.

Updated Forest Modeling Parameters for Lewis's Woodpecker Source Habitat

The updated mid-scale habitat parameters for the Lewis's Woodpecker are as follows:

Within HRV
PVGs: 1, 2, and 5
Tree Size Class: Large and Very Large
Tree Canopy Cover Class: Low and Low-Medium

Note: This species is documented in the literature to be associated with recent fires (see comment on page 11); adequate numbers of large, soft ponderosa pine or grand fir/white fir snags in clumps; and herb-shrub- dead/down material that provide large numbers of insects. The mid/fine-scale model cannot take these needs into account and therefore will overestimate the amount of suitable habitat for this species.
Source habitat is defined by those characteristics of macrovegetation *that contribute to stationary or positive population growth*.

**Comment: Though Lewis's woodpecker is described as a "burn specialist", this may be an artifact of the time period these studies were conducted. These birds appear to require soft snags in clumps adjacent to open shrub- herb communities. In PVGs 1, 2, and 5, these conditions would have occurred under historical non-lethal fire regimes and endemic insect cycles rather than stand-replacing fire. Recent wildfires may be creating the open conditions with snags that have been lost on the landscape from changes in disturbance regimes and cutting/harvesting of large trees.

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 Lewis's Woodpecker Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

The literature search found six references dated more recent than 2008 and that would not have been available for the last update of the model, and that was habitat focused. A summary of relevant habitat information from *The Birds of North America* (BNA) online account was also included because it is a good synthesis of all available habitat information for this species.

Reference – Vierling, Kerri T., Victoria A. Saab and Bret W. Tobalske. (2013). Lewis's Woodpecker (*Melanerpes lewis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/lewwoo DOI: 10.2173/bna.284. Accessed on March 31, 2017.

The following excerpts from the BNA online account are pertinent to this update:

May prefer ponderosa pine forests at medium to high elevations (up to 2,800 m in Arizona, 900 m in British Columbia), and open riparian forests at low elevations (Bock 1970a; Diem and Zeveloff 1980; Siddle and Davidson 1991; Tashiro-Vierling 1994; Vierling 1997). Breeding distribution is widely associated with the distribution of ponderosa pine in w. North America (see Diem and Zeveloff 1980). When using burned forests for breeding, birds may move to unburned forest after young fledge (Block and Brennan 1987). Open stands near water are preferred habitat in the Blue Mtns. of the Pacific Northwest (Thomas et al. 1979a).

Often classified as a specialist in burned pine forest habitat, although the suitability of burned areas as habitat may vary with postfire age, size and intensity of burn, and geographic region (Bock 1970a; Raphael and White 1984; Block and Brennan 1987; Linder 1994; Saab and Dudley 1996 unpubl. data).

Nesting

In burned forests of Idaho, 68% of nests were placed in ponderosa pine and 32% in other coniferous trees, primarily Douglas-fir (*n* = 353; Saab et al. 2009). In aspen forests of central Idaho, 57% of nests placed in aspen and the remaining primarily in black cottonwood (*Populus balsamifera*) (*n* = 76; Newlon and Saab 2011).

Nest sites associated with presence of abundant free-living insects, **open-canopy forest** or tree clusters, standing dead trees (snags), and dense ground cover in the form of downed material, grasses, and shrubs (Bock 1970a; Linder 1994; Tashiro-Vierling 1994; Vierling 1997).

In burned forests of Idaho, model selection was used to evaluate nest site selection at multiple spatial scales; most parsimonious model revealed that habitat characteristics at the nest plot scale (within 1 ha surrounding the nest tree) best described nest site selection, including nest snag dbh, tree species, snag densities, pre-fire vegetation type (*n* = 353, Saab et al. 2009). **Average diameter of trees at nests 50.47 cm ± 0.97 SE (20 inches) vs. 26.26 cm ± 2.45 (10 inches) at non-nest random tree**; 68% of nest trees vs. 64% of random trees were ponderosa pine; average of 107.48 ± 4.03 SE snags/ha surrounding nest trees vs. an average of 36.42 ± 6.21 SE snags/ha surrounding non-nest random trees; 41% of nest plots vs. 39% of non-nest random plots were in ponderosa pine vegetation type.

Management Recommendations

Post-wildfire salvage logging designed to **retain >50% of the snags >23 cm (9 inches) in diameter** helps retain suitable nesting habitat during the decade following fire (Saab et al 2007); similar pattern was noted by Haggard and Gaines (2001)

In aspen forests, values of overall nest survival are similar to those reported for burned pine habitats (Saab et al. 2007, 2011) and nearly twice those reported for cottonwood riparian habitats (Saab and Vierling 2001).

Open cottonwood habitat with mature trees is used for breeding and overwintering (Bock 1970a; Hadow 1973; Tashiro-Vierling 1994; Vierling 1997).

Reference – Saab, V. A., R. E. Russell, and J. G. Dudley. 2009. Nest-site selection by cavity-nesting birds in relation to postfire salvage logging. Forest Ecology and Management 257:151–159.

This study looked at how several species of woodpecker, including Lewis's, selected nest sites within large wildfires that had salvage logged areas. The study reported that nest site selection by LEWOs was consistently associated with higher snag densities and larger diameters, that they selected for the more open canopied areas that had been salvaged logged, and that they selected large snags that occurred within a clump of snags. The study didn't report on canopy cover, as it was conducted within burned areas, but did show that LEWOs selected snags with a mean DBH of around 50 cm (**20 inches**) compared to much smaller snags (mean DBH of 10 inches) that were available (Figure 1, pg. 155).

Reference – Saab, V.A., R.E. Russel, J. Rotella, J. G. Dudley. 2011. Modeling nest survival of cavity-nesting birds in relation to postfire salvage logging. Journ. of Wildl. Mgmt. 75(4):794-804.

This emphasis of this study was on nest survival of six cavity-nesting species, including Lewis's woodpecker, and how salvage logging may or may not impact nest survival. The paper didn't really go into TSC or TCCC specifics as it was more focused on the survival numbers and other parameters such as temperature, age of fire, tree height, distance to unburned habitat, and whether stands were harvested or not. It used the same study area as Saab et al. (2009) did for their work. It also stated that the salvage logging that occurred in the study area "was designed to maintain a portion of large diameter snags, those >23 cm diameter at breast height with an average density of 45.0 $\pm$ 5.1 snags/ha, that appeared to provide adequate nesting substrate without apparent effects on survival of most cavity-nesting birds." Other than that there was no useful information on TSC and TCCC that would inform this model update.

Reference – Newlon, K.R., and V.A. Saab. 2011. Nest-site selection and nest survival of Lewis's woodpecker in aspen riparian woodlands. The Condor. 113()1):183-193.

This study monitored 76 nest sites in aspen-riparian woodland habitat in south central Idaho in order to assess habitat selection and how that may or may not affect young survival. The study found that LEWOs selected nest trees that were larger than random trees within the study area. Only DBH was included as a variable for the models; canopy cover was not. Mean DBH of nest trees was found to be 41.3 cm + (**16 inches**). Even though this study looked at only aspen habitat, it still shows the LEWO's preference for the largest trees available within a given habitat type.

Reference – Vierling, K.T., D.J. Gentry, A.M. Haines. 2009. Nest Niche Partitioning of Lewis's and Red- headed Woodpeckers in Burned Pine Forests. The Wilson Journal of Ornithology. (121(1):89-96.

The emphasis of this study was to assess potential habitat differences between two overlapping woodpecker species, Lewis's and red-headed, in the Black Hills, South Dakota. Vegetation variables in the modeling did not include canopy cover but did include DBH. The mean DBH of nest trees n=46) was 38.2 $\pm$ 1.09 (**15 inches**) versus 31.1 $\pm$ 1.07 (12 inches) at random sites. LEWOs preferred trees or snags that were larger and taller than available at random. The study suggested that there was no meaningful competition between the species because both had nest success over 90 percent.

Reference – Vande Voort, Amy M., "Habitat Characteristics and Occupancy Rates of Lewis's Woodpecker in Aspen" (2011). *All Graduate Theses and Dissertations.* Paper 922.

This study compared habitat characteristics to occupancy rates in aspen habitat types for nesting LEWOs. The study reported a mean nest tree DBH of 35.79 + 5.89 cm (**14 inches**) and a percent canopy cover of **29 percent**. The logistic models showed that crown cover was negatively associated with nest occurrence, indicating that less crown cover is favorable. Average DBH was also positively associated indicating that LEWOs select for larger diameter trees for their nesting areas. The results indicated that LEWO selects large diameter trees in areas with **<30 percent canopy cover**. While this study was solely in aspen types and maybe not completely comparable to habitat on the Boise National Forest, the parameters provided still have some merit in that they selected the largest trees available with relatively low canopy cover.

Reference – Vierling, K. T., L. B. Lentile, and N. Nielsen-Pincus. 2008. Preburn characteristics and woodpecker use of burned coniferous forests. Journal of Wildlife Management 72:422–427.

This study compared woodpecker use of burned forests to preborn vegetative characteristics. The density of LEWOs was relatively low compared to other studies in Idaho, potentially due to the general lack of large diameter trees. Of 6 LEWO nests, 4 were located in areas that had Low (<40%) pre-fire canopy cover, and two were located in areas that had Medium (40-70%) pre-fire canopy cover. The paper listed mean DBH of nest tree and canopy cover at nest sites for all species except LEWO because of the small sample size (6 total nests) compared to other species (all other species had 17 or greater nest sites).

The following reference from 2002 was also used to inform this model update but was not referenced in the original 2008 model, even though it would have been available at the time.

Reference - Saab, V., R. Brannon, J. Dudley, L. Donohoo, D. Vanderzanden, V. Johnson, H. Lachowski. 2002. Selection of fire-created snags at two spatial scales by cavity-nesting birds. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181.

This study occurred on the Boise National Forest from 1994 through 1998 in the Foothills and Star Gulch fire perimeters. The study specifically looked at the use of snags in both logged and unlogged stands by seven species of cavity-nesting birds, including Lewis's woodpecker. They looked at two spatial scales; microhabitat and landscape.

The study reported that Lewis's woodpeckers selected nest sites with moderate densities of large diameter snags. While this study occurred in burned habitat and not in live forested stands which is the focus of this habitat model, it still offered information on preferred snag size which was used to inform the tree size class portion of this model update. The mean diameter of nest tree in this Idaho study was cm $\pm$ 1.1 cm SD (n=115), or **18.5 inches** DBH. For canopy cover, LEWOs selected stands that before fire were **moderate crown closure** stands of ponderosa pine and Douglas-fir, and that post burn were moderately dense stands of snags with relatively large diameters. This characterized nest-site selection by Lewis's woodpecker at the microhabitat and landscape scales.

Burned landscapes used by nesting Lewis's woodpeckers were primarily composed of closely distributed, small to medium-sized stands of ponderosa pine/moderate crown closure (pre-fire).

Regardless of cover type or treatment, moderate crown closure in a burned condition was the most important characteristic of a landscape feature in predicting the presence of a Lewis's woodpecker nest.

K-2-1.13 Mountain Quail

Mid-scale Modeling Update
for the
Mountain Quail
April 1, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the Mountain Quail Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Geier-Hayes and Nutt 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

Review of New Species Literature Since 2008

The Boise NF mid-scale habitat model for the Mountain Quail (MOQU) was created in 2005 and last revised in 2008 (Geier-Hayes and Nutt 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and shrub or shrub/tree canopy cover class were listed in the Crosswalk tables in the Forest Habitats and Non-forest Habitats sections. All new literature reviewed for this 2019 Mountain Quail Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or canopy cover, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-Scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the “Forest Derived Product.” Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger

unit on the ground (i.e. “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the

Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a; Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Outline for Parameter Review Discussion

This species is primarily associated with shrub communities that may or may not occur within or adjacent to forested habitats. Therefore, this literature review and model update will address mid-scale habitat parameters for both Forest and Non-Forest habitats to account for the entire range of source habitat.

Parameter Review Discussion for Forest Habitats

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the mountain quail. No change is recommended.

Tree Size Class Discussion

Tree Size Class classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-38**.

Table K-2-38 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification?
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (0.1 – 4.9" DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (≥ 30" DBH)	**new**

Quantitative descriptions of tree size classes used by MOQU are lacking in the literature. Most describe forested source habitat in broad terms, and only one reference could be found that actually reported on sizes of the forested overstory used by MOQU. Therefore, most of the habitat descriptions used in this discussion, and listed in the parameter crosswalk (**Table K-2-39**), were chosen primarily to establish that MOQU use forested habitats.

Wisdom et al. (2000) describes forest habitat associations for this species as all forested vegetation stages except stem exclusion in Interior Douglas-fir, Interior Ponderosa Pine, and Western Larch cover types. In Idaho, Herman et al. (2002, *in* Vogel and Reese 2002), Reese et al. (1999, *in* Vogel and Reese 2002), and Vogel and Reese (1995), all describe use of conifer shrub or riparian shrub communities that have a forested component by mountain quail. In a study in west-central Idaho, Reese et al. (2005) reported that 71 percent of nests and 44 percent of broods were located in conifer shrub cover types. They also reported a mean DBH of trees at quail nest sites to be 9.4 inches and 6.5 inches in different years, indicating that MOQU were using habitat with a forested canopy and in the Small Tree Canopy Cover class. Other studies broadly described MOQU habitat as having open or partially open (forest) canopies (Nelson and Douglas 2006) or occurring within mixed forests (Brennan et al. 1987).

Because the mix of forest/shrub vegetative communities described in the literature is not dependent on the size of the overstory, but rather is related to the shrub understories, source habitat can occur in any tree size class. As a result, all growth stages can provide habitat and should be included in the model.

Table K-2-39 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size classes, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Seedling (<4.5” tall), Sapling (0.1-4.9” DBH), Small (5-9.9” DBH), Medium (10-19.9” DBH), Large (20-29.9” DBH) and Very Large (>30” DBH) Tree Size classes be used to model source habitat for the mountain quail for all forested habitats.

Table K-2-39 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior	Source habitat includes **all forested vegetation stages** except stem exclusion in the following covertypes: **Interior Douglas-fir, Interior Ponderosa pine, and Western Larch**; all stages in Chokecherry-serviceberry-rose. Source Habitat from Appendix 1, Volume 3, Table 1, pages 437-440 Cover types/structural stage for summer: Interior Douglas-fir, Interior Ponderosa pine/old multi-story, old single-story, unmanaged young multi-story, managed young multi-story, understory re-initiation, stand initiation. Chokecherry-serviceberry-rose/open tall shrub, open low-medium shrub, closed low-medium shrub.	All Size Classes

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Columbia Basin Ecosystem Management Project: scientific assessment).	*Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	
Vogel, C.A; Reese, K.P. 1995. Habitat Conservation Assessment for Mountain Quail (*Oreortyx pictus*). Prepared for: Idaho State Conservation Effort, Idaho Dept. of Fish and Game, Boise, ID. 68 pages (ID, OR, CA, WA, NV)	In Idaho, mountain quail distribution is closely associated with riparian shrub habitats that **may or may not have a forest canopy** (Ormiston 1966, Brennan 1989) that occur along waterways and secondary drainages within a few hundred meters of water. Habitat is confined to corridors of vegetation along breaks and secondary drainages of the Snake, Salmon, and Clearwater Rivers (Ormiston 1966). Remaining habitat covers steep, dissected slopes with ridges, gulches, and outcrops of basalt. South-facing slopes are arid and dominated by grasses such as bluebunch wheatgrass and Idaho fescue together with several species of forbs. In draws or on north facing slopes, serviceberry, hawthorn, ninebark, snowberry, and wild rose are common. Moist sites are elderberry, alder, red-osier dogwood, and cottonwood. **Higher elevation sites include ponderosa pine and Douglas-fir**.	All Size Classes
Vogel, C.A; Reese, K.P. 2002. Mountain quail (*Oreortyx pictus*)	*This document summarizes reports and publications on mountain quail distribution,*	All Size Classes
distribution and conservation in the eastern portion of their range. Prepared for: Idaho State Conservation Effort, Idaho Department of Fish and Game, Boise, ID. 59 pages	*status, biology, ecology, and management through the eastern portion of their range (including western Idaho).* *Idaho Spring and Summer Habitats*: The majority of 1,072 mountain quail locations in the Herman et al. (2002) study in west-central Idaho were in riparian shrub (29%), **conifer shrub (27%)**, and mountain shrub (22.4%). The remaining locations were in grass, agriculture and residential garden habitats (21.6%). *Idaho Fall and Winter Habitats*: Reese et al. (1999) found mtn quail in the Little Salmon River area were most often in **conifer/shrub (37% in 1994/1995; 33% in 1995-96)** and grass/scattered shrub (15% in 1994-95; 40% in 1995-96) cover types. Remaining locations were divided among **riparian/tree/shrub**, riparian/shrub, residential garden, and mountain/shrub cover types, predominantly. Road and grass cover types were used infrequently; agriculture cover type least of all. Reese et al (1999) found covey sites were at lower elevations, had taller shrubs, more visual obstructions, less snow depth, greater vegetative canopy cover, **smaller trees**, and were closer to water compared to independent sites. Nocturnally 34% (n=35) of locations were in	

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	conifer/shrub in 1994-5 while 50% occurred in grass/scattered shrub in 1995-6.	
Reese, K.P., J.L. Beck, P. Zager, P.E. Heekin. 2005. Nest brood site characteristic of mountain quail in west-central Idaho. NW Science. Col. 79, No. 4. (west-central Idaho)	**Fifteen (71%) nests were located in conifer-shrub**, 4 (19%) in mountain-shrub, and 2 (10%) in riparian-shrub. **Seven (44%) broods were located in conifer-shrub cover**, 5 (31%) in mountain shrub, 3 (19%) in grass-scattered shrub, and 1 (6%) in riparian-shrub (pg. 258) Mean DBH of trees at quail nest sites was 23.9 cm (**9.4 inches**) in 1992 and 16.4 cm (**6.5 inches**) in 1995 (Table 1, pg. 259) as measured for microhabitat portion of study.	All Size Classes
Nelson, Jamie and Douglas Robinson. 2006. Mountain quail translocations in eastern Oregon, Project Report 2006. Dept. of Fisheries and Wildlife, Oregon State University. Corvallis, OR. 20 p. (eastern Oregon)	Nest sites were often in areas with generally **open or partially open canopies** and limited shrub cover. **Forest types** in the study area included **ponderosa pine, Douglas-fir**, white fir and **grand fir**.	All Size Classes
Brennan, L.A.; Block, W.M.; Gutierrez, R.J. 1987. Habitat use by mountain quail in northern California. The Condor, 89: 66-74 (California)	Macrohabitats used: **mixed forest**, mixed brush, oak woodland, pine-juniper, and shrub-steppe.	All Size Classes

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-40**.

Table K-2-40 Tree Canopy Cover Class Differences Between the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 40% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
41 – 70% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
71 - 100% High		

Similar to the tree size class discussion, information on tree canopy cover class for MOQU habitats is scarce. The shrub component is the most critical part of MOQU source habitat as it affords MOQU security, thermal cover, food, and shade, and it, along with ground cover, is typically what is described in most habitat accounts. Tree canopy cover is secondary in importance and is likely why most sources describe tree overstory at MOQU nest/brood sites in general terms, such as within ‘open canopy ponderosa pine’ (Reese et al. 2005) or ‘open or partially open canopies’ (Nelson and Robinson 2006).

These broad descriptions probably fall within the Low and Low-Medium Tree Canopy Cover classes the best. Reese et al. (2005) measured canopy covers at nest and brood sites and reported fairly high canopy covers, however, their canopy cover value was a combination of both tree and shrub overstory. They reported mean overstory canopy covers of 62 percent for nest sites and 43 percent for brood sites in the first year of the study, and 46 percent for nest sites and 33 percent for brood sites in the second year. Because habitat was described as occurring within areas of dense shrub cover, the actual canopy cover for the tree overstory by itself was likely minimal. Nelson (2007) similarly described mean canopy cover at nest sites at 28 percent that was again a combination of shrubs and trees.

In general as conifer density increases, shrub coverage generally declines. This is particularly true for seral shrubs though climax species such as ninebark and snowberry also reach higher coverages in less

shaded areas. Because dense shrub communities are most likely to develop under relatively low tree canopy cover, only the Low and Low-Medium Tree Canopy Cover classes are recommended. Inclusion of the Medium Tree Canopy Cover class and above would not likely generate the shrub densities preferred by this species and are not recommended for inclusion in the model.

Table K-2-41 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover classes, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Low (11-19%) and Low-Medium (20-29%) Tree Canopy Cover classes is recommended for modeling mountain quail source habitat.

Table K-2-41 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
Reese, K.P., J.L. Beck, P. Zager, P.E. Heekin. 2005. Nest brood site characteristic of mountain quail in west-central Idaho. NW Science. Col. 79, No. 4. (west-central Idaho)	Mountain quail typically nested in **open-canopy** ponderosa pine with a ninebark understory (pg. 261). From Table 1 (pg. 259) mean overstory canopy closure for year 1992 was 62 + 8 percent at nests and 43 + 9 at brood locations. For year 1995 it was 46 + 5 percent for nesting and 33 + 8 for brood sites. However, these mean canopy closures included both tree and shrub overstories.	Low (10-19%) Low-Medium (20-29%)
Nelson, Jamie and Douglas Robinson. 2006. Mountain quail translocations in eastern Oregon, Project Report 2006. Dept. of Fisheries and Wildlife, Oregon State University. Corvallis, OR. 20 p. (eastern Oregon)	Nest sites were often in areas with generally **open or partially open canopies** and limited shrub cover.	Low (10-19%) Low-Medium (20-29%)
Gutiérrez, R. J. and David J. Delehanty. (1999). Mountain Quail (*Oreortyx pictus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/mouqua DOI: 10.2173/bna.457 Accessed March 15, 2017.	On ground, usually very dense overhead cover of shrubs or tree bough (Bent 1932), near protective cover, highly concealed, requiring view from <0.5 m to see eggs (DJD). Nests observed under **short (1 m) pine saplings**, under piñon boughs at trunk, under shrubs (DJD). Often nests on steep hillside or adjacent to steep bank in **second-growth forest** or shrub-dominated communities, usually under or against protective cover. Studied in detail by Gutiérrez (Gutiérrez 1977 , Gutiérrez 1980). Forages in shrub	Nothing described or defined enough to assign a Tree Canopy Cover Class
	and **forest communities** under canopy and at edge of these habitats... *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	
Nelson, Jamie N. 2007. Survival and nest site characteristics of translocated mountain quail on Steens Mountain, Oregon. Thesis. Oregon State University. 54 pgs. (Oregon)	Mean canopy cover for nest sites in study was 28%, includes both shrubs and trees. (western juniper dominant tree sp.)	Low (10-19%) Low-Medium (20-29%)
Vogel, C.A; Reese, K.P. 1995. Habitat Conservation Assessment for Mountain Quail (*Oreortyx pictus*). Prepared for: Idaho State Conservation Effort, Idaho Dept. of Fish and Game, Boise, ID. 68 pages (ID, OR, CA, WA, NV)	**Thick, closed-canopy forests support few mountain quail** and periodic fires or logging in, these areas may improve habitat conditions and result in higher densities of birds.	**NOT** Medium (30-44%), Medium-High (45-59%), or High (≥ 60%)

Parameter Review Discussion for Non-Forest Habitats

This species is primarily associated with shrub communities that border forested habitats. While the Existing Vegetation Map data includes a Shrub Life Form Group, complimentary to the Forest Life Form Group above, the Boise National Forest decided to use LANDFIRE Environmental Site Potential (ESP) and Existing Vegetation Type (EVT) classifications as a surrogate for the vegetation refresh non-forest PVGs. This was because LANDFIRE classifications were felt to better represent the non-forested landscape.

Therefore, the LANDFIRE ESPs and EVTs were used in development of this mid-scale model. There are no size class associations for the LANDFIRE vegetation stages, therefore no recommendations for size classes will be made for the non-forest LANDFIRE vegetation stages (Shrub and Forest) used in this model update. LANDFIRE does, however, define canopy cover classes for its vegetation stages, which are listed below in **Table K-2-42**.

The LANDFIRE ESP, EVT, and canopy cover classifications were not part of the forest vegetation layer update and therefore did not change. As a result, the model parameters pertaining to LANDFIRE classifications used in the *2008 Mountain Quail Documentation of Modeling Parameters for Use in Mid- and Fine-Scale Habitat Models* (Geier-Hayes and Nutt 2008) were carried over verbatim to this model update document. The only change to this section is that additional rationale was added in support of the LANDFIRE model parameters chosen back in 2008.

Environmental Site Potential (ESP) Discussion

The literature mentions low sagebrush, mountain big sagebrush, and shrubland communities that border conifers (Wisdom et al. 2000; Brennan et al. 1987; Nelson and Douglas 2006; Vogel and Reese 2002). Recommend including Low Sagebrush, Mountain and Wyoming Big Sagebrush, and Shrub- Forest Transition in the model (this discussion taken verbatim from *Mountain Quail Documentation of Modeling Parameters for Use in Mid- and Fine-Scale Models* [Geier-Hayes and Nutt 2008]).

Existing Vegetation Type (EVT) Discussion

Shrub and Forest EVTs were mentioned in the various studies. Un-vegetated, grass dominated, exotics, developed, and agricultural lands were mentioned as not providing source habitat (Vogel and Reese 2002). Therefore, recommend including Shrub and Forest EVTs only [this discussion taken verbatim from *Mountain Quail Documentation of Modeling Parameters for Use in Mid- and Fine-Scale Models* (Geier- Hayes and Nutt 2008)].

Non-forest Canopy Cover Discussion

LANDFIRE canopy cover classifications for SHRUB and FOREST EVTs are listed below in **Table K-2-42**.

Table K-2-42 LANDFIRE Canopy Cover Classes for the SHRUB and FOREST EVTs

LANDFIRE Canopy Cover Classes	
<10 percent (sparsely vegetated)	Unvegetated
10-20 %	Very Low
20-30 %	Low
30-40 %	Moderate
40-60 %	High
>60 %	Very High

Nelson and Robinson (2006) generally described MOQU source habitat as open canopied with limited shrub cover. Such communities generally develop with lower canopy cover of the tallest life-form that can occupy the site. Wisdom et al. (2000) describes source habitat as open tall shrub, open low-medium shrub, and closed low-medium shrub habitats; shrub communities with canopy cover predominantly below 15 percent. Other studies from Oregon and California reported shrub canopy covers that ranged from 28 percent (Nelson 2007) to 36 percent (Vogel and Reese 1995). A 2-year study by Reese et al. (2005) in west central Idaho reported mean overstories of 62 and 43 percent for nest sites and 43 and 33 percent for brood sites; however, these values were for both tree and shrub so the actual shrub percentage was likely much less. The one outlier was the Brennan et al. (1987) work that reported a mean shrub canopy cover averaged across four study areas of 46 percent, within the lower end of the High Canopy Cover class. Because the majority of the literature described MOQU use of shrub habitats with canopy cover below the 35 percent threshold, and when trees and shrubs were mixed the canopy covers were somewhat higher, it is recommended that the Very Low and Low Canopy Cover classes for the SHRUB EVT and Very Low, Low, and Moderate Canopy Cover classes for the FOREST EVT be used to model source habitat for this species.

Table K-2-43 shows the crosswalk between the relative shrub canopy cover parameters found in the literature and the LANDFIRE SHRUB and FOREST EVT canopy cover classifications, and lists the references that support the rationale for the final selection of habitat parameters.

It is recommended that Very Low (10-20%) and Low (20-30%) Canopy Cover classes for the SHRUB EVT and Very Low (10-20%), Low (20-30%), and Moderate (30-40%) for the FOREST EVT be used to model non-forest source habitat for the Mountain Quail.

Table K-2-43 Table Showing Crosswalk Between Parameters Found in the Literature and LANDFIRE Canopy Cover Classes for SHRUB and FOREST EVTs

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and LANDFIRE Classes
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria	Source habitat includes all stages in Chokecherry-serviceberry-rose.	Very Low (10-20%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and LANDFIRE Classes
A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	Mountain quail are most often found in areas with high abundance of shrubs Source Habitat from Appendix 1, Volume 3, Table 1, pages 437-440 **Chokecherry-serviceberry-rose/open tall shrub, open low-medium shrub, closed low-medium shrub** *(Definitions from Vol. 1, Table 4, pg. 26)* *Open tall shrub = a canopy of tall (2-5 m) shrubs with* ***<66% canopy cover****; tree cover <10%* *Open low-medium shrub = a canopy of low (<50 cm) or medium-sized (50cm – 2 m) shrubs with* ***<66% canopy cover****; tree cover <10%* *Closed low-medium shrub = a canopy of low (<50 cm) or medium-sized (50 cm - 2 m) shrubs with* ***>66% canopy cover****; tree cover <10%* ***Note:*** *The author(s) explained that due to the method of measurement technique for canopy cover, 66% shrub canopy cover listed above (taken at a scale of 1:12,000) would equal approx. 15 percent using fine-scale (1:1) on the ground methods. Even though this information is to inform the selection of parameters for a mid-scale model, the parameter information from typical field study references would typically report with data collected using more site-specific (1:1) canopy cover measurement techniques. Therefore the 66% referred to in the above definitions is actually more like 15% for the purposes of this model update and for this particular reference.* *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	
Vogel, C.A; Reese, K.P. 1995. Habitat Conservation Assessment for Mountain Quail (*Oreortyx pictus*). Prepared for: Idaho State Conservation Effort, Idaho Dept. of Fish and Game, Boise, ID. 68 pages (ID, OR, CA, WA, NV)	At the· micro habitat level, Edminster (1954) found that mountain quail used **shrub cover** for nesting and brood rearing **that shades 25 - 50%** of the ground. An open forest with a shrub understory may be the most desirable composition because the resulting shrub layer is more open and allows the quail to move through the habitat more easily (Johnsgard 1973). Gutierrez (1977:39) found that this quail uses habitat with **36% ground cover** (percent shrub cover and dead material).	Very Low (10-20%) Low (20-30%) Moderate (30-40%)
Reese, K.P., J.L. Beck, P. Zager, P.E. Heekin. 2005. Nest brood site characteristic of mountain quail in west-central Idaho. NW Science. Col. 79, No. 4.	From Table 1 (pg. 259) mean overstory canopy closure for year 1992 was **62 ± 8 percent** at nests and **43 ± 9** at brood locations. For year 1995 it was **46 ± 5** percent for nesting and **33**	Low (20-30%) Moderate (30-40%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and LANDFIRE Classes
(west-central Idaho)	**± 8** for brood sites. However, these mean canopy closures included both tree and shrub overstories.	
Brennan, L.A.; Block, W.M.; Gutierrez, R.J. 1987. Habitat use by mountain quail in northern California. The Condor, 89: 66-74 (California)	Mean shrub canopy cover for four study areas was **37.1%, 48.8%, 41.8%, and 50.6%**. Overall mean percent shrub canopy cover for all four study areas was **45.8%** (SE=2.3) (n=114).	Moderate (30-40%) High (40-60%)
Nelson, Jamie N. 2007. Survival and nest site characteristics of translocated mountain quail on Steens Mountain, Oregon. Thesis. Oregon State University. 54 pgs. (Oregon)	Perimeter shrub height (shrub height 8 m from the nest center) was the habitat characteristic most predictive of Mountain Quail nest site selection. As perimeter shrub height increased, the odds of a site being selected as a nest site also increased. Mean canopy cover for nest sites in study was 28%, includes both shrubs and trees. (western juniper dominant tree sp.)	Very Low (10-20%) Low (20-30%)
Nelson, Jamie and Douglas Robinson. 2006. Mountain quail translocations in eastern Oregon, Project Report 2006. Dept. of Fisheries and Wildlife, Oregon State University. Corvallis, OR. 20 p. (eastern Oregon)	Nest sites were often in areas with generally open or partially open canopies and **limited shrub cover.** *JF – "Limited shrub cover" would suggest relatively low shrub canopy cover, likely in the Very Low and Low canopy cover classes.*	Very Low (10-20%) Low (20-30%)

Source Habitat Conditions When Outside HRV Discussion

None.

Additional Modeling Parameters

This species requires dense shrubby conditions in close proximity (within 100 to 200 meters [300-650 feet]) to live water. Vogel and Reese (1995) state that it is restricted to the breaks and secondary drainages of the Snake and Salmon Rivers but does not describe the extent of these secondary drainages. Much of the habitat is likely beyond of the boundary of the Forest at lower elevations. The mid/fine-scale model cannot take this into account and therefore will overestimate the amount of suitable habitat for this species.

Model Limitations

This species requires dense shrubby conditions in close proximity (within 100 to 200 meters [300-650 feet]) to live water. Vogel and Reese (1995) state that it is restricted to the breaks and secondary drainages of the Snake and Salmon Rivers but does not describe the extent of these secondary drainages. Much of the habitat is likely beyond of the boundary of the Forest at lower elevations. The mid/fine-scale model cannot take this into account and therefore will overestimate the amount of suitable habitat for this species.

Updated Forest Modeling Parameters for Mountain Quail Source Habitat

The updated mid-scale habitat parameters for the Mountain Quail are as follows:

Summary of Forest Modeling Parameters for Mountain Quail Source Habitat

PVGs: 1, 2, 4, 5, 7 and 11
Tree Size Class: Seedling, Sapling, Small, Medium, Large, and Very Large
Tree Canopy Cover Class: For Sapling, Small, Medium, Large, and Very Large: Low and Low-Medium
(*the Seedling TSC does not have an associated canopy cover*)

Summary of Non-Forest Modeling Parameters for Mountain Quail Source Habitat ESPs: Low Sagebrush, Mountain and Wyoming Big Sagebrush, Shrub-Forest Transition EVTs**:** SHRUB and FOREST
Canopy Cover Class: For SHRUB: Very Low and Low For FOREST: Very Low, Low and Moderate

Model Limitations**:** This species requires dense shrubby conditions in close proximity (within 100 to 200 meters [300-650 feet]) to live water. Vogel and Reese (1995) state that it is restricted to the breaks and secondary drainages of the Snake and Salmon Rivers but does not describe the extent of these secondary drainages. Much of the habitat is likely beyond of the boundary of the Forest at lower elevations. The mid/fine-scale model cannot take this into account and therefore will overestimate the amount of suitable habitat for this species.
Source habitat is defined by those characteristics of macrovegetation that contribute to stationary or positive population growth.

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2017 Mountain Quail Mid-scale Modeling Update,

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2017 Mountain Quail Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or tree/shrub canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

The literature search found only two references dated more recent than 2008 and that would not have been available for the last update of the model, and that was habitat focused. A summary of relevant habitat information from *The Birds of North America* online account was also included because it is a good synthesis of all available habitat information for this species, although the species account has not been updated since 1999.

Reference – Gutiérrez, R. J. and David J. Delehanty. (1999). Mountain Quail (*Oreortyx pictus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/mouqua DOI: 10.2173/bna.457

Accessed March 15, 2017.

The following excerpts from the BNA online account are pertinent to this update:

Shrub-dominated communities. These include chaparral, mixed desert scrub of Mojave Desert, early- successional-stage shrub vegetation following fire, logging, or other disturbance. Also, mixed evergreen- hardwood, **mixed conifer**, redwood (*Sequoia sempervirens*), **pine** (*Pinus* spp.), **montane conifer**, white fir (*Abies concolor*), and red fir (*Abies magnifica*) forests; piñon-juniper (*Pinus* spp.- *Juniperus* spp.), occasionally foothill woodland if shrubs present; high-elevation aspen (*Populus tremuloides*) stands surrounded by sagebrush (*Artemesia* spp.), and **riparian habitats associated with these forests** and woodlands (Grinnell and Miller 1944; Miller 1950; Ormiston 1966; Gutiérrez Gutiérrez 1977; Gutiérrez 1980; Brennan et al. 1987; RJG).

Forest habitats used by Mountain Quail usually have a significant shrub component (Miller 1950; Gutiérrez 1980; Brennan 1984). These habitats occur over wide altitudinal (sea level to >3,000 m) and moisture gradients.

Nesting

On ground, usually very dense overhead cover of shrubs or tree bough (Bent 1932), near protective cover, highly concealed, requiring view from <0.5 m to see eggs (DJD). Nests observed under short (1 m) pine saplings, under piñon boughs at trunk, under shrubs (DJD). Often nests on steep hillside or adjacent to steep bank in second-growth forest or shrub-dominated communities, usually under or against protective cover.

Foraging

Studied in detail by Gutiérrez (Gutiérrez 1977; Gutiérrez 1980). Forages in shrub and forest communities under canopy and at edge of these habitats, rarely venturing far from cover but at greater distance than when not foraging.

Reference – Stephenson, J., K. P. Reese, P. Zager, P. E. Heekin, P. J. Nelle, and A. Martens. 2011. Factors influencing survival of native and translocated mountain quail in Idaho and Washington. Journal of Wildlife Management 75:1315–1323.

This study looked at survival of native and translocated mountain quail in order to help managers design more effective recovery programs. The study really didn't assess vegetative habitat characteristics or use vegetative parameters in their survival rates. Instead, they used age, sex, native vs. translocated, movement rates, time, as well as precipitation and temperature. There were no useful habitat information for this model update.

Reference – Zornes, M, and R. A. Bishop. 2009. Western Quail Conservation Plan. Association of Fish and Wildlife Agencies. Washington, DC. 92 pages.

This document is a comprehensive quail management plan for the western states that include Oregon, Idaho, California, Utah, Nevada, Oklahoma, Colorado, Washington, Texas, Kansas, and New Mexico.

Habitat descriptions for the mountain quail were very general and didn't mention Idaho. Did describe habitat in eastern Oregon in Hells Canyon as "most often with overstories dominated by mixed hardwoods or with conifers that contained a healthy shrub understory, such as an overstory of black cottonwood and a snowberry understory." There were no parameters or additional information not already included in the original literature review for this species.

Note: There were three other references that pertained to Idaho that I could not find a copy of on line and would probably need ordered or found in a library. They are listed below.

- Heekin, P.E., K.P Reese, and P. Zaeger. 1993. Movements, habitat use, and population characteristics of Mountain quail in west-central Idaho. Annual Report. University of Idaho, ID.
- Pope, M.D., Hansen, M., Crawford, J.A. 2004. Habitat associations of translocated and native mountain quail in Oregon. Northwest Science. 78 (3): 242-249
- Heekin, P.E., C.A. Vogel, and K.P. Reese. 1994. Uncovering the elusive habits of Mountain Quail in Idaho. Quail Unlimited 12(2):8-11

The following references were also used to inform this model update but were not referenced in the original 2008 model, even though they would have been available at the time.

Reference - Reese, K.P., J.L. Beck, P. Zager, P.E. Heekin. 2005. Nest brood site characteristic of mountain quail in west-central Idaho. NW Science. Col. 79, No. 4.

This study investigated nest and brood-rearing habitats used by mountain quail in the Little Salmon River drainage in west-central Idaho during 1992 and 1995. Habitat components at the micro- and macro-habitat scales were measured. At the macrohabitat scale, 71% of nests were found in open- canopied, conifer shrub cover types and broods were observed in a wider variety of shrub types. At microhabitat scale, mallow ninebark, black hawthorn, common snowberry, Saskatoon serviceberry, and wild rose were important shrub species in both nest and brood habitats.

The study reported fifteen (71%) nests were located in conifer-shrub, 4 (19%) in mountain-shrub, and 2 (10%) in riparian-shrub. Seven (44%) broods were located in conifer-shrub cover, 5 (31%) in mountain shrub, 3 (19%) in grass-scattered shrub, and 1 (6%) in riparian-shrub (pg. 258)**.** Mean DBH of trees at quail nest sites was 23.9 cm (**9.4 inches**) in 1992 and 16.4 cm (**6.5 inches**) in 1995 (Table 1, pg. 259) as measured for microhabitat portion of study.

Reference - Nelson, Jamie N. 2007. Survival and nest site characteristics of translocated mountain quail on Steens Mountain, Oregon. Thesis. Oregon State University. 54 pgs.

This study looked at habitat preferences on a translocated population in the Steens Mountain area in Oregon. They translocated 217 wild quail from southwestern Oregon to the Steens area. They measured habitat characteristics at 45 nest sites and compared to 90 random sites to identify nest site habitat preferences. Findings were canopy cover of shrubs, trees, and rocks, and shrub height 8 meters from the nest were the two most important habitat variables that influence nest site selection. Mean shrub height at nest sites was about 1 meter tall and **mean canopy cover was 28%**, includes both shrubs and trees (western juniper dominant tree sp.).

K-2-1.14 Northern Goshawk (Summer)

Mid-scale Modeling Update
for the
Northern Goshawk (Summer)
March 22, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the Northern Goshawk Mid-scale Habitat Model developed for the Boise National Forest in 2009 (Nutt et al. 2009), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been ten years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2009 model was created and validate selected habitat parameters.

<u>Review of New Species Literature since 2010</u>

The Boise NF mid-scale habitat model for the Northern Goshawk (Summer) was created in 2005 and revised in 2009 (Nutt et al. 2009). This literature review of published information between 2009 and 2016 was conducted to validate whether model parameters from 2009 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Northern Goshawk (Summer) Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2016; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the "Forest Derived Product." Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e., "stands"), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9" DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a; Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2009 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2009 model into the 2019 model.

Parameter Review Discussion

The following parameter review discussion describes the vegetation parameters used to model source habitat when under historic range of variability (HRV) conditions.

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the northern goshawk. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-44**.

Table K-2-44 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (1.0 – 4.9 " DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (≥ 30" DBH)	**new**

For modeling nesting habitat, the majority of literature sources support selecting the Medium (10-19.9" DBH), Large (20 – 29.9" DBH) and Very Large (>= 30" DBH) Tree Size classes (Patla 1991; Hayward 1997; Hayward and Escano 1989; Siders and Kennedy 1994; Moser and Garton 2009; Desimone and DeStephano 2005).

Quantitative information for tree size parameters within forage habitat was limited in the literature, however, as most descriptions of foraging habitat were qualitative in nature. Only two literature sources described tree size characteristics for goshawk forage habitat; Beier and Drennan 1997 and Reynolds et al. 1992. Beier and Drennan (1997) reported that goshawks selected foraging sites that had a greater density in trees greater than 40.6 cm (16") DBH than on contrast plots. Management guidelines in Reynolds et al. (1992) recommend managing for 3-5 mature or old live trees per acre within ponderosa pine forest types and a minimum of one group of six mature or old live trees per acre within mixed conifer forest types to meet the needs of various goshawk prey species, and identified live trees greater than 18" DHB as important features of prey habitat. While goshawk forage habitat can vary widely within a given territory with the use of openings, edge habitat, young forests, and various forest structures (Austin 1993; Hargis et al 1994), the large tree component within mature or older forested stands remains an important habitat factor for both post-fledgling areas (PFA) and forage habitat (Reynolds et al. 1992; Beier and Drennan 1997). Large trees provide hiding, feeding, denning, and nesting sites for many key prey species (squirrels and cavity nesters), hunting perches, and hiding cover for young goshawks (in the PFA). These larger tree sizes would be represented in the Medium, Large, and Very Large Tree Size classes, which are recommended for modeling goshawk forage habitat.

Table K-2-45 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Medium (10-19.9” DBH), Large (20-29.9” DBH), and Very Large (>30” DBH) Tree Size classes be used to model source habitat for the northern goshawk (summer).

Table K-2-45 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Patla, Susan. 1991. Northern Goshawk Monitoring Project #2. USDA Targhee National Forest, St. Anthony. 42pp. (Idaho)	Mean DBH for 29 PSME nests was **20.5 inches** (SD = 5.1). Mean DBH for three aspen nests was 11.4 inches (SD = 0.6). Mean DBH for three lodgepole pine nests was 10.3 inches (SD = 1.4).	Medium – 10-19.9” DBH Large – 20-29.9” DBH Very Large - >30” DBH
Hayward, Gregory D. 1997. Goshawk nest site characteristics on a portion of the Payette National Forest, Idaho. USDA Payette National Forest. McCall, Idaho. 30pp.	Nests were in PSME fir trees about **18 inches** in DBH.	Medium – 10-19.9” DBH
Hayward, G. D. and R.E. Escano. 1989. Goshawk nest site characteristics in western Montana and northern Idaho. *Condor 91:476-479.*	Mean nest tree DBH at 17 sites was 50 cm (+ 10.57) (**20”)** with a range from 25-97 cm (**10-38”**) DBH. In the Rocky Mountain portion of the study (n = 9), only the mean was 42 (+ 14.31) (**17”**) with a range from 25-79 cm (**10-31”**) DBH.	Medium – 10-19.9” DBH Large – 20-29.9” DBH Very Large - >30” DBH
Siders, M.S. and P.L. Kennedy. 1994. Nesting habitat of Accipiter hawks: Is body size a consistent predictor of nest habitat characteristics? Studies in Avian Biology No. 16:92-96. (north-central New Mexico)	Nest stand average tree diameters (DBH-cm) from available studies ranged from 15 – 46 [**6-18-inch dbh**].	Medium – 10-19.9” DBH Large – 20-29.9” DBH
Moser, B.W. and E.O. Garton. 2009. Short-term effects of timber harvest and weather on northern goshawk reproduction in northern Idaho. J. Raptor Res. 43(1):1-10.	All 21 nest areas had an overstory tree dbh of >31 cm [**12”**].	Medium – 10-19.9” DBH Large – 20-29.9” DBH Very Large - >30” DBH
Desimone, S.M. and DeStefano. 2005. Temporal patterns of northern goshawk nest area occupancy and	Of 38 occupied nests in 1992 to 1994, 86% (33/38) were in mid-aged or late closed structural-stage forest. Post 1992, 25 of 42 (60%) were in late closed and 11 of 42 were in mid-aged closed.	Medium – 10-19.9” DBH Large – 20-29.9” DBH

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
habitat: A retrospective analysis. J. Raptor Res. 39(3):310-323. (south-central Oregon)	Late closed = Mean stand DBH >53 cm **(>21”)**. Mid-aged closed = Mean stand DBH 23-53 cm (**9-21”)** Recommend retaining large trees (>53 cm (**21”**) DBH) to help preserve nest site integrity, maintain closed canopies, and provide connectivity to alternative nest sites within nest areas.	
Reynolds, Richard T.; Graham, Russell T.; Reiser, M. Hildegard; and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. Gen. Tech. Rep. RM-217, Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 90 p.	Recommendations for PFA (for the 60% of PFA in older stand structure ages) and for the foraging Area: PP Forest Type– min of 3-5 mature/old live trees/ac. (Also leave same number within openings for reserve trees) Mixed Conifer Forest Type – min of 1 group of 6 mature and old live trees/ac. (Also leave same number within openings for reserve trees) The above recommendations for live trees/ac are the same for Foraging Area as well, for both respective Forest Types: (for the 60% of foraging area in older stand structure ages). Identified features of prey habitat in the PFA and Foraging Areas include large (**>18”** DBH)	Medium – 10-19.9” DBH Large – 20-29.9” DBH
	live trees for squirrels, large (**>18”** DBH) snags/live trees for cavity excavation by woodpeckers, and are also used for hunting perches. The large tree component provides hiding, feeding, denning, and nesting sites for many goshawk prey species.	
Beier,P.,and J. E.Drennan. 1997. Forest structure and prey abundance in foraging areas of northern goshawks. Ecological Applications 7:564–571. (northern Arizona)	Foraging Habitat: Goshawks selected foraging sites that had a greater density of trees >40.6 cm (**16”**) DBH than on contrast plots.	Medium – 10-19.9” DBH Large – 20-29.9” DBH

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in Table **K-2-46**.

Table K-2-46 Canopy Cover Class Differences Between the 2003 Forest Plan Appendix A and New Vegetation Layer (Tree Canopy Cover Only)

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

A review of the literature shows that there is strong support for selection of the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes. The four studies that occurred in Idaho reported mean nest site canopy covers ranging from 67 to 81 percent (Patla 1991; Hayward 1997; Moser and Garton 2009; Hayward and Escano 1989), while other studies in Oregon, Montana, and New Mexico reported nesting canopy covers from 50 to 74 percent (Reynolds et al. 1982; Siders and Kennedy 1994; Desimone and DeStephano 2005). Furthermore, Reynolds et al. (1992) recommends managing or retaining stands with 50-70 percent canopy closure for nesting habitat.

Studies that addressed post fledgling areas and forage habitat were limited in the literature, and when mentioned were usually only described in generalities. However when quantified, PFA requirements where typically reported to be similar to those of nesting habitat, with the majority of the PFA in the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes (Clough 2000, Reynolds et al. 1992), although a mix of age classes and forest seral classes were also necessary to provide habitat for a variety of prey species and hiding cover for young goshawks (Daw and Stephano 2001).

Forage habitat, while also lacking quantitative descriptions in the literature, was commonly described as stands with higher canopy cover with a high density of large trees and relatively open understory that allow goshawks to hunt (Bright-Smith and Mannan 1994, Beier and Drennan 1997, Graham et al. 1999), although other studies found goshawks to forage in a wider variety of habitats. Greenwald et al. (2005) summarized that most radio telemetry studies of goshawk home range selection conducted in the United States found that foraging goshawks selected for late succession stands with high canopy closure, large trees, and high stem densities, among other parameters, although the overall range of habitats used was quite broad. More specifically, Beier and Drennan (1997) reported a mean canopy closure of 48.3% (11) taken at foraging sites within nesting territories, and recommendations for the management of forage habitat from Reynolds et al. (1992) suggest maintaining canopy covers above 40-60 percent for stands within or larger than the 12-18" structural class in ponderosa pine, mixed species, and spruce/fir forest types. As a result, modeling for stands within the Medium-High

(45-59%) and High (>60%) Tree Canopy Cover classes should reasonably identify foraging habitat for the goshawk, even though it will not account for the variety of forage habitat used. Inclusion of canopy cover classes within the next lower class of Medium (30-44%) would likely overestimate source habitat at this scale.

Expanding the range down to 30 percent would allow more source habitat to be modeled, but could result in large blocks of low canopy cover habitat being modeled that is not in proximity to higher canopy cover nesting and PFA habitat, which are generally more limiting for territory development than forage habitat. This would seemingly misrepresent goshawk source habitat across the landscape.

Selection of the Medium-High and High Tree Canopy Cover classes is expected to encompass the late succession higher canopy cover stands that are universally common to nesting, PFA, and forage habitat.

To assess source habitat, modeling would best approximate the findings of the literature by selecting for forested stands in the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-47 shows the crosswalk between parameters found in the literature and the new tree canopy cover class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Medium-High (45-59%) and High (>60%) Canopy Cover classes is recommended for modeling northern goshawk (summer) source habitat.

Table K-2-47 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Patla, Susan. 1991. Northern Goshawk Monitoring Project #2. USDA Targhee National Forest, St. Anthony. 42pp. (Idaho)	(Nesting) Canopy cover for all nest sites ranged from **67 percent** in lodgepole to **72 percent** for aspen and PSME.	High (≥60%)
Hayward, Gregory D. 1997. Goshawk nest site characteristics on a portion of the Payette	(Nesting) Canopy cover ranged from 31 to 96 percent with a **mean of 81 percent** and a median of 85 percent (n = 30). Ninety percent of all nests occurred in stands with canopy cover greater than **63 percent**.	High (≥60%)
National Forest, Idaho. USDA Payette National Forest. McCall, Idaho. 30pp. (Idaho)		

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Moser, B.W. and E.O. Garton. 2009. Short-term effects of timber harvest and weather on northern goshawk reproduction in northern Idaho. J. Raptor Res. 43(1):1-10. (Northern Idaho)	(Nesting) All 21 nest areas had **>70%** overstory tree canopy.	High (≥60%)
Hayward, G. D. and R.E. Escano. 1989. Goshawk nest site characteristics in western Montana and northern Idaho. *Condor 91:476-479.* (Idaho and Montana)	(Nesting) Mean canopy closure for this study was **80 percent ± 3 percent**.	High (≥60%)
Reynolds, R. T., E. C. Meslow and H. M. Wright. 1982. Nesting habitat of coexisting Accipiter in Oregon. J. Wildl. Manage. no. 46:124-138 (Oregon)	(Nesting) Mean canopy closure for 7 goshawk nest sites was **59.8%** (SD 20.5%).	Medium-High (45-59%) High (≥60%)
Siders, M.S. and P.L. Kennedy. 1994. Nesting habitat of Accipiter hawks: Is body size a consistent predictor of nest habitat characteristics? Studies in Avian Biology No. 16:92-96. (northern New Mexico)	(Nesting) At 42 nest sites in PP, aspen/ mixed conifer, and mixed conifer habitat types CC was **58-74%** at the nest tree and **60-71%** for the nest site. Nest site = the area surrounding the nest tree, includes vegetation and topo features used by nesting pair during entire nesting season exclusive of foraging areas. Nest area = a defended area that may contain a cluster of nest sites that accipiters used during the breeding season.	High (≥60%)
Desimone, S.M. and DeStefano. 2005. Temporal patterns of northern goshawk nest area occupancy and habitat: A retrospective analysis. J. Raptor Res. 39(3):310-323. (south-central Oregon)	(Nesting) Of 38 occupied nests in 1992 to 1994, 86% (33/38) were in mid-aged or late closed structural-stage forest. Post 1992, 25 of 42 (60%) were in late closed and 11 of 42 were in mid-aged closed. Late closed = Mean stand DBH ≥53 cm, **>50% CC**, ≥15 TPH ≥53 cm DBH Mid-aged closed = Mean stand DBH 23-53 cm, <15 TPH >53 cm DBH, **>50% CC**	Medium-High (45-59%)
Graham, Russell T., Ron L. Rodriguez, Kathleen M. Paulin, Rodney L. Player, Arlene P. Heap, and Richard Williams. 1999.	(Nesting and Forage) Nests are in mature to old forests with relatively large trees, high canopy closure (relative to surrounds), sparse ground cover, and open understories. Often positioned near bottom of moderately steep slopes, close to water and adjacent to	Did not contain specific CC values but description suggests High (≥60%) for nesting and Medium-

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
The Northern Goshawk in Utah: Habitat Assessment and Recommendations. Gen. Tech. Rep. RMRS-GTR –22. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 48. (Utah)	a canopy break. Important stand characteristics include multiple canopies, snags and downed woody debris. Foraging habitat consists of closed canopy forest with moderate tree densities as compared to young open forest. *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself. It is primarily a document providing guidance on management.*	High (45-59%) and High (>60%) for forage habitat.
Bright-Smith, D.J. and R.W. Mannan. 1994. Habitat use by breeding male northern goshawks in northeastern Arizona/ Studies in Avian Biology No. 16:58-65. (northeastern Arizona)	Average rank of relative preference of the canopy closure categories increased with increasing canopy closure. Eight of 11 birds used CC in proportion to availability, 3 birds used **>55% CC** more than expected. 4 birds used open areas less than expected. Management recommendations include maintaining **relatively high canopy closure** over a significant portion of areas managed for foraging goshawks. Harvest methods that create large open forests (<34%cc as measured from aerial photos) in more than 35% of a home range may be detrimental.	Medium-High (45-59%) High (>60%)
Clough, Lorraine T.,	(Post Fledgling Area) On average, 68.9% of PFAs	
Nesting habitat selection	contained forest with **>50% CC** and 8.9% pf the PFAs had	
and productivity of	**25% to 50% CC**. *(Note: This study occurred in a highly*	
northern goshawks in west-central Montana" (2000). Theses,	*managed landscape. Within the 170 ha PFA around a nest, only 11.3 + 5.1% (19.2 + 8.7 ha) contained mature or old growth forest. The majority of the rest of the PFA*	Medium-High (45-59%) High (>60%)
Dissertations, Professional	*was dominated by small-sized trees. Regardless of the*	
Papers. Paper 5828.	*tree size class available, goshawks in this study still*	
(west-central Montana)	*preferred relatively high canopy closures in the PFA)*	
Reynolds, Richard T.; Graham, Russell T.; Reiser, M. Hildegard; and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. Gen. Tech. Rep. RM-217, Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 90 p.	This reference recommends the following canopy cover values for goshawk habitat in these vegetation structural stages (VSS) 4 (12-18" DBH), 5 (18-24" DBH), and 6 (>24" DBH) Nesting: Canopy closure (CC) of **50-70%** for VSS 5 and VSS 6 Post Fledgling Area: **> 50%** CC in ponderosa pine (PP) forest types for VSS 4-6, **>60%** CC in Mixed Species (MS) for VSS 4-6, and **>70%** CC in spruce/fir (SF) for VSS 4-6	Medium-High (45-59%) High (>60%) Medium-High (45-59%) High (>60%) Medium (30-44% Medium-High (45-59%) High (>60%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	<u>Foraging Area (PFA)</u>: in PP types **>40%** in VSS 4, 5, and 6, in MS types **>40%** CC for VSS 4, **> 50%** CC for VSS 5, and **>60%** CC for VSS 6, and in SF types **>40%** CC for VSS 4, and **>60%** CC for VSS 5 and 6	
	(the reference also recommends that >60% of both the PFA and foraging area in a home range is in the larger VSSs (4, 5, and 6))	
	Note: this citation is a comprehensive summary of scientific literature and does not provide data itself. It is primarily a document providing guidance on management.	
Beier,P.,and J. E.Drennan. 1997. Forest structure and prey abundance in foraging areas of northern goshawks. Ecological Applications 7:564–571. (northern Arizona)	(Forage) Mean canopy closure at 63 1.77-Ha plots used by adult goshawks was **48.3%** (11.0). *(Study characterized forest structure at foraging sites within nesting territory. Study area dominated by ponderosa pine forests)*	Medium-High (45-59)
Greenwald, D. Noah, D. Coleman Crocker-Bedford, Len Broberg, Kieran F. Sucling, and Timothy Tibbitts. 2005. A review of northern goshawk habitat selection in the home range and implications for forest management in the western United States. Wildlife Society Bulletin, 33(1):120-129	(Forage) Results of all 12 North American radio telemetry studies of goshawk home range habitat selection show that foraging goshawks select for late succession stands with high canopy closure, large trees, canopy layering, and abundant coarse wood, although the overall range of forest and structural types used is very broad. *Note: This citation summarizes the work of others and does not provide data itself. It is primarily a document providing guidance on management.*	Did not contain specific CC values but description suggests Medium-High (45-59%) and High (≥60%) for forage habitat.
Squires, J. R., and R. T. Reynolds. 1997. Northern Goshawk (*Accipiter gentilis*). *In* The Birds of North America, No. 298 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.	High canopy closure is one of the most uniform habitat characteristics of goshawk nest stands (Hayward and Escano 1989). Goshawks nested 2.5 times more often than expected in stands with 70 to 79 percent canopy coverage and 5.8 times more often than expected in stands with 80 percent or greater canopy coverage. Canopy coverage (*n* = 36 stands) in stands used by this population averaged 76 percent ± 7 SD; 18 percent greater ($p < 0.001$) than the surrounding landscape. Although high canopy cover is apparently preferred, some populations use open forests (33 percent, Reynolds et al 1982; 31 percent ± 13 SD, Hargis et al 1994)).	Medium (30-44% Medium-High (45-59%) High (≥60%)

Source Habitat Conditions When Outside HRV Discussion

Goshawks can utilize some forested conditions that are not within the historical range of variability in PVGs 2, 3, 4, 5, 6, and 7. These conditions generally consist of higher densities, greater species diversity, and more complex vegetative structure than what would have developed when stands in these PVGs were experiencing historical disturbance processes. For PVGs 3, 4, 6, and 7, when functioning outside HRV, the High canopy cover class should be included when in the Medium, Large, and Very Large tree size classes. For PVGs 2 and 5, when functioning outside HRV, the Medium-High and High canopy cover classes should be included in the model only when in the Large and Very Large size classes.

Updated Forest Modeling Parameters for Northern Goshawk (Summer) Source Habitat

The updated mid-scale habitat parameters for the northern goshawk (summer) are as follows:

Within HRV

PVGs: 3, 4, 6, 7, 8, 9, and 10
Tree Size Class: Medium, Large*, and Very Large*
Canopy Cover Class: PVGs 3, 4, 6, and 7 =
Medium-High
PVGs 8, 9, and 10 = Medium-High and High

* Large and very large tree size classes do not occur in PVG 10

Outside HRV

PVGs: 2, 3, 4, 5, 6, and 7
Tree Size Class: PVGs 3, 4, 6, and 7 = Medium, Large, and Very
Large PVGs 2 and 5 = Large and Very Large

Canopy Cover Class: PVGs 3, 4, 6, and 7 = High
PVGs 2 and 5 = Medium-High and High

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 Northern Goshawk Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016 literature review process.

The literature search found only one reference dated more recent than 2009 and that would not have been available for the last update of the model, and that was habitat focused.

Reference – Squires, John R. and Richard T. Reynolds. (1997). Northern Goshawk (*Accipiter gentilis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/norgos DOI: 10.2173/bna.298

Accessed in September 2016.

The species account has not been updated since 1997, implying that no significant developments in research on the species' natural history have occurred.

Reference - Reynolds, Richard T., Douglas A. Boyce Jr., and Russel T. Graham. 2012. Ponderosa Pine Forest Structure and Northern Goshawk Reproduction: Response to Beier et al. (2008).

There was nothing in this paper that spoke to new information that would change current habitat parameters for the goshawk. This paper was a rebuttal to a 2008 paper by Beier et al. that questioned the validity of the Reynolds et al. 1992 goshawk management guidelines that were incorporated into many forest plans.

K-2-1.15 Pileated Woodpecker

Mid-scale Modeling Update
for the
Pileated Woodpecker
March 28, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the Pileated Woodpecker Mid-scale Habitat Model developed for the Boise National Forest in 2009 (Nutt et al. 2009), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been ten years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2009 model was created and validate selected habitat parameters.

Review of New Species Literature since 2009

The Boise NF mid-scale habitat model for the Pileated Woodpecker (PIWO) was created in 2005 and revised in 2009 (Nutt et al. 2009). This literature review of published information between 2009 and 2017 was conducted to validate whether model parameters from 2009 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 Pileated Woodpecker Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the "Forest Derived Product." Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e. "stands"), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9" DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant, 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a, Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

The following parameter review discussion describes the vegetation parameters used to model source habitat when under historic range of variability (HRV) conditions.

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the pileated woodpecker. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-48**.

Table K-2-48 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (1.0 – 4.9" DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (≥ 30" DBH)	**new**

For modeling nesting, roosting, and forage habitat, nearly all literature sources support selecting the Large (20 – 29.9" DBH) and Very Large (>= 30" DBH) Tree Size classes (Bull and Holthausen 1993; Bull et al. 1992; Bull 1987; Bull et al. 1986; Wisdom et al. 2000; Hartwig et al. 2004). These studies overwhelmingly cite mean tree/snag DBH used for nesting, roosting, and foraging greater than or equal to 20 inches, and in some cases greater than 30 inches DBH.

There is also some support for use of the Medium Tree Size class (10-19.9" DBH) for modeling forage habitat. Bull and Holthausen (1993) in northeastern Oregon reported that over 70 percent of the average home range was made up of stands in the mature stage, while only 24 percent was comprised of stands in the old growth stage (*old growth defined as containing ≥12 trees/ha (5 trees/ac) that were* ≥51 cm DBH [**20 in**] in the grand fir type, or >8 trees/ha (3 trees/ac) ≥51 cm DBH in the ponderosa pine and Douglas-fir types; mature defined as stands with trees ≥30 cm DBH (**12 in**) but no trees ≥51 cm DBH (20 in) or did not have enough to qualify as old growth). Bull et al. (1986) also reported that 46 percent of trees used for foraging were greater than 20 inches DBH, implying that there was some percentage of trees used that were less than 20 inches. While both of these studies describe forage structure as either something less than 20 inches or within a matrix of trees less than 20 inches, neither quantify just how much smaller than 20 inches PIWOs were using, which makes it difficult to assess how important (or not) inclusion of the Medium tree size class would be. Because no references actually quantify forage habitat in stands dominated by trees less than 20 inches, and at the same time collectively report a preference for large trees and/or old growth or old forest stands for foraging (Bull and Holthausen 1993; Bull et al. 1992; Bull 1987; Bull et al. 1986; Wisdom et al. 2000), the inclination is to not include the Medium tree size class in this modeling update until more information is available, perhaps from a habitat assessment more local to the Boise National Forest. While this may under-estimate source habitat for the PIWO on the Boise National Forest, inclusion of the Medium size class could over- estimate source habitat by including stands down to the 10-inch DBH threshold. Therefore, it is recommended that only the Large and Very Large Tree size classes be used to model PIWO habitat.

Table K-2-49 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Large (20-29.9" DBH) and Very Large (>30" DBH) Tree Size classes be used to model source habitat for the pileated woodpecker, both for within and outside the Historical Range of Variation (HRV).

Table K-2-49 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Bull, Evelyn L. and Jerome A. Jackson. (2011). Pileated Woodpecker (*Dryocopus pileatus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/pilwoo DOI: 10.2173/bna.148 Accessed March 1, 2017.	Following is a summary of relevant tree size information from The Birds of North America online: Nesting: Of 105 nest trees in northeastern Oregon, had strong selection for nest trees 54 cm (21 in) dbh; about half the nest trees had broken tops. Nest sites had taller canopies, higher stem density of live trees < 50 and ≥50 cm (20 in) dbh, higher density of snags <50 cm and ≥50 cm dbh than random plots; grand fir forest types were preferred (Bull 1987). Forage: Prefers logs ≥38 cm (15 in) in diameter and extensively decayed. Carpenter ants, the primary prey of this woodpecker in northeast Oregon, select western larch logs >25 cm (10 in) in diameter in a moderate stage of decay (Torgersen and Bull 1995.), so woodpecker preference of material probably reflects prey's preference for habitat. In closed canopy forests in western Washington favored foraging areas with high	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	densities of large snags [> 52 cm (20 in) dbh and > 7.5 m tall; Raley and Aubry 2006]. Roosting Roost trees in northeast Oregon typically were in old-growth stands of grand fir that had old growth structural stages (Bull et al. 1992b).	
Bull, Evelyn L. and Richard S. Holthausen. 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. Journal of Wildlife Mgmt. 57(2): 335 -345. (NE Oregon)	Stands with **old-growth** were used more than expected. The **mature** successional stage comprised the majority of the home range, regardless of home range size (for all pairs: 70 percent mature stage; 24 percent old growth stage; 6 percent young stage). [Old growth stands contained ≥12 trees/ha that were ≥51 cm DBH [**20 in**] in the grand fir type, or >8 trees/ha ≥51 cm DBH in the ponderosa pine and Douglas-fir types.]	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)
	[Stands with trees ≥30 cm DBH (**12 in**) but no trees ≥51 cm DBH (20 in) or did not have enough to qualify as old growth were considered mature.] (Foraging) Extrapolating from Table 2, page 343: 92% of snags used for foraging were ≥25 cm DBH (10 in), 66% of snags used for foraging were ≥ 38 cm DBH (**15 in**), and 36% were ≥ 51 cm DBH (**20 in**). Only 41% of available snags were ≥ 25 cm DBH, 14% were ≥ 38 cm DBH (15 in), and 5% were ≥ 51 cm DBH, showing a selection for larger snags. (n = 1,030)	
Bull, Evelyn L., Richard S. Holthausen, and Mark G. Henjum. 1992. Roost trees used by pileated woodpeckers in northeastern Oregon. Journal of Wildlife Mgmt. 56(4):786-793. (NE Oregon)	(Nesting) Average DBH of 36 nest trees was 80.0 cm (SE = 0.8) [**31.4 in**]. (Roosting) Average DBH of roost trees was 71 cm [**28 in**]. Seventy-two percent of roost trees were in old-growth stands (Old Growth defined as containing ≥10 trees/ha ≥51 cm DBH [**20 in**] in the grand fir type, or >8 trees/ha ≥51 cm DBH in the ponderosa pine and Douglas-fir types)	Large (20-29.9" DBH) Very Large (>30" DBH)
Bull, Evelyn L. 1987. Ecology of the pileated woodpecker in northeastern Oregon. Journal of Wildlife Mgmt. 51(2): 472-481. (NE Oregon)	(Nesting) The DBH of 105 nest trees averaged 84 cm [**33 in**]. (Foraging) The use of large diameter trees was most pronounced, with **74 percent** of the foraging in trees >50-cm (**20 in**) DBH, 12 percent in trees 25-50-cm (10-20 in) DBH and 14 percent in trees<25 cm (10 in).	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)
Bull, Evelyn L., S.R. Peterson, and	Selected the largest dead trees available to nest in (n = 62, greater than 50 percent of	Medium (10-19.9" DBH) Large (20-29.9" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. PNW-444 Research Note. 19 pp. (NE Oregon)	nests were in trees with a DBH of 50-74 cm (**20-29 in**) and the remaining 40+ percent were greater than 75 cm (**29 in**) DBH). Live trees used as foraging sites were significantly different from available live trees in DBH (and height). **Large trees** were preferred; 46 percent of the trees used for feeding were greater than 50 cm (**20 in**) DBH. **Seventy-five percent** of feeding sites were characterized by greater than 50 cm (**20 in**) DBH.	Very Large (>30" DBH)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW- GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	Source habitats are old-forest single and multi-strata stages of grand-fir/white-fir, interior Douglas-fir, and western larch; and the old forest multi-strata stage of Engelmann spruce –subalpine fir. Depends on snags for nesting and roosting. Uses large (>53 cm [**21 in**] DBH) hollow, live or dead trees for roosting. Special habitat features include >53 cm DBH (**21 in**) large snags or hollow live trees for nesting, roosting, or both, and large standing dead and downed trees for foraging. *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	Large (20-29.9" DBH) Very Large (>30" DBH)
Hartwig, C. L., D. S. Eastman, and A. S. Harestad. 2004. Characteristics of pileated woodpecker (Dryocopus pileatus) cavity trees and their patches on southeastern Vancouver Island, British Columbia, Canada. Forest Ecology and Management. 187: 225-234.	Nest trees had a mean DBH of 82 cm (**32 in**) (±16 S.E.). The mean diameter of nest trees used by pileated woodpeckers in North America ranges from 40 to 100 cm [**16-39 in**] and varies with location, tree species, and forest characteristics, such as the availability of large dead trees. Although this broad range of diameters indicates flexibility in nest tree selection, in all published studies, pileated woodpeckers select the larger trees of those available, thus revealing consistent preferences for large diameter trees for nesting. Habitat patches that are more likely to provide suitable nesting habitat for pileated woodpeckers have greater densities of large snags or defective trees, are in mature structural stages and mature climax successional stages.	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (>30" DBH)

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-50**.

Table K-2-50 Canopy Cover Class Differences Between the 2003 Forest Plan Appendix A and New Vegetation Layer (Tree Canopy Cover Only)

<table>
<tr><th colspan="3">Tree Canopy Cover Class</th></tr>
<tr><th>2003 Forest Plan Appendix A</th><th>New Vegetation Layer (2011)</th><th>Changed or New Classification?</th></tr>
<tr><td rowspan="3">10 – 39% Low</td><td>10 – 19% (Low Tree Canopy)</td><td>change</td></tr>
<tr><td>20 – 29% (Low-Medium Tree Canopy)</td><td>change</td></tr>
<tr><td>30 – 44% (Medium Tree Canopy)</td><td>change</td></tr>
<tr><td rowspan="2">40 – 69% Moderate</td><td>45 – 59% (Medium-High Tree Canopy)</td><td>change</td></tr>
<tr><td rowspan="2">60% (High Tree Canopy)</td><td rowspan="2">change</td></tr>
<tr><td>>70% High</td></tr>
</table>

A review of the literature shows the PIWO is strongly associated with high canopy closures in nest stands (Bull and Holthausen 1993; Bull et al. 1992; Bull 1987; Bull et al. 2007). Studies that specifically looked at roosting habitat also reported a strong association with high canopy covers (Bull et al. 1992; Bull 1987). These characterizations for nesting and roosting habitat fit well under the Medium-High and High canopy cover classes.

While there was little quantitative information on forage habitat parameters, there were studies that looked at PIWO habitat use at the scale of the home range, which would include forage habitat. Bull and Holthausen (1993) assessed canopy cover associations in three categories: <10 percent; 10-59 percent, ≥60 percent. They found that the highest canopy cover class comprised most of the home range (51 percent) for all PIWO pairs in their study with home ranges less than 500 ha (1,235 acres), and the 10-59 percent range was the next most prevalent class. The 10-59 percent class crosses four of the five new canopy cover classes and is not all that useful in describing relevant canopy cover by itself. However, the Low, Low-Medium, and Medium classes can likely be eliminated because these classes would not tend to provide the combinations of dense stand conditions and large live and dead trees, large downed logs, and high canopy cover habitat components described in the literature as important for PIWOs.

Where quantitative parameters were not available, PIWO habitat was generally described as occurring in old growth, mature, closed canopy, old forest single and multi-strata stands (Bull and Holthausen 1993; Bull et al. 1992; Bull 1987; Bull et al. 2007; Wisdom et al. 2000; Bull et al. 1986; Groves et al. 1997). These characterizations are commonly associated with the high canopy covers and large tree/snag components that are positively associated with PIWO habitat and further supports use of the Medium- High and High canopy cover classes for the PIWO mid-scale model.

To assess source habitat, modeling would best approximate the findings of the literature by selecting for forested stands in the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-51 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Medium-High (45-59%) and High (>60%) Canopy Cover classes is recommended for modeling pileated woodpecker source habitat.

Table K-2-51 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Bull, Evelyn L. and Jerome A. Jackson. (2011). Pileated Woodpecker (Dryocopus pileatus), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/pilwoo DOI: 10.2173/bna.148 Accessed March 1, 2017.	Following is a summary of relevant canopy cover information from The Birds of North America online: Roosting Roost trees in northeast Oregon typically were in old-growth stands of grand fir that had experienced little or no logging and had >60% canopy closures; canopies may be less dense where insect outbreaks caused extensive tree mortality (Bull et al. 2007). Grand fir forest types, old growth structural stages, unlogged or high-graded stands, and denser canopy closures were favored when compared to available habitat (Bull et al. 1992b).	High (≥ 60%)
Bull, Evelyn L. and Richard S. Holthausen. 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. Journal of Wildlife Mgmt. 57(2): 335 - 345. (Northeastern Oregon)	Stands with old-growth, grand-fir, no logging, and **>60 percent crown closure** were used more than expected. (Home Range) Canopy closure was divided into three classes (<10 percent; 10-59 percent, ≥60 percent), the highest crown closure class comprised most of the home range for all pairs (51 percent) and for home ranges less than 500 ha. Home ranges greater than 500 ha showed a higher percentage of area in the 10-59 percent crown closure class. The 10-59 percent canopy closure class made up the second highest proportion of the home ranges for all pairs (41 percent). Stands with less than 10 percent canopy closure were less than 8 percent of the home range.	Medium (30-44%) Medium-High (45-59%) High (≥ 60%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Bull, Evelyn L., Richard S. Holthausen, and Mark G. Henjum.1992. Roost trees used by pileated woodpeckers in northeastern Oregon. Journal of Wildlife Mgmt. 56(4):786-793. (Northeastern Oregon)	(Roosting) Majority of roosts occurred in old-growth stands of grand-fir, with **≥60 percent** crown closure. Roost trees were surrounded by old-growth stands of grand fir. Seventy-two percent in old-growth stands, 73 percent in stands with canopy closures **≥60 percent.** Mean canopy closures at roosts were **62.5 percent** (SE = 0.32).	Medium-High (45-59%) High (≥ 60%)
	Successional stage and canopy closure of nesting habitat parameters were similar to roost sites.	
Bull, Evelyn L. 1987. Ecology of the pileated woodpecker in northeastern Oregon. Journal of Wildlife Mgmt. 51(2): 472-481. (Northeastern Oregon)	Mean nest tree canopy closure was **70 percent** (SD = 23.5) and for roost trees was **66 percent** (SD=26.3). Two-thirds of nest sites were in the grand fir type. Fifty-four percent of the nest sites were in mature stands, 21 percent in old growth stands, and 24 percent in young stands with a few large, live and dead trees.	High (≥ 60%)
Bull, E. L., N. Nielsen-Pincus, B. C. Wales, J. L. Hayes. 2007. The influence of disturbance events on pileated woodpeckers in northeastern Oregon. Forest Ecology and Management. 243: 320-329 (northeastern Oregon)	Closed canopy forests were not essential for use by pileated woodpeckers, although nest success was higher in home ranges that had greater amounts of forested habitat with **≥60% canopy closure**. Canopies may be less dense where insect outbreaks caused extensive tree mortality.	Medium-High (45-59%) High (≥ 60%)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	Source habitats are old-forest single and multi-strata stages of grand-fir/white-fir, interior Douglas-fir, and western larch; and the old forest multi-strata stage of Engelmann spruce –subalpine fir. *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	N/A

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Bull, Evelyn L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. PNW-444 Research Note. 19 pp. (Northeastern Oregon)	In general, stands are multi-layered with numerous patches of young, even-aged trees and a few large, overmature trees.	N/A
Groves, C.R., B. Butterfield, A. Lippincott, B. Csuti, and J.M. Scott. 1997. Atlas of Idaho's Wildlife:	Found in dense, coniferous and mixed forests, open woodlands, second growth and, locally, parks and wooded residential areas of towns. Preliminary results of	N/A
Integrating Gap Analysis and Natural Heritage Information. Idaho Dept. Fish and Game, Nongame Wildlife Program. Boise, Idaho.	Montana-Idaho study of old-growth and rotation-aged Douglas-fir found pileated woodpeckers are old-growth associates.	

Source Habitat Conditions When Outside HRV Discussion

Pileated woodpeckers can utilize some forested conditions that are not within the historical range of variability under PVGs 2, 3, 5, and 6. These conditions generally consist of higher tree densities and more complex vegetative structure than what would have developed when stands in these PVGs were experiencing historical disturbance processes. These dense conditions would also make stands more susceptible to insect infestations which are important to this species. For PVGs 2 and 5, when functioning outside HRV, the Medium-High and High canopy cover class should be included when in the Large and Very Large tree size classes. For PVGs 3 and 6, when functioning outside HRV, the High canopy cover class should be included when in the Large and Very Large tree size classes.

Additional Modeling Parameters

This species is documented in the literature as being associated with large diameter (>21 inches DBH) snags or hollow trees for nesting, roosting, or both; and large standing dead and downed trees for foraging. The model cannot take these parameters into account and therefore may overestimate the amount of suitable habitat for this species

Updated Forest Modeling Parameters for Pileated Woodpecker Source Habitat

The updated mid-scale habitat parameters for the Pileated Woodpecker are as follows:

Within HRV
PVGs: 3, 6, 8, and 9
Tree Size Class: Large and Very Large
Canopy Cover Class: PVGs 3 and 6 = Medium-High
PVGs 8 and 9 = Medium-High and High

Outside HRV
PVGs: 2, 3, 5, and 6
Tree Size Class: Large and Very Large
Canopy Cover Class: PVGs 3 and 6 = High
PVGs 2 and 5 = Medium-High and High

Note: This species is documented in the literature as being associated with large diameter (>21 inches DBH) snags or hollow trees for nesting, roosting, or both; and large standing dead and downed trees for foraging. The model cannot take these parameters into account and therefore may overestimate the amount of suitable habitat for this species.

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 Pileated Woodpecker Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

The literature search found only two references dated more recent than 2009 and that would not have been available for the last update of the model, and that was habitat focused. A summary of relevant habitat information from *The Birds of North America* online account was also included because it was a good synthesis of all available habitat information for this species.

Reference – Bull, Evelyn L. and Jerome A. Jackson. (2011). Pileated Woodpecker (*Dryocopus pileatus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/pilwoo DOI: 10.2173/bna.148 Accessed March 1, 2017.

The following excerpts from the BNA online account are pertinent to this update:

Prefer late successional stages of coniferous or deciduous forest, but also younger forests that have scattered, large, dead trees.

In northeast Oregon, selected unlogged stands of old-growth (i.e., late successional) grand fir (*Abies grandis*) with closed canopies (Bull and Holthausen 1993). In western Oregon, densities were greater in forests >80 yr old than in younger ones (Nelson 1989d). Also in western

Oregon, preferred forests >40 yr old and riparian habitats for foraging, forest stands >70 yr old for nesting and roosting (Mellen et al. 1992).

Nesting

Nest trees are typically in dead or deteriorating live trees and within a mature or late-successional stand of coniferous (McClelland 1977, ELB), deciduous trees, or mixed trees. May be in relict dead trees in younger forests or even in cities (particularly in eastern U.S.; Bull 1974).

Of 105 nest trees in northeastern Oregon, had strong selection for nest trees > 54 cm dbh; about half the nest trees had broken tops. Nest sites had taller canopies, higher stem density of live trees < 50 and ≥50 cm dbh, higher density of snags <50 cm and ≥50 cm dbh than random plots; grand fir forest types were preferred (Bull 1987).

Forage

Prefers logs ≥38 cm in diameter and extensively decayed. Carpenter ants, the primary prey of this woodpecker in northeast Oregon, select western larch logs >25 cm in diameter in a moderate stage of decay (Torgersen and Bull 1995.), so woodpecker preference of material probably reflects prey's preference for habitat.

In closed canopy forests in western Washington favored foraging areas with high densities of large snags (> 52 cm dbh and > 7.5 m tall; Raley and Aubry 2006).

Roosting

Roost trees in northeast Oregon typically were in old-growth stands of grand fir that had experienced little or no logging and had >60% canopy closures; canopies may be less dense where insect outbreaks caused extensive tree mortality (Bull et al. 2007). Grand fir forest types, old growth structural stages, unlogged or high-graded stands, and denser canopy closures were favored when compared to available habitat (Bull et al. 1992).

Reference - Drever, M.C. and K. Martin. 2010. Response of woodpeckers to changes in forest health and harvest: Implications for conservation of avian biodiversity. Forest Ecology and Management. 259 (210) 958-966.

This was a study that looked at correlations between species richness in forest woodpeckers and species richness of all other forest birds, theorizing that management practices that maintained or improved species richness for one group would also improve it for the other. The variables they looked at were primarily tree species and beetle-killed pine, along with harvest. These variables were fairly broad scale and the study didn’t offer any nesting or forage-specific vegetation parameters that could be used for this modeling update.

Reference – Edworthy, A. B., M. C. Drever, and K. Martin. 2011. Woodpeckers increase in abundance but maintain fecundity in response to an outbreak of mountain pine beetles. Forest Ecology and Management. 261: 203-210

This study looked at whether increased food availability, in this case after a mountain pine beetle outbreak, led to a response in fecundity for six species of woodpeckers, including PIWO. Results showed that there was an increase in population densities but not in clutch size or fledgling rates. The study measured some vegetative characteristics, mainly to assess beetle presence and impacts of the infestation on stands. No relevant tree size or canopy cover class parameters were described.

The following references were also used to inform this model update but were not referenced in the original 2008 model, even though they would have been available at the time.

Reference - Bull, E. L., N. Nielsen-Pincus, B. C. Wales, J. L. Hayes. 2007. The influence of disturbance events on pileated woodpeckers in northeastern Oregon. Forest Ecology and Management. 243: 320- 329.

This study compared the effects of natural and human-caused disturbances on density of nesting pairs, reproductive success, and home ranges using 30 years of data in two areas and 15 years of data in five other areas. The study found that nesting density was positively associated with the amount of habitat in late structural stages, and was negatively associated with both the area in regeneration harvests and ponderosa pine forest types. Nest success was positively associated with the amount of unharvested stands and closed canopy stands within a given home range, whereas the amount of harvested stands was negatively correlated with nest success. The study also found that while closed canopy forests were not essential for use, nest success was higher in those home ranges that had more forested habitat **≥60 percent** canopy closure.

Reference - Hartwig, C. L., D. S. Eastman, and A. S. Harestad. 2004. Characteristics of pileated woodpecker (*Dryocopus pileatus*) cavity trees and their patches on southeastern Vancouver Island, British Columbia, Canada. Forest Ecology and Management. 187: 225-234. This study occurred on Vancouver Island, BC, during 1996 and 1997. The study located cavity trees used by pileated woodpeckers and measured nest tree and some stand characteristics. Pileateds that had active nests and/or pileated cavities were found to be larger than trees without cavities. Seven nests were located. Three were in grand fir, two were in Douglas-fir, and two were in red alder. These nest trees had a mean diameter of 32 inches DBH and a mean height of 72 feet.

The study also described other North American pileated woodpecker studies collectively with the following summary:

“The mean diameter of nest trees used by pileated woodpeckers in North America ranges from 40 to 100 cm [**16-39 in**] and varies with location, tree species, and forest characteristics, such as the availability of large dead trees. Although this broad range of diameters indicates flexibility in nest tree

selection, in all published studies, pileated woodpeckers select the larger trees of those available, thus revealing consistent preferences for large diameter trees for nesting.”

The study also noted that habitat patches that are more likely to provide suitable nesting habitat for pileated woodpeckers have greater densities of large snags or defective trees, are in mature structural stages and mature climax successional stages.

K-2-1.16 Silver-haired Bat

Mid-scale Modeling Update
for the
Silver-haired Bat
March 28, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the Silver-haired Bat Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Nutt and Geier-Hayes 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5^{th} HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

<u>Review of New Species Literature since 2008</u>

The Boise NF mid-scale habitat model for the Silver-haired Bat was created in 2005 and most recently revised in 2008 (Nutt and Geier-Hayes 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and tree canopy cover class (TCCC) were listed in the Crosswalk tables in the TSC and TCCC sections. All new literature reviewed for this 2019 Silver-haired Bat Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or TCCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the “Forest Derived Product.” Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e., “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant, 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a, Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the Silver-haired Bat. No change is recommended.

Tree Size Class Discussion

Tree Size Class classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-52**.

Table K-2-52 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification?
Grass/Forb/Shrub/Seedling (GFSS) (<4.5' tall)	Seedling (<4.5' tall)	**change in name only**
Sapling (0.1 – 4.9 " DBH)	Sapling (0.1 – 4.9" DBH)	
Small (5.0 – 12.0" DBH)	Small (5 – 9.9" DBH)	**change**
Medium (12.1 – 20" DBH)	Medium (10 – 19.9" DBH)	**change**
Large (>20.0" DBH)	Large (20 – 29.9" DBH)	**change**
	Very Large (≥ 30" DBH)	**new**

Studies by Hayes and Adam (1996) and Erickson and West (1996) found that silver-haired bats (SIHB) prefer foraging in open habitats, including recently harvested riparian areas. Erickson and West (1996) also reported that silver-haired bats foraged in clear cuts and pre-commercially thinned units but were absent from young, unthinned stands and mature forest. These openings within the larger forested landscape would be represented by the Seedling Tree Size Class, which is the recommended tree size class for modeling foraging habitat.

Most studies that described roost tree characteristics noted that roost trees generally were the largest trees available in the stand (Mattson et al. 1996; Betts 1998; Vonhof 1996). The study by Campbell et al. (1996) reported on ranges of roost tree sizes by species;

- Grand fir – average of 21 inches DBH
- Western larch – range of 12-25 inches, average of 18.9 inches DBH
- Lodgepole pine – range of 8-12 inches, average of 10.2 inches DBH
- Ponderosa pine – range of 13-29 inches, average of 19.3 inches DBH
- Douglas fir – average of 14 inches DBH

The lower end of these size ranges falls within the Medium Tree size class, while the high end for grand fir, western larch, and ponderosa pine are within the Large Tree size class. In an Oregon study, Betts (1998) reported an average diameter of 23.5 inches for roost trees used by maternity colonies. Mattson et al. (1996) reported an average DBH of 15 inches for roost trees in a study in South Dakota. Because all reported mean diameters of roost trees from the literature ranged from 10.2 to 23.5 inches DBH, it is recommended that the Medium, Large, and Very Large tree size classes be used to model roost habitat for the silver-haired bat.

To model the full range of source habitat for this species, which consists of both forage and roosting habitat, it is recommended that the Seedling, Medium, Large, and Very Large Tree size classes be included in the model.

Table K-2-53 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size classes, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Seedling (<4.5' tall), Medium (10-19.9" DBH), Large (20-29.9" DBH), and Very Large (> 30" DBH) Tree Size classes be used to model source habitat for the Silver-haired Bat.

Table K-2-53 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Erickson, J.L.; West, S.D. 1996. Managed forests in the western Cascade: the effects of seral stage on	(Foraging) Silver-haired bats were found predominately in **clearcut areas** and a few were found in the **pre-commercial thin**	Seedling (<4.5' tall) Sapling (0.1-4.9" DBH)
bat habitat use patterns. IN: Barclay, R.M.R.; Brigham, R.M. (editors). Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 23/1996	areas. No silver-haired bats were found in the young, un-thinned or mature forest areas. Authors noted the lack of silver-haired bats in the mature forest. Stated that large trees and snags, "roost-type" trees were available, but conjectured that the conditions may not have been those needed for roosting. The paper did not characterize average stand conditions for each of the managed forest types.	
Hayes, J.P.; Adam, M.D. 1996. The influence of logging riparian areas on habitat utilization by bats in western Oregon. IN: Barclay, R.M.R.; Brigham, R.M. (editors). Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 23/1996 (Oregon)	(Foraging) Study was conducted in logged and unlogged riparian areas. Silver-haired bats appeared to be more prevalent in the logged areas compared to the unlogged. The authors speculated that silver-haired bats are able to forage more effectively in the **open habitat** created by the harvesting than in the "cluttered" densely forested riparian as they are larger- bodied than the *Myotis* species that used the unlogged areas. *("Open" suggests seedling and/or sapling stages)*	Seedling (<4.5' tall) Sapling (0.1-4.9" DBH)
Mattson, Todd A., Steven W. Buskirk, and Nancy L. Stanton. 1996. Roost sites of the silver-haired bat (*Lasionycteris noctivagans*) in the Black Hills, South Dakota. Great Basin Naturalist 56(3). 247-253 p. (South Dakota)	(Roosting) Located 39 roosts, 10 of which were maternity roosts containing 6-55 bats. 38 of 39 roosts (97%) were in PIPO snags averaging 39 cm ±1 SD [**15 inches** ±1 SD] DBH. One roost was in aspen. Roost plots had more **large trees** and a corresponding higher basal area than	Medium (10-19.9" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
	surrounding plots. Roost trees were larger than average in diameter.	
Campbell, L.A.; Hallett, J.G.; O'Connell, M.A. 1996. Conservation of bats in managed forests: use of roosts by *Lasionycteris noctivagans*. Journal of Mammalogy 77(4): 976-984	(Roosting) Monitored 15 roost trees. All but one were snags. The non-snag was a dying western red cedar. Sizes of roost trees: grand fir=**21.3 inches** western larch=range **12 to 25 inches**, average **18.9 inches** lodgepole pine=range **8 to 12 inches**, average **10.2 inches** ponderosa pine=range **13 to 29 inches**, average **19.3 inches** Douglas-fir=**14 inches**	Medium (10-19.9" DBH) Large (20-29.9" DBH) Very Large (≥30" DBH)
Betts, B.J. 1998. Roosts used by maternity colonies of silver-haired bats in northeastern Oregon. Journal of Mammalogy 79(2): 643-650 (Oregon)	(Roosting) There were no significant differences in diameters of roost and available trees. Average diameter of roost trees was 59.8 cm (**23.5 inches**) and average diameter of available trees was 51.5 cm (20.2 inches).	Large (20-29.9" DBH) Very Large (≥30" DBH)
Christy, R.E.; West, S.D. 1993. Biology of bats in Douglas-fir forests. Gen. Tech. Rep. PNW-GTR-308. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 28 pages.	In Oregon, silver-haired bats were found to prefer Douglas-fir/western hemlock forests more than **200 years old** over other forest types and ages (Perkins and Cross 1988).	Large (20-29.9" DBH) Very Large (≥30" DBH)
Vonhof, M. 1996. Roost-site preferences of big brown bats (*Eptesicus fuscus*) and silver-haired bats (*Lasionycteris noctivagans*) in the Pend d'Oreille Valley in southern British Columbia. IN: Barclay, R.M.R.; Brigham, R.M. (editors). Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 23/1996 (British Columbia)	(Roosting) Tree size was a primary discriminator of roost trees from available trees. The silver-haired bat's roost trees tend to have greater diameters than available trees in the stand.	----
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications.	Source habitat for resident silver-haired bats is in forested and woodland areas. Source habitat is generally late seral stages of subalpine, montane, lower montane, and riparian woodland community groups. Snags are also a special habitat feature for silver-haired bats. They roost in trees, snags, mines, caves, crevices, and buildings. Day roost trees are usually characterized as large (>53 cm [**21 inch**]) DBH, dead or live with	Large (20-29.9" DBH) Very Large (≥30" DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	some defect, with loose bark and cracks. Silver-haired bats were found roosting in live western larch and ponderosa pine, and grand fir and ponderosa pine snags in Oregon. The average diameter of these roost trees was 59.6 cm (**23.5 inches**). These roost trees were generally located on densely forested slopes. Source Habitat from Appendix 1, Volume 3, Table 1, pages 437-440	
	Cover types/structural stage: Interior Douglas-fir, Western Larch, Lodgepole pine, Grand fir-white fir, Interior Ponderosa pine/old multi-story and old single-story. Aspen, Cottonwood-willow/old multi- story. *Note: this citation is a comprehensive summary of scientific literature and does notprovide data itself.*	

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-54**.

Table K-2-54 Tree Canopy Cover Class Differences Between the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

Many references describe this species as a contrast species that requires a closed canopy forest that provides high snag densities for roosting structure but that also has small openings or edge habitat necessary for forage (Wisdom et al. 2000; Campbell et al. 1996; Bat Conservation International 2017). Erickson and West (1996) was the exception; they found that SIHBs used clear cut areas most of the time and did not use young, unthinned or mature forests, even though potential roost trees were available in the mature forest.

Forage habitat is generally described as being open, occurring in habitats such as natural openings, waterways or waterbodies, open riparian habitat, or in clear cuts or other harvested areas with reduced tree densities (Hayes and Adam 1996; Bat Conservation International 2017; Wisdom et al. 2000). These descriptions likely fall within the Low and Low-Medium Tree Canopy Cover classes where there would be minimal overstory that would allow for unimpeded foraging activity.

While the literature is in general agreement about forage habitat it is not very definitive in describing the canopy cover attributes of roosting habitat. Some studies reported that canopy cover immediately surrounding the roost tree was lower than random plots (Mattson et al. 1996; Campbell et al. 1996). However, very few reported actual canopy cover values. Other studies generally described roost habitat as occurring within “dense” or close-canopied forests. Campbell et al. (1996) reported roost tree vegetation plots as having less canopy cover than plots without roost trees, but also that roost trees were located in gaps in an otherwise close-canopied stand. Christy and West (1993) noted that SIHBs prefer Douglas fir/western hemlock forests more than 200 years in age more than other forest types and ages; stands 200 years or older could be described as having a closed canopy. Wisdom et al. (2000) generally described roost habitat as occurring on “densely forested slopes.” All of these references describe roost habitat as occurring within a dense or close-canopied forest, but do not quantify what exactly close-canopied or dense means.

From the above discussion potential roosting habitat could be characterized as occurring in small openings surrounded by an older forested component. This is consistent with Vonhof (1996) who described “older-aged” stands as being important for the SIHB because they provide a greater abundance of large snags with a variety of decay classes (Cline et al. 1980), and are characterized by reduced tree densities, more openings in the canopy, and less canopy “clutter” (Franklin et al. 1981). Older, decedent stands with these later successional qualities would likely fall within the Medium Tree Canopy Cover class. In addition, the only reference that reported actual canopy cover percentages was Betts (1998), who measured 0.1-acre plots centered on roost trees and reported a mean canopy cover of 41.5 percent, which falls within the Medium class. As a result, the Medium Tree Canopy Cover class is recommended for modeling source habitat for the SIHB. Higher density classes (greater than 44 percent) would not generally contain the pockets of low canopy cover where large snags are used for roosting or openings that provide forage habitat. Lower classes (<30 percent) would not likely contain the high snag densities used for roost structure, although the Low and Low-Medium classes are also recommended in the model to represent forage habitat.

To assess source habitat, modeling would best approximate the findings of the literature by selecting for forested stands in the Low (10-19%), Low-Medium (20-29%), and Medium

(30-44%) Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-55 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Low (10-19%), Low-Medium (20-29%), and Medium (30-44%) Tree Canopy Cover classes is recommended for modeling Silver-haired Bat source habitat.

Table K-2-55 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
Mattson, Todd A., Steven W. Buskirk, and Nancy L. Stanton. 1996. Roost sites of the silver-haired bat (*Lasionycteris noctivagans*) in the Black Hills,	(Roosting) Roost plots had more large trees and a corresponding higher basal area than surrounding plots.	*(Too general to make a tree canopy cover class association)*
South Dakota. Great Basin Naturalist 56(3). 247-253 p. (South Dakota)		
Christy, Robin E.; Stephen D. West. 1993. Biology of bats in Douglas-fir forests. Gen. Tech. Rep. PNW-GTR-308. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 28 p. (Huff, Mark H.; Holthausen, Richard M.; Aubry, Keith B., Tech. coords. Biology and management of old-growth forests).	(Roosting) In Oregon, it has been determined that silver-haired bats prefer Douglas fir/ western hemlock forests more than **200 years old** over other forest types and ages (Perkins and Cross 1988).	Medium (30-44%) Medium-High (45-59%) High (≥60%)
Campbell, L.A.; Hallett, J.G.; O'Connell, M.A. 1996. Conservation of bats in managed forests: use of roosts by *Lasionycteris noctivagans*. Journal of Mammalogy 77(4): 976-984 (northeastern Washington)	(Roosting) Plots containing roost trees had significantly less canopy cover, shorter understory, and less vegetative cover than plots without roost trees. Authors speculated that this is advantageous as it would allow for unimpeded flight, particularly for young. However, all but one of the roost sites were located in gaps in otherwise closed-canopy patches (typically >30 and <80 years old). The exception was a Douglas fir snag located in a clump of trees on the edge of a large, partial clear cut. Overall, plots with roosts exhibited significantly less canopy closure than random plots.	Low (10-19%) Low-Medium 20-29%) Medium (30-44%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
Betts, B.J. 1998. Roosts used by maternity colonies of silver-haired bats in northeastern Oregon. Journal of Mammalogy 79(2): 643-650 (northeastern Oregon)	(Roosting) In 0.1 acre plots centered on a roost mean tree canopy cover was **41.5%** ± 11.9 vs 45.3% ± 13.8 for available trees.	Medium (30-44%)
Erickson, J.L.; West, S.D. 1996. Managed forests in the western Cascade: the effects of seral stage on bat habitat use patterns. IN: Barclay, R.M.R.; Brigham, R.M. (editors). Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 23/1996	Measured bat activity in four types of managed forests: clearcut (2-3 years old), pre-commercial thin (12-20 years old), young-unthinned (30-40 years old), and mature (50-70 years old) Silver-haired bats were found predominately in clearcut areas and a few were found in the pre-commercial thin areas. No silver-haired bats were found in the young, unthinned or mature forest areas, even though potential roost trees were available in the mature forest.	Low (10-19%) Low-Medium (20-29%) Medium (30-44%)
Vonhof, M. 1996. Roost-site preferences of big brown bats (*Eptesicus fuscus*) and silver-haired bats (*Lasionycteris noctivagans*) in the Pend d'Oreille Valley in southern British Columbia. IN: Barclay, R.M.R.; Brigham, R.M. (editors). Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 23/1996	Forest harvesting practices that result in relatively large cutblocks separated by small strips of forest removes large portions of the available roosting habitat, and because older-aged stands are most often targeted in forest-harvesting operations, the remaining forested areas are often deficient of suitable roosting habitat. Older-aged stands contain a greater abundance of large snags in a variety of decay classes (Cline et al. 1980) and are characterized by reduced tree densities, more canopy gaps, and less clutter (Franklin et al. 1981). Thomas (1988) found that bat activity was high in old-aged forest stands in Oregon for the first fifteen minutes after sunset, and suggested that bats use older stands for roosting. However, similar conditions to older-aged stands may be provided in second-growth stands in which large trees were retained, and bats in this study roosted equally often in large trees in older-aged stands or in remnant trees in second-growth stands.	Medium (30-44%)
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service,	Silver-haired bats use contrasting forested areas for roosting and open areas for foraging. Roost trees were generally located on **densely forested** slopes.	Low (10-19%) Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).		
Hayes, J.P.; Adam, M.D. 1996. The influence of logging riparian areas on habitat utilization by bats in western Oregon. IN: Barclay, R.M.R.; Brigham, R.M. (editors). Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 23/1996 (British Columbia)	Study was conducted in logged and unlogged riparian areas. Silver-haired bats appeared to be more prevalent in the logged areas compared to the unlogged. The authors speculated that silver-haired bats are able to forage more effectively in the **open habitat** created by the harvesting than in the "cluttered" densely forested riparian as they are larger-bodied than the *Myotis* species that used the unlogged areas.	Low (10-19%) Low-Medium (20-29%) Medium (30-44%)
Bat Conservation International Website Species Profile for *Lasionycteris noctivagans* Accessed 5/5/2017	Most closely associated with coniferous or mixed coniferous and deciduous forest types, especially in areas of Old Growth. It is estimated that these bats require snag densities of at least 21 per hectare. Even though they are highly dependent upon Old Growth forest areas for roosts, silver-haired bats feed predominantly in disturbed areas, sometimes at tree-top level, but often in small clearings and along roadways or water courses.	*(Too general to make a tree canopy cover class association)*

Table Notes:

New references shaded green

Source Habitat Conditions When Outside HRV Discussion

None.

Additional Modeling Parameters

None.

Model Limitations

This species is documented in the literature as being a contrast species, requiring the juxtaposition of habitats used for foraging and roosting. They also require large, tall snags with natural or cavities excavated by primary cavity nesters for maternity roosts and access to open water for drinking. The model cannot take this need for juxtaposed habitats, snags, or distance to open water into account and therefore will overestimate the amount of suitable habitat for this species.

Updated Forest Modeling Parameters for Silver-haired Bat Source Habitat

The updated mid-scale habitat parameters for the Silver-haired Bat are as follows:

Within HRV

PVGs: 1, 2, 3, 4, 5, 6, and 7

Climax Aspen is also source habitat for silver-haired bats.

Tree Size Class: Seedling, Medium, Large, and Very Large Tree Canopy Cover Class: Low, Low-Medium, and Medium

Model Limitations: This species is documented in the literature as being a contrast species, requiring the juxtaposition of habitats used for foraging and roosting. They also require large, tall snags with natural or cavities excavated by primary cavity nesters for maternity roosts and access to open water for drinking. The model cannot take this need for juxtaposed habitats, snags, or distance to open water into account and therefore will overestimate the amount of suitable habitat for this species. Source habitat is defined by those characteristics of macro-vegetation *that contribute to stationary or positive population growth*.

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 Silver-haired Bat Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or tree canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

The literature search resulted in a limited number of new (2008 and newer) references that looked at habitat preferences in the western United States.

Reference – Jantzen, M.K., and M.B. Fenton. 2013. The depth of edge influence among insectivorous bats at forest-field interfaces. Can. J. Zool. 91: 287-292.

Study in Ontario, Canada, that looked at how variations in wing morphology and echolocation call characteristics affects the type of habitat used for foraging activities for 5 bat species, including silver- haired bat. While this study looked at three broad habitat types, open, cluttered, and edge, it didn't look specifically at tree size or canopy cover parameters that would help inform this model update.

Reference – Lacki, M.J., J.S. Johnson, L.E. Dodd, M.D. Baker. 2007. Prey consumption of insectivorous bats in coniferous forests of north-central Idaho. Northwest Science, 81(3):199-205.

Study looked at insect prey consumed by 5 species of bat (including silver-haired) that inhabited actively managed forests near Elk River, Idaho. Found that these species consumed a variety of prey species but that Lepidoptera (moths) was relied upon by four of the five bats species, suggesting competition between species. Could not, however, determine whether inter-specific partitioning of food resources was occurring. Study did not offer any information on habitat parameters for foraging.

Reference – Reimer, J.P., E.F. Baerwald, R.M. Barclay. 2010. Diet of hoary (*Lasiurus cinereus*) and silver- haired (*Lasionycteris noctivagans*) bats while migrating through southwestern Alberta in late summer and autumn. A. Midl. Nat. 164:230-237.

Once again, this study only reported on diet of these bats species and didn't include any discussion of a forage habitat component. Not useful for this mid-scale model update.

Reference - C.C. Voigt and T. Kingston (eds.), *Bats in the Anthropocene: Conservation of Bats in a Changing World*, DOI 10.1007/978-3-319-25220-9

This reference is a comprehensive report on bats at a world view. It did have one chapter that spoke to habitat requirements of bats and how silviculture/timber production may be impacting bats, but did not include specific habitat parameter discussions for the silver-haired bat that would be useful for this model update. A very nice publication none-the-less.

Reference – Vonhof, M.J., and B.J. Betts. 2010. Nocturnal activity patters of lactating silver-haired bats (*Lasionycteris noctivagans*): the influence of roost-switching behavior. Acta Chiropterologica. 12(2):283- 291.

This study tracked lactating females from roost to roost and assessed how those movements may impact foraging activity for those females. This was more of a behavioral study and didn't describe roost habitat like I thought it might.

Reference - Bat Conservation International Website Species Profile for *Lasionycteris noctivagans*

Accessed 5/5/2017

I accessed the species profile for silver-haired bat on the Bat Conservation International website to see what information this group may have. There wasn't much that spoke to actual habitat parameters that would be useful to this update, although it did have snag density numbers and some general information about forest types and preferred forage habitat.

Most closely associated with coniferous or mixed coniferous and deciduous forest types, especially in areas of Old Growth. It is estimated that these bats require snag densities of at least 21 per hectare. Even though they are highly dependent upon Old Growth forest areas for roosts, silver-haired bats feed predominantly in disturbed areas, sometimes at tree-top level, but often in small clearings and along roadways or water courses.

K-2-1.17 American Three-toed Woodpecker

Mid-scale Modeling Update
for the
American Three-toed Woodpecker
March 26, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the Three-toed Woodpecker Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Nutt et al. 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

<u>Review of New Species Literature since 2008</u>

The BNF mid-scale habitat model for the Three-toed Woodpecker (TTWO) was created in 2005 and most recently revised in 2008 (Nutt et al. 2008). This literature review of published information between 2008 and 2017 was conducted to validate whether model parameters from 2008 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and tree canopy cover class (TCCC) were listed in the Crosswalk tables in the TSC and TCCC sections. All new literature reviewed for this 2019 American Three-toed Woodpecker Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or TCCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2017; however, the actual review of this document and subsequent update of the model did not occur until 2019.

<u>Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes</u>

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the "Forest Derived Product." Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e., “stands”), to meet the minimum map unit of 5 acres for most polygons, and to reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a; Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2008 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2008 model into the 2019 model.

Parameter Review Discussion

The following parameter review discussion describes the vegetation parameters used to model source habitat when under historic range of variability (HRV) conditions.

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the three-toed woodpecker. No change is recommended.

Tree Size Class Discussion

Tree Size Class classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-56**.

Table K-2-56 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification?
Grass/Forb/Shrub/Seedling (GFSS) (<4.5’ tall)	Seedling (<4.5’ tall)	change in name only
Sapling (0.1 – 4.9“ DBH)	Sapling (0.1 – 4.9” DBH)	
Small (5.0 – 12.0” DBH)	Small (5 – 9.9” DBH)	change
Medium (12.1 – 20” DBH)	Medium (10 – 19.9” DBH)	change
Large (>20.0” DBH)	Large (20 – 29.9” DBH)	change
	Very Large (> 30" DBH)	new

Although lacking local references, the literature describes nesting habitat to be within the lower half of the Medium (10-19.9” DBH) tree size class and the very upper edge of the Small (5-9.9” DBH) tree size class. The mean DBH of nest trees was reported to be 11 inches by Goggans et al. (1989) in central Oregon, 12.4 inches by Lester (1980) in northwestern Montana, and 10 inches by Steeger and Dulisse (1997) in British Columbia. Goggans et al. (1989) also found that the stand surrounding the nest tree averaged 8 inches DBH.

The mean DBH of foraging trees was found to be 15.5 inches by Goggans et al. (1989), 9 inches by Steeger and Dulisse (1997), and 9.4 inches by Bull et al. (1986). Murphy and Lehnhausen reported that in fire-damaged spruce forest in Alaska TTWO males foraged on trees that averaged 16.5 inches DBH while females used trees averaging 13.6 inches DBH. Only one reference, Goggans et al. (1989), looked at roosting habitat, reporting that TTWOs roosted trees with a mean DBH of 12 inches and within stands that averaged 9 inches DBH.

Most of the above references indicate that TTWOs utilize nesting, forage, and roosting structure firmly within the Medium tree size class, although at the lower half of the classes’ range. The new Medium Tree Size Class goes down to 10 inches DBH, two inches smaller than what the lower threshold for the Medium Classification was for the 2010 Forest Plan Amendment (12 inches DBH). This is perhaps a better fit for this species as most mean diameters were in the 10 to 16-inch range. There were some studies that reported mean DBH below 10 inches, which fall within the Low tree size class. This occurred where mean DBHs were around 10 or 11 inches and some values in the study’s range of diameters fell below 10 inches, and also under Goggans et al. (1989) where stands surrounding the nest, roost, or forage tree were measured. This would seem to indicate that TTWOs were selecting stands with an abundance of small trees. However, many of the same studies reported that in the larger context of the landscape, TTWOs were selecting for mature or overmature stands (Goggans et al. 1989; Toone 1992; Wisdom et al. 2000; Hoffman 1997) and in some cases were selecting against young, multi-storied, or harvested stands (Goggans et al. (1989). It is unlikely that a stand in the Low size class could be considered a mature or over mature stand. Mature and overmature stands would more likely equate to Medium, Large, or Very Large stands. Therefore, based on the literature it appears three-toed woodpeckers need a small diameter tree component but those trees need to be within a matrix of stands with medium and large trees such that the stand as a whole would be classed as mature or over- mature. Therefore, it is recommended that the Medium, Large, and Very Large Tree size classes be used to model TTWO habitat.

Table K-2-57 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

It is recommended that Medium (10-19.9” DBH), Large (20-29.9” DBH), and Very Large (>30” DBH) Tree Size classes be used to model source habitat for the American three-toed woodpecker, both for within and outside the Historical Range of Variation (HRV).

Table K-2-57 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
(This study has two separate reports that give the same parameter information) Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Wildlife Program. Technical Report #87-3-02. 44 pp. And Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1988. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Project No. 87-3-02. 103 pp. (Oregon)	Habitat selection for mature and overmature forest stands and against younger stands and logged areas was documented for three-toed woodpeckers in 16 nests, 493 forage bouts, and 16 roosts. (Nesting, pg. 17) Mean stem size at nests was 8.0 inches DBH. All nest trees were lodgepole. Mean DBH for nest trees was 11 inches (SD=20.7, range=7-17, n=20). (Roosting, pg. 20) Mature and overmature stands were selected for roosts; young stands (seedlings, saplings, poles), multi- storied, or logged areas were avoided. Mean DBH of roost stands was 9.0 inches. Mean DBH of roosts trees was 12.0 inches. (Forage, pg. 18) Mature and overmature stands were selected for foraging; younger stands and logged areas were avoided. Mean DBH of all trees used for foraging 15.5 in (SD=5.9, range = 2-34, n=429), and mean DBH of all lodgepole pine trees used for foraging was 11.5 inches. Mean DBH for forage stands was 10.0 inches.	Medium (10-19.9” DBH)
Lester, Amy N. 1980. Numerical response of woodpeckers and their effect on mortality of mountain pine beetles in lodgepole pine in northwestern Montana. Master of Science Thesis. University of Montana. 103 pp. (Montana)	(Nesting) The average nest tree DBH was 12.4 inches (n = 11, range = 8.6 -17.2).	Medium (10-19.9” DBH)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Steeger, C. and J. Dulisse. 1997. Ecological interrelationships of three-toed woodpeckers with bark beetles and pine trees. Forest Sciences in Tremblay, J. A., D. L. Leonard Jr., and L. Imbeau (2018). American Three-toed Woodpecker	(Nesting) Mean DBH 26.1 cm ± 6.9 SD [10 inches ± 2.7]. (Forage) Mean DBH 23.1 cm ± 4.5 SD [9.0 inches ± 1.8].	Medium (10-19.9" DBH)
(Picoides dorsalis), version 2.0. In The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.attwoo 1.02 Accessed 3/25/2019 (British Columbia)		
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab, Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	Special habitat features include snags, which are used for nesting and foraging. Nest trees generally are within the diameter range of 22-50 cm (9 to 20 inches) (Bull 1980, Lester 1980). Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.	Medium (10-19.9" DBH)
Bull, Evelyn L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. PNW-444 Research Note. 19 pp. (Oregon)	(Forage) Three-toed woodpeckers scaled dead trees that averaged 24 cm DBH [9.4 inches].	Medium (10-19.9" DBH)
Murphy, Edward C. and W.A. Lehnhausen. 1998. Density and foraging ecology of woodpeckers following a stand-replacement fire. J. Wildl. Manage. 62(4):1359-1372. (Alaska)	(Forage) In a fire-damaged spruce forest in central Alaska. Mean circumference of trees used by males 133.4 cm ± 3.7 SE (n = 80) [42 cm or 16.5 inches DBH] and 108.8 cm ± 12.3 SE (n = 12) [34.6 cm or 13.6 inches DBH] for females.	Medium (10-19.9" DBH)
Toone, Robin A. 1992. General Inventory for Northern Three-toed Woodpeckers (Picoides tridactylus dorsalis) on the Wasatch Plateau, Ferron, and Price Ranger Districts,	A total of 15 three-toed woodpeckers were detected in the study. These birds were using the insect-infested, mature Engelmann spruce stands and the mature mixed conifer and aspen stands with burned trees.	----

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Manti-La Sal National Forest, Utah. Cooperative Challenge Cost Share Project. Utah Department of Natural Resources. 23 pp. (Utah)		
Hoffman, Nancy. 1997. Distribution of Picoides woodpeckers in relation to habitat disturbance within the Yellowstone area. Thesis. Montana State University. 85 pgs. (Idaho/Wyoming)	Three-toed woodpeckers nested on sites with higher densities of solid, naturally fallen down woody debris (i.e., >24 cm in diameter) and lower densities of small- diameter down woody debris than did Hairy Woodpeckers. These results provide further evidence that Three-toed are more likely to use mature/overmature forest habitat. Mature/overmature forests may provide several features (large trees and dead, dying, and down wood) that Three-toed woodpeckers use for nesting and foraging (Goggans et al. 1987, Marshall 1992, Angelstam and Mikusirisld 1994).	----

Table Notes:

DBH = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-58**.

Table K-2-58 Tree Canopy Cover Class Differences Between the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

Similar to the black-backed woodpecker, the three-toed woodpecker is associated with disturbance events such as mountain pine beetle infestations and wildfire that create areas with high densities of snags and insect prey (Leonard 2001, Wisdom et al. 2000, Toone 1992, Hoffman 1997). Quantitative descriptions of canopy cover were very limited in the literature. As a result, canopy cover parameters were largely determined using Goggans et al. (1989), the only reference that offered quantitative measures regarding canopy cover for this species.

Goggans et al. (1989) reported a mean canopy cover of 27 percent in uncut stands used for nesting, and also found that percent canopy cover at the nest tree was less than 60 percent for 19 nests (95% of nests). These nesting habitat parameters fall within the low-medium, medium, and medium-high classes. The same study reported foraging canopy cover was less than 60 percent in 58 percent of the stands, and greater than 60 percent in 42 percent of the stands, which fall within the medium, medium- high, and high classes. Canopy cover in stands used for roosting was described as less than 60 percent in 53 percent of the stands measured with a mean canopy cover of 44 percent. This would fall within the medium and medium-high classes. The above parameters for nesting, foraging, and roost habitat indicate that TTWOs can utilize a wide range of canopy covers that fall within the Low-Medium, Medium, Medium-High, and High tree canopy cover classifications, with the Medium and Medium-High classes common across all three habitat functions.

Inclusion of the Medium-High and High tree canopy cover classes is also supported in the literature by references that qualitatively describe preference for mature or over-mature stands (Goggans et al. 1989; Leonard 2001; Wisdom et al. 2000; Toone 1992; Hoffman 1997; Hoyt and Hannon 2002). Hoyt and Hannon (2002) showed a preference for “old growth” forest but not for “mature” forest, the later somewhat of an anomaly in the literature (mature forest was defined as less than 100 years old). In general, mature and overmature stands would be expected to have canopy cover in the upper range of classes.

While TTWO use of canopy cover in the Low-Medium and Medium class seems to be supported in the literature, it may be somewhat of a misrepresentation of what live stand structure the species actually uses. The beetle-infested stands where the Goggans et al. (1989) study occurred were a result of stands developing dense conditions, which would then cause tree mortality and eventually lead to an outbreak (or wildfire) event that attracted TTWOs. The mortality in those unburned stands would likely cause canopy cover measurements to be less than what the pre-infested stand originally had, and is likely this study reported canopy covers that fall within the low-medium and medium classes. Selection of the Low-Medium and Medium tree canopy cover classes would have the potential to include stands with lower canopy covers that are within their historical range of variation that wouldn’t necessarily be susceptible to MPB outbreaks or stand-replacing fire, and would likely result in over-estimation of source habitat. To avoid this, the Low-Medium and Medium tree canopy cover classes are not recommended for inclusion in the mid-scale model for three-toed woodpecker.

To assess source habitat, modeling would best approximate the findings of the literature by selecting for forested stands in the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes for preferred PVGs within their historic range of variability (HRV).

Table K-2-59 shows the crosswalk between parameters (or qualitative descriptions) found in the literature and the new tree canopy cover class breakouts, and lists the references that supported the rationale for the final selection of habitat parameters.

Selecting forested stands in the Medium-High (45-59%) and High (>60%) Tree Canopy Cover classes is recommended for modeling American three-toed woodpecker source habitat.

Table K-2-59 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Wildlife Program. Technical Report #87-3-02. 44 pp. **And** Goggans, Rebecca, Rita D. Dixon, and L.Claire Seminara. 1988. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Dept. Fish and Wildlife and USDA Forest Service. Nongame Project No. 87-3-02. 103 pp. (Oregon)	(Nesting) Habitat selection for mature and overmature forest stands and against younger stands and logged areas was documented for three-toed woodpeckers in 16 nests, 493 forage bouts, and 16 roosts. Percent canopy closure at the nest tree was estimated at **less than 60 percent for 19 nests** (95 percent). Mean canopy closure for nests in uncut stands was **27 percent** (SD=14.4, range 8-61, n=14), and for nests in cut stands was 18 percent (SD=14.4, range=0-35, n=5). Fourteen of 19 nests were in unlogged stands. (Forage) Mature and overmature stands were selected for foraging; younger stands and logged areas were avoided. Canopy closure in foraging habitat was **less than 60 percent in 58 percent of the stands**, and **greater than 60 percent in 42 percent**. (Roosting) Mature and overmature stands were selected for roosts; young stands (seedlings, saplings, poles), multi-storied, or logged areas were avoided. Mean canopy closure was **44 percent** (SD=35, range=2-93, n=15) **(<60 percent in 8 of 15 stands; >60 percent in 7 stands**).	Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59%)
Leonard Jr., David L. (2001). American Three-toed Woodpecker (*Picoides dorsalis*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species-Account/bna/species/attwoo1 DOI: 10.2173/bna.588. Accessed February 26, 2017.	Mature or old-growth coniferous forests with an abundance of insect-infested snags or dying trees (Goggans et al. 1988 , Virkkala et al. 1994 , Murphy and Lehnhausen 1998 , Imbeau et al. 1999). Prefers denser forests than does the Black-backed Woodpecker (Short 1974b , Goggans et al. 1988). *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	----
Wisdom, Michael J.; Holthausen, Richard S.; Wales, Barbara C.; Hargis, Christina D.; Saab,	Specific habitats used by three-toed woodpeckers are **mature and overmature** stands with bark beetles, disease, and heart rot	----

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TCCC Breakouts
Victoria A.; Lee, Danny C.; Hann, Wendell.; Rich, Terrell D.; Rowland, Mary M.; Murphy, Wally J.; Eames, Michelle R. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications. Volume 2 - Group Level Results. Gen Tech. Rep. PNW-GTR-485, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3 vol. (Quigley, Thomas M., tech. ed.: Interior Columbia Basin Ecosystem Management Project: scientific assessment).	(Goggans et al. 1988) and recent stand-replacing burns with abundant wood-boring insects (Caton 1996, Hutto, 1995) *Note: this citation is a comprehensive summary of scientific literature and does not provide data itself.*	
Toone, Robin A. 1992. General Inventory for Northern Three-toed Woodpeckers (Picoides tridactylus dorsalis) on the Wasatch Plateau, Ferron, and Price Ranger Districts, Manti-La Sal National Forest, Utah. Cooperative Challenge Cost Share Project. Utah Department of Natural Resources. 23 pp. (Utah)	A total of 15 three-toed woodpeckers were detected in the study. These birds were using the insect-infested, **mature** Engelmann spruce stands and the **mature** mixed conifer and aspen stands with burned trees.	----
Hoffman, Nancy. 1997. Distribution of Picoides woodpeckers in relation to habitat disturbance within the Yellowstone area. Thesis. Montana State University. 85 pgs. (Idaho/Wyoming)	Three-toed woodpeckers nested on sites with higher densities of solid, naturally fallen down woody debris (i.e., >24 cm in diameter) and lower densities of small-diameter down woody debris than did Hairy Woodpeckers. These results provide further evidence that Three-toed are more likely to use **mature/overmature forest** habitat. **Mature/overmature forests** may provide several features (large trees and dead, dying, and down wood) that Three-toed woodpeckers use for nesting and foraging (Goggans et al. 1987, Marshall 1992, Angelstam and Mikusirisld 1994).	----
Hoyt, J.S. and S.J. Hannon. 2002. Habitat associations of black- backed and three-toed woodpeckers in the boreal forest of Alberta. Can. J. For. Res. 32: 1881-1888. (Alberta)	Detected three-toed woodpeckers only in stands in the 2-year burn and **old-growth forest**; none were detected in mature conifer stands.	----

Source Habitat Conditions When Outside HRV Discussion

Three-toed woodpeckers can utilize some forested conditions that are not within the historical range of variability under PVGs 5 and 11. These conditions generally consist of higher tree densities and more complex vegetative structure than what would have developed when stands in these PVGs were experiencing historical disturbance processes. These dense conditions would also make stands more susceptible to insect infestations or stand-replacing wildfire which are important to this disturbance- dependent species. For PVG 5, when functioning outside HRV, the Medium-High and High tree canopy cover class should be included when in the Medium, Large, and Very Large tree size classes. For PVG 11, when functioning outside HRV, the High tree canopy cover class should be included when in the Medium, Large, and Very Large tree size classes.

Additional Modeling Parameters

This species is documented in the literature as being associated with burn areas less than 5 years post- fire; burned areas of light to moderate intensity (Murphy and Lehnhausen 1998; Toone 1992); and often in higher elevations, such as above 4,500 feet (Goggans et al. 1987). Therefore, the recommendation is to include areas that have burned within the last 5 years that are greater than 528 acres (Wisdom et al. 2000) and above 4,500 feet elevation as additional modeling parameters to portray three-toed woodpecker source habitat.

Model Limitations

Adequate numbers of snags 9-20 inches DBH for nesting and foraging habitat is a key habitat component that the mid/fine-scale model is unable to take into account.

Updated Forest Modeling Parameters for American Three-toed Woodpecker Source Habitat

The updated mid-scale habitat parameters for the three-toed woodpecker are as follows:

Within HRV
PVGs: 8, 9, 10, and 11
Tree Size Class: Medium, Large*, and Very Large*
Tree Canopy Cover Class: PVGs 8, 9, 10 = Medium-High and High
PVG 11 = Medium-High

* Large and very large tree size classes do not occur in PVG 10

Outside HRV
PVGs: 5 and 11
Tree Size Class: Medium, Large, and Very Large
Tree Canopy Cover Class: PVG 5 = Medium-High and High
PVG 11 = High

Additional Modeling Parameters
In addition to the vegetative parameters above, include all **burn areas less than 5 years post-fire, above 4,500 feet in elevation, and equal to or greater than 528 acres in size**.
Model Limitations: Adequate numbers of snags 9-20 inches DBH for nesting and foraging habitat is a key habitat component that the mid/fine-scale model is unable to take into account.
Source habitat is defined by those characteristics of macrovegetation that contribute to stationary or positive population growth.

New Literature Sources Reviewed for this Update

Below is a list of all new literature reviewed for this 2019 American Three-toed Woodpecker Mid-scale Modeling Update, including those references that did not provide relevant habitat information regarding tree size class or tree canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016/2017 literature review process.

The literature search found only two references dated more recent than 2008 that would not have been available for the last update of the model and that were habitat focused.

Reference – Tremblay, J. A., D. L. Leonard Jr., and L. Imbeau (2018). American Three-toed Woodpecker (*Picoides dorsalis*), version 2.0. *In* The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.attwoo1.02 Accessed March 25, 2019.

This species account is a comprehensive summary of scientific literature and does not provide original data itself. However, the Birds of North America species accounts do provide a collection of what is considered the most recent and relevant information on a given species. Any pertinent habitat information for tree size and canopy cover is summarized below.

From Nest Site - Microhabitat and Site Characteristics section:

Goggans et al. 1989 - Of 20 nests (15 Lodgepole Pine snags and 5 living Lodgepole Pines) in central Oregon, heartrot was verified in 14 and assumed in remainder based on physical characteristics of trees. Nest trees averaged 27.9 cm ± 6.35 SD in DBH, 23.1 m ± 6.4 SD in height, and cavity height averaged 7.7 m ± 3.4 SD S. Hejl and M. McFadzen, unpublished data - In Idaho and Montana, 59 of 61 nests were in snags and 84% occurred in unlogged study plots. Tree species included: Subalpine Fir (*n* = 24), Lodgepole Pine (*n* = 15), Douglas-fir (*n* = 15), and other species (*n* = 7).

Steeger and Dulisse 1997 - In British Columbia, mean nest-tree height 21.0 m ± 8.1 SD (*n* = 13), mean nest height 5.2 m ± 2.7 SD, and mean DBH 26.1 cm ± 6.9 SD, and mean nest-tree DBH 29.0 (*n* = 7) in partial cutting. Tree species used included Lodgepole Pine (*n* = 5), Western Larch (*n* = 3), Douglas-fir (*n* = 2), Quaking Aspen (*n* = 2), and Western Redcedar (*n* = 1).

A. Nappi and JAT, unpublished data and C. Craig, unpublished data - In Québec (*n* = 8;) and New Brunswick (*n* = 10;), nest trees averaged 24.4 cm ± 5.1 SD in DBH, 7.9 m ± 3.2 SD in height, and cavity height averaged 4.4 m ± 2.1 SD.

From Diet and Foraging – Microhabitat for Foraging section:

Murphy and Lehnhausen 1998 - In a fire-damaged spruce forest in central Alaska, males selected lightly to moderately burned trees, whereas Hairy Woodpecker and Black-backed Woodpecker foraged on heavily charred trees; females rarely occurred in the burn area. For males, 91% of 81 observations were on White Spruce; females (*n* = 12) were restricted to White Spruce. Mean circumference of trees used by males 133.4 cm ± 3.7 SE (*n* = 80) and 108.8 cm ± 12.3 SE (*n* = 12) for females.

Short 1974 - In an unburned spruce bog in New York, American Three-toed Woodpeckers foraged high on live spruce trunks in dense stands

Villard 1994 - In Manitoba, American Three-toed Woodpeckers fed high on trunks of dead Spruce (95% of observations), followed by American Larch and Jack Pine S. Hejl and M. McFadzen, unpublished data - In Idaho and Montana, 94% of foraging observations were on snags; tree species used included Douglas-fir (30.9%), Lodgepole Pine (29.3%), Ponderosa Pine (19.1%), Subalpine Fir (*Abies lasiocarpa*; 14.2%), and other species (6.5% of 257 observations).

Bull et al. 1986 - During 86 min of observations in northeastern Oregon, Lodgepole Pine trees located on flat terrain were used exclusively, 78% of which were recently killed (< 3 yr); mean foraging height was 19 m ± 4.5 SD and mean diameter-at breast-height (DBH) of trees used for foraging was 24 cm ± 6.7 SD (*n* = 58).

Goggans et al. 1989 - In central Oregon from late April to mid-September, 63% of foraging observations were on Lodgepole Pine and 25% on Engelmann Spruce (used trunks of standing trees 90% of observations and logs 7%). Snags (77% recently dead) were used 88% of the time and were most likely used in a greater proportion than available. Mean DBH of all forage trees was 37.2 cm ± 13.4 SD (range 5–82, *n* = 429); mean foraging height 9.1 m ± 5.8 SD (range 0–27, *n* = 446).

Steeger and Dulisse 1997 - From May to August in British Columbia, Lodgepole Pine were selected for foraging in 217 of 275 (79%) observations; mean DBH 23.1 cm ± 4.5 SD. Other trees used included Douglas-fir, hybrid spruce, Western Larch, Western White Pine (*Pinus monticola*), and Western Hemlock (*Tsuga heterophylla*).

Reference - Drever, M.C. and K. Martin. 2009. Response of woodpeckers to changes in forest health and harvest: Implications for conservation of avian biodiversity. Forest Ecology and Management. 259 (210) 958-966.

This was a study that looked at correlations between species richness in forest woodpeckers and species richness of all other forest birds, theorizing that management practices that maintained or improved species richness for one group would also improve it for the other. The variables they looked at were primarily tree species and beetle-killed pine, along with harvest. These variables were fairly broad scale and the study didn't offer any nesting or forage-specific vegetation parameters that could be used for this modeling update.

Reference - Kotliar, N.B., E.W. Reynolds, and D.H. Deutschman. 2008. American three-toed woodpecker response to burn severity and prey availability at multiple spatial scales. Fire Ecology 4(2): 26-45.

This study looked at three-toed woodpecker response to burn severity and prey availability at the home range (36 ha), foraging patch 1 ha), and single tree scales. Birds established territories in moderately burned areas with live and dead tree patches. TTWOs also foraged in patches with high proportions of severely burned trees in moderately burned areas, but rarely foraged in severely burned patches in severely burned areas. While vegetation data such as canopy cover and tree size was collected, it wasn't reported in terms useful for this model update. The emphasis of the study was on the burn severity anyway.

K-2-1.18 White-headed Woodpecker

Mid-scale Modeling Update
for the
White-headed Woodpecker
March 21, 2019 Payette National Forest
Joe Foust, District Wildlife Biologist, Cascade RD, BNF, on Detail to the PNF

The purpose of this document is to update the White-headed Woodpecker Mid-scale Habitat Model developed for the Boise National Forest in 2008 (Nutt et al. 2008), which is being used as the base habitat model for the 2019 Payette National Forest Baseline Habitat Modeling Update. This mid-scale model was developed for use at the scale of the entire Forest but is useful for habitat patch and pattern information at the scale of the fifth hydrologic unit code. It has been eleven years since the original mid- scale species model for the Boise National Forest's modeling effort was created. In order to complete the 2019 Payette National Forest Baseline

Habitat Modeling Update effort, there was a need to update three key components of the modeling process, including the new existing vegetation layer that had different canopy cover and tree size classes, the new 5th HUC boundaries, and the most up to date fire data. For the vegetation portion, in order to run the mid-scale habitat model with this new data a crosswalk that linked the old breakdown classes to the new breakdowns was needed, which is the focus of this document. This model update effort also offered an opportunity to review any new literature published since the original 2008 model was created and validate selected habitat parameters.

Review of New Species Literature since 2010

The Boise NF mid-scale habitat model for the White-headed Woodpecker (WHWO) was created in 2008 (Nutt et al. 2008). This literature review of published information between 2010 and 2016 was conducted to validate whether model parameters from 2010 are still consistent with the literature for this species. Any references that had relevant habitat information pertaining to tree size class (TSC) and canopy cover class (CCC) were listed in the Crosswalk tables in the TSC and CCC sections. All new literature reviewed for this 2019 White-headed Woodpecker Mid-scale Model Update, including those references that did not provide relevant habitat information regarding TSC or CCC, are listed and briefly summarized at the end of this document. It should be noted that the literature review for this update was completed in 2016; however, the actual review of this document and subsequent update of the model did not occur until 2019.

Application of Mid-scale Species Habitat Parameters to New Vegetation Structure Classes

A new existing vegetation map was completed for the mid-scale in 2012 using imagery acquired from 2008 and field data collected from 2007 through 2011. The data represent conditions across the Forest through the fall of 2008. This map was updated for the Payette National Forest in 2016 and called the “Forest Derived Product.” Forest Derived Products are Forest-level updates of the contractor provided maps that better facilitate Forest-level data needs. These can be added to or updated as emerging Forest-level needs arise. This included post-processing of polygon delineations to reduce the noise of many small polygons by aggregating these to produce polygons that more adequately represent a larger unit on the ground (i.e., “stands”), to meet the minimum map unit of 5 acres for most polygons, and to

reduce the overall number of polygons for processing. Size class polygons were then reattributed utilizing the same imagery used by the original mapping product and newer imagery as it became available. The original contractor mapping process generalized much of the size class polygons into the medium size class (10.0-19.9” DBH). The hand-edits of the size class attributes helped to spread the distribution of size classes into the seedling, sapling, small and large tree classes and more closely mirror Forest Inventory data. Secondly, the canopy cover map needed to be updated to incorporate changes due to recent fires. Rule sets utilizing post-fire vegetation condition were developed to adjust canopy cover changes where necessary, and reviewed with newer imagery. No changes were made to the dominance type map and all changes made to the size class and canopy cover class were made to nest into the correct corresponding dominance types in that map, so that the map integrity between the three layers was maintained. An update to the accuracy assessment was also completed for the Forest Derived Products.

Although there was no change to the Potential Vegetation Group (PVG), this new existing vegetation product created new categories for tree size class and canopy cover class. The final dominance type map units, size classes and canopy cover classes conform to the mid-level mapping standards referenced in the Existing Vegetation Classification and Mapping Technical Guide Version 1.0 (Brohman and Bryant 2005). This existing vegetation map provides the Payette National Forest with a new baseline of current condition. However, the classification for the components of this vegetation map are different than the classifications used in previous vegetation mapping efforts used for the Payette National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 2003a, Redmond et al. 1998). Therefore, crosswalks needed to be developed to translate the categories for size class and canopy cover classes used for the 2009 model in order to run the models on the new existing vegetation product. The following documentation explains how the parameters were cross-walked from the 2009 model into the 2019 model.

Parameter Review Discussion

PVG Discussion

No new information was found during the literature review on potential vegetation group (PVG) preferences for the white-headed woodpecker. No change is recommended.

Tree Size Class Discussion

Tree Size Class (TSC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-60**.

Table K-2-60 Tree Size Class Differences Between 2003 Forest Plan Appendix A and New Vegetation Layer

2003 Forest Plan Appendix A	New Vegetation Layer (2011)	Changed or New Classification
Grass/Forb/Shrub/Seedling (GFSS) (<4.5’ tall)	Seedling (<4.5’ tall)	**change in name only**
Sapling (1.0 – 4.9“ DBH)	Sapling (0.1 – 4.9” DBH)	
Small (5.0 – 12.0” DBH)	Small (5 – 9.9” DBH)	**change**
Medium (12.1 – 20” DBH)	Medium (10 – 19.9” DBH)	**change**
Large (>20.0” DBH)	Large (20 – 29.9” DBH)	**change**
	Very Large (> 30" DBH)	**new**

For modeling both nesting and forage habitat, the majority of literature sources support selecting the Large (20 – 29.9” DBH) and Very Large (>= 30" DBH) Tree Size classes (Frederick and Moore 1991; Blair and Servheen 1995; Dixon 1995a,b; Bull et al. 1986). Most references specific to nesting habitat were firmly within the Large Tree Size class (Frederick and

Moore 1991; Dixon 1995a,b), while foraging habitat parameters were generally larger and sometimes spilled into the Very Large size class (Frederick and Moore 1991; Blair and Servheen 1995; Dixon 1995a). Larger live trees have more surface area and deep fissured bark for insect gleaning in the summer, and would be regular seed producers which provide a winter food source.

There is also some support for the Medium Tree Size class (10-19.9" DBH), including the most recent body of research by J. Kozma (Bull et al. 1986; Kozma 2011, 2012). However, Kozma and Kroll (2012) conducted a population source/sink analysis for essentially the same study area as the one used in both Kozma 2011 and Kozma 2012. The source/sink analysis concluded that the study area comprised of either managed or burned stands was likely a sink for the white-headed woodpecker population, even though the species could successfully breed in this habitat. As a result, it is likely premature to consider smaller trees in the Medium Tree Size class as providing sufficient nesting and forage habitat for the white-headed woodpecker.

Table K-2-61 shows the crosswalk between Tree Size class parameters found in the literature and the new recommended Tree Size class breakouts.

It is recommended that both Large (20-29.9" DBH) and Very Large (> 30" DBH) Tree Size classes be used to model source habitat for the white-headed woodpecker.

Table K-2-61 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Size Class Parameter

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Frederick, Glen P. and Teresa L. Moore. 1991. Distribution and habitat of white-headed woodpeckers (*Picoides albolarvatus*) in west-central Idaho. Idaho Dept. Fish and Game, Boise. 32pp. (Idaho)	Nesting Habitat - dead trees in moderate to late stages of decay, average dbh. = 56 cm **(22 inches).** Table 5. Characteristics of habitats sampled using five 0.04 ha subplots located within a 3.1 ha (7.7 ac.) area and centered on whwo nest sites = average for 6 study sites was **17.3" (+ 5.5") dbh**. Nest stands were mature to old, open-canopied, sparsely stocked. Foraging – Detected whwo on transects with a mean dbh of 32 cm (**12.6"**), but birds were commonly observed foraging on much larger trees. Mean dbh of 8 pines on which foraging was observed was 70 cm (+25), **or 27.6" (+9.8)**	Medium – 10-19.9" DBH Large – 20-29.9" DBH Very Large - >30" DBH
Blair, Steve and Greg Servheen. 1995. A Species Conservation Assessment and Strategy for White-Headed Woodpecker (*Picoides*	Recommendations for Management based on literature and species expert review include: Favor late-seral PIPO stands with **>10 tpa >21 inches dbh, >2tpa >31 in dbh**. Mean d.b.h. of retained snags = **27-31 inches.**	Large – 20-29.9" DBH Very Large - >30" DBH

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
albolarvatus) *draft February 1995.* Idaho Dept. of Fish and Game, Boise, 21pp. (Idaho)		
Dixon, R.D. 1995a. Density, nest-site and roost-site characteristics, home-range, habitat-use, and behavior of White-headed Woodpeckers: Deschutes and Winema National Forests, Oregon. Oregon Dept. Fish and Wildl. Nongame Rep. 93-3-01. (Oregon)	Mean dbh of nest trees was 80 + 8 cm (**31"**) Mean dbh of roost trees was 60 + 3 cm (**24"**) Mean dbh of trees surrounding nest tree was 55 cm +3 (**21.7" + 1"**) Mean dbh of trees surrounding roost tree was 51 cm + 1 (**20" + 0.4"**) Mean dbh of trees surrounding foraging (mostly forage sites but included other daily activities) sites was 57 + 0.6 cm (**22.4" + 0.2"**) Selected home ranges were dominated by old-growth PIPO. Foraging occurred on large diameter live PIPO (x=68cm (**27 inches**)).	Large – 20-29.9" DBH Very Large - >30" DBH
Dixon, R.D. 1995b. Ecology of White-headed Woodpeckers in the Central Oregon Cascades. Master's thesis, Univ. of Idaho, Moscow. (Oregon)	Mean dbh of nest trees was 65 + 4 cm (**25.6" + 1.6**) (p.36). Mean dbh of roost trees was 61 cm (**24"**) (p. 23) Whwo used large-diameter (>53 cm d.b.h. (**21 inches**)) snag classes for nesting and roosting in greater proportion than available (p. 24)	Large – 20-29.9" DBH
Bull, Evelyn L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. PNW-444 Research Note. 19 pp. (Oregon)	Preferred trees greater than 25 cm **(10")** dbh.	Medium – 10-19.9" DBH Large – 20-29.9" DBH Very Large - >30" DBH
Kozma, J. M. 2011. Composition of forest stands used by Whiteheaded Woodpeckers for nesting in Washington. Western North American Naturalist 71:1–9. (Washington)	In 16 forest stands (all managed or burned) that contained whwo nests, PP was most common species in all but 3 stands, and mean density of PP was greatest in 20.3-30.5 cm (**8-12"**) and 30.6-40.6 (**12-16"**) dbh size class and lowest in 50.8-61.0 cm (20-23.6") and > 61.0 cm (24") size classes. Also, mean dbh of PP was **13" dbh** and ranged from **10.3" to 19.8" dbh**.	Medium – 10-19.9" DBH
Kozma, J. M. 2012. Nest-site character-istics of	Essentially the same study area as Kozma 2011.	Medium – 10-19.9" DBH

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
three wood-pecker species in managed ponderosa pine forests of	Mean dbh of nest substrates used by whwo was 43.1 cm (17") in burned stands and 38.1 cm (15") in unburned stands.	
the eastern Cascade Range. Northwestern Naturalist 93:111–119. (Washington)		
Kozma, J. M., and A. J. Kroll. 2012. Woodpecker nest survival in burned and unburned managed ponderosa pine forests of the northwestern United States. Condor 114:1–13. (Washington)	No new parameters to add but this study completed a population source/sink analysis and determined that the study area could be a sink. This is pertinent to this update because the other Kozma studies (2011 and 2012 listed above) showed use of stands with somewhat smaller mean dbh preferences that dipped into the Medium TSC, likely because that's what was available due to substantial management within this study area.	----

Table Notes:

dbh = diameter at breast height

Tree Canopy Cover Discussion

Tree Canopy Cover (TCC) classifications for both the 2003 Forest Plan Appendix A and New 2011 Vegetation Layer are compared below in **Table K-2-62**.

Table K-2-62 Canopy Cover Class Differences Between the 2003 Forest Plan Appendix A and New Vegetation Layer (Tree Canopy Cover Only)

Tree Canopy Cover Class		
2003 Forest Plan Appendix A	**New Vegetation Layer (2011)**	**Changed or New Classification?**
10 – 39% Low	10 – 19% (Low Tree Canopy)	**change**
	20 – 29% (Low-Medium Tree Canopy)	**change**
	30 – 44% (Medium Tree Canopy)	**change**
40 – 69% Moderate	45 – 59% (Medium-High Tree Canopy)	**change**
	60% (High Tree Canopy)	**change**
>70% High		

A review of the literature shows that there is strong support for selection of the Low (10-29%) and Low- Medium (20-29%) Tree Canopy Cover classes as the majority of literature sources reported canopy covers for nesting sites and/or nesting habitat below 30 percent (Frederick and Moore 1991; Blair and Servheen 1995; Dixon 1995a).

While parameters in the literature for nesting habitat fell firmly within the Low and Low-Medium Tree Canopy Cover classes, white-headed woodpeckers were found to be using habitat with higher canopy covers for roosting and foraging. Dixon (1995a) reported mean canopy cover at roost sites to be 44 percent, while mean canopy cover around foraging sites was 54 percent. Similarly Dixon (1995b) reported mean canopy cover at roost sites to be 57 percent and described foraging stands to be multi-

storied with an average canopy cover of 65 percent. Including the Medium Tree Canopy Cover class would represent this higher range of canopy cover use for roost and forage habitat within the model, as this canopy cover class could still provide the open-canopied structure preferred by this species.

Inclusion of anything higher than the Medium Tree Canopy Class would likely substantially overestimate source habitat for this species because large blocks of modeled habitat with more than 45 percent canopy cover wouldn't necessarily contain the important openings and lower tree densities associated with nesting habitat.

Table K-2-63 shows the crosswalk between parameters found in the literature and the new tree canopy cover class breakouts.

Selecting forested stands in the Low (10-19%), Low-Medium (20-29%), and Medium (30-44%) Canopy Cover classes is recommended for modeling white-headed woodpecker source habitat.

Table K-2-63 Table Showing Crosswalk Between Parameters Found in the Literature and New Tree Canopy Cover Class Parameters

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Frederick, Glen P. and Teresa L. Moore. 1991. Distribution and habitat of white-headed woodpeckers (*Picoides albolarvatus*) in west-central Idaho. Idaho Dept. Fish and Game, Boise. 32pp. (Idaho)	Located 6 nest sites. Did not nest in stands with **>26%** CC. Table 5. Characteristics of habitats surrounding nest sites: sampled using five 0.04 ha subplots located within a 3.1 ha (7.7 ac.) area and centered on whwo nest sites = average for 6 study sites was **27% ± 7** Conducted line transects through study area (where observations were recorded from) with sampling points spaced 160m apart. Veg data was taken at sampling points. Mean canopy "closure" on transects with unsolicited responses was **56%** for all 6 study sites	Low (10-19%) Low-Medium (20-29%) Medium (30-44%)
Blair, Steve and Greg Servheen. 1995. A Species Conservation Assessment and Strategy for White-Headed	Recommendations for Management based on literature and species expert review: target canopy between **20 and 26%.**	Low (10-19%) Low-Medium (20-29%)

Parameter Reference in Literature	Parameter Descriptions	Crosswalk Between Parameter in Literature and New TSC Breakouts
Woodpecker (*Picoides albolarvatus*) *draft February 1995.* Idaho Dept. of Fish and Game, Boise, 21pp. (Idaho)		
Dixon, R.D. 1995a. Density, nest-site and roost-site characteristics, home-range, habitat-use, and behavior of White-headed Woodpeckers: Deschutes and Winema National Forests, Oregon. Oregon Dept. Fish and Wildl.	Mean canopy closure was **24 ± 4% at nests** (n=16) and **44 ± 2% at roosts.** Mean canopy "closure" at foraging sites was **54% ± 1**. Mean canopy closure around these sites was **57% ± 0.6**.	Low (10-19%) Low-Medium (20-29%) Medium (30-44%) Medium-High (45-59)
Nongame Rep. 93-3-01. (Oregon)		
Dixon, R.D. 1995b. Ecology of White-headed Woodpeckers in the Central Oregon Cascades. Master's thesis, Univ. of Idaho, Moscow. (Oregon)	The majority (40) of nests and all roosts were in ponderosa pine forest types with **57%** canopy closure (p. 23). Canopy closure at nest sites averaged **41 ± 4%** (p. 38). Canopy closure at roost trees averaged **57.4 ± 2%** (p. 41). In foraging section of thesis, stands used for foraging were typically multi-storied with average canopy closure of **65%**(p. 131 and 141).	Medium (30-44%) Medium-High (45-59)
Lorenz, T. J., K. T. Vierling, J. M. Kozma, J. E. Millard, and <. G. Raphael. 2015. Space Use by White-Headed Woodpeckers and Selection for Recent Forest Disturbances. The Journal of Wildlife Management 79(8):1286-1297. DOI: 10.1002/jwmg.957 (Central Washington)	Home Ranges in this study had 42.86% ± 11.83 canopy cover during nesting season, and 42.08 ± 13.83 in post-nesting season	Medium (30-44%)

Updated Forest Modeling Parameters for White-headed Woodpecker Source Habitat

The updated mid-scale habitat parameters for the white-headed woodpecker are as follows:

PVGs: 1, 2, 3, 5, and 6

Tree Size Class: Large and Very Large

Canopy Cover Class: Low, Low-Medium, and Medium

New Literature Sources

Below is a list of all new literature reviewed for this 2019 white-headed woodpecker (WHWO) mid-scale model update, including those references that did not provide relevant habitat information regarding tree size class or canopy cover class parameters. This list was compiled to both inform the next literature review and/or model update of what references were reviewed and to document the entire 2016 literature review process.

Reference – Garrett, Kimball L., Martin G. Raphael and Rita D. Dixon. (1996). White-headed Woodpecker (*Picoides albolarvatus*), The Birds of North America (P. G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/Species- Account/bna/species/whhwoo DOI: 10.2173/bna.252. Accessed September 2016.

The species account had not been updated since 1996, implying that no significant developments in research on the species' natural history or habitat requirements have occurred.

Reference - Hollenbeck, J. P., V. A. Saab, and R. W. Frenzel. 2011. Habitat suitability and nest survival of White-headed Woodpeckers in unburned forests of central Oregon. Journal of Wildlife Management. 75:1061–1071.

This work compared multiple habitat suitability models in an effort to evaluate habitat suitability and nest survival for breeding WHWO. Key finding was that a mix of low and high canopy cover of ponderosa pine was important for nest suitability. Can be used as a predictive model for land managers. Didn't go into specifics of habitat characteristics for the species though.

Reference – Kozma, J. M. 2011. Composition of forest stands used by Whiteheaded Woodpeckers for nesting in Washington. Western North American Naturalist 71:1–9.

This study examined the composition of ponderosa pine forests that had a history of management and fire that were being used by nesting WHWO. Mean dbh of PP was 13" dbh and ranged from 10.3" to 19.8" dbh. Important to note that tree densities were up to 5.3 times greater than what's typically found in the literature for areas pre-fire suppression. Take-away from this study is that WHWO may be more adaptable to using smaller diameter PP (and DF) than previously thought. However, it still doesn't change the preferred stand parameters that we are using to model source habitat; it just shows that they can tolerate, and even reproduce successfully, within lesser quality habitat). Another important point of this study was that there were some large diameter PP and DF in the overstory that were still contributing to large snag recruitment. The author highlighted the importance of land managers to retain these large live and dead PP and DF on the landscape to retain nesting opportunities for WHWO and to reduce competition with other cavity excavators.

Reference – Kozma, J. M. 2012. Nest-site characteristics of three woodpecker species in managed ponderosa pine forests of the eastern Cascade Range. Northwestern Naturalist 93:111–119.

This study compared use of nesting substrate in three woodpecker species, flicker, WHWO, and hairy woodpecker, in managed stands. The report offered up some good comparisons between the species' preferences. Didn't offer any specifics about canopy cover class but did report tree size characteristics for the study (see Crossover Table 2). Made some general recommendation for snag retention but didn't quantify anything.

Reference – Kozma, J. M., and A. J. Kroll. 2012. Woodpecker nest survival in burned and unburned managed ponderosa pine forests of the northwestern United States. Condor 114:1–13.

This study expands on Kozma's other studies using this same study area, with the same site characteristics as documented in previous papers. This paper was more about nest survival rates and not habitat, which was the focus on the first of this author's papers (Kozma 2011). Something of note from this paper though was that WHWO nest survival was negatively associated with shrub cover, as nest predator (chipmunks, squirrels) populations increased with increases in shrub cover. It also mentioned that nest survival for this area was comparable to other sites in the literature, but then followed that up with suggesting that their study site was acting as a sink. This is pertinent to this update because the other Kozma studies (2011 and 2012 listed above) showed use of stands with somewhat smaller mean dbh preferences that dipped into the Medium TSC, potentially because that's what was available due to substantial management within this study area.

Reference – Latif, Q. S., V. A. Saab, K. Mellen-McLean, and J. G. Dudley. 2015. Evaluating Habitat Suitability Models for Nesting White-Headed Woodpeckers in Unburned Forest. The Journal of Wildlife Management 79(2):263-273; 2015; DOI: 10.1002/jwmg.842.

This study refined and evaluated presence-only habitat suitability models for nesting white-headed woodpeckers. They developed (2) models from nest location datasets from eastside of the Cascade Mtn. Range in Oregon, (1) from 1997-2004 and 2010-2011. Consistent with known ecology of WHWO, both HSI models related positively with percent Ponderosa pine, moderate levels of canopy cover (approx. 40%) and moderate-to-high levels of heterogeneity in forest structure.

Reference – Linden, Daniel W. and Gary J. Roloff. 2015. Improving inferences from short-term ecological studies with Bayesian hierarchical modeling: white-headed woodpeckers in managed forests. Ecology and Evolution. 5(16): 3378-3388.

This was another paper on predictive modeling for nesting WHWOs within a highly managed landscape. Again, there were no quantitative habitat parameters to take away from this work, but their results did support snag retention within harvest units of >2 snags/ha (for snags greater than 25 cm dbh), as stands that retained snags at this rate had relatively high nest persistence probabilities.

Reference – Lorenz, T. J., K. T. Vierling, J. M. Kozma, J. E. Millard, and <. G. Raphael. 2015. Space Use by White-Headed Woodpeckers and Selection for Recent Forest Disturbances. The Journal of Wildlife Management 79(8):1286-1297. DOI: 10.1002/jwmg.957

This study in Central Washington documented selection by nesting WHWOs for forested patches that had undergone some type of disturbance when setting up their home ranges. Disturbed could mean burned, diseased and dying stands, or thinned stands. Burns were mixed severity and averaged 4.8 ha (12 acres). They suggested that this behavior was in response to limited nest site availability within unburned portions of their home ranges, as much of existing standing dead in the study area was likely too hard for excavation by WHWOs.

One important finding was that large home ranges do not always signify bad habitat for this species, which is a commonly used relationship with most terrestrial species.

Also, WHWOs can occur and successfully breed in areas with little to no “old growth” habitat. Suggested that mixed-severity prescribed fire could be an important tool for creating WHWO habitat.

The tables and data were hard to decipher because of the complicated model vernacular, but a takeaway parameter was:

- Used Home Ranges had 42.86% ± 11.83 canopy cover during nesting season, and 42.08 ± 13.83 in post-nesting season.

Reference – Mellen-McLean, Kim, Barbara Wales, and Barbara Bresson. 2013. A conservation assessment for the white-headed woodpecker (*Picoides albolarvatus*). USDA Forest Service, Region 6, and USDI Bureau of Land Management, OR and WA. 48 p.

This is a very thorough conservation assessment. While the document does not provide any new research or other new information regarding species biology, ecology, and habitat use by itself, it does nicely summarize existing data and research up to the most current available. Especially useful are the tables that summarize nesting habitat parameters by reference.

Reference - Wightman, C. S., V. A. Saab, C. Forristal, K. Mellen-Mclean, and A. Markus. 2010. White- headed Woodpecker nesting ecology after wildfire. Journal of Wildlife Management 74:1098–1106.

This study developed predictive models for WHWO nesting habitat in post-fire habitat in south-central Oregon based on 45 WHWO nest locations. The study found that open-canopied PP forests pre-fire and mosaic burn severities post-fire characterized habitat 1 km surrounding nests in the study area. Also, habitats with large, more decayed snags and fewer live trees characterized habitat within 1 ha of the nest site. However, neither of these habitat features influenced nest survival. Models indicated that open canopies with mature, cone-producing trees remain important for WHWO after wildfire, which is consistent with the literature. A mosaic of burn severities may improve habitat by opening up canopies while retaining decayed snags, in areas adjacent to unburned areas that provide live cone-producing trees. Therefore, managing for habitats that will burn with mixed severity is ideal.

Authors recommended opening forest canopy within stands containing medium and larger diameter (>23 cm [9 inch]) mature trees and snags and retaining large snags that were there before the fire as these snags are softer and will be more valuable to WHWO in early years following the fire.

K-3: Additional Information for Impacted Species and Life Histories for Special Status Species

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WILDLIFE – APPENDIX K-3 ADDITIONAL INFORMATION FOR IMPACTED SPECIES AND LIFE HISTORIES FOR SPECIAL STATUS SPECIES

1.1 Introduction

This appendix to the Wildlife section of the Draft Environmental Impact Statement (EIS) provides additional information about wildlife species that may be affected by the Midas Gold Idaho, Inc., (Midas Gold) Stibnite Gold Project. It also includes life histories for the threatened, endangered, proposed, candidate, sensitive, or management indicator species discussed in the Draft EIS.

1.2 Threatened, Endangered, Proposed, and Candidate Species

This section contains additional information about the threatened, endangered, proposed, and candidate species presented and analyzed in Section 3.13, Wildlife, of the Draft EIS. All information about the Northern Idaho ground squirrel is addressed in the EIS.

1.2.1 Canada Lynx

There are 16 records of Canada lynx (*Lynx canadensis*) in the Payette National Forest (PNF) in the Idaho Fish and Wildlife Information System database through 2017. Eight are potential sightings, one record is of a tagged pelt, and seven are records of tracks observed. Ten of these records were digitized from a report titled *Canada Lynx in Idaho: Past, Present and Future* (Terra-Berns et al. 1998). Many of the records are documented as anecdotal, incomplete, or have not been verified. The most complete and verifiable records of lynx comprise a sighting in 1957 in the headwaters of the Little Salmon River (Lewis and Wenger 1998; Strobilus Environmental 2017) and a pelt (trapped) in Fall Creek in 1964. Further review found that the 1957 sighting, verified by the Idaho Department of Fish and Game (IDFG), occurred in the Mill Creek–Council Mountain area of the PNF West Zone, which is west of Lake Cascade. The last documented occurrence of Canada lynx in the Cascade Ranger District and nearest sighting to the Project area was a trapped individual near Warm Lake in 1978 (United States Forest Service [Forest Service] 2018; Terra-Berns et al. 1998), which is approximately 25 miles southwest of the mine site and adjacent to the access route. Lynx also have been observed approximately 35 miles north of the Project area in the Frank Church-River of No Return Wilderness (Forest Service 2015). Canada lynx were recorded in the Disappointment-Little Squaw, Chamberlain, Cabin Canyon, and Upper North Fork Payette Lynx Analysis Units (LAUs; Forest Service 2008); none were recorded in LAUs in the Canada lynx analysis area.

The Natural Resource Manager (NRM) WILDLIFE database maintains observations and survey records for the Forest Service, which contains five records for lynx through 2017. Only one record in NRM is complete and verifiable: a sighting in 2012 near Price Valley in the vicinity of the Wesley Fire, which is located northwest of McCall. Of the remaining four sightings, there are two in the Wilderness (Chamberlain, East Zone) and two between Ladder and Mann Creeks (i.e., Cuprum, West Zone). Recent surveys (2010-2017), associated with winter carnivore studies on the PNF, included baited camera hair-snare and monitoring stations located in suitable habitat cells across the Forest. During a winter carnivore survey for Canada lynx, wolverine (*Gulo gulo*), and fisher (*Martes pennanti*) in February and March of 2013 (Strobilus Environmental 2017), Garcia and Associates placed 27 survey sets and one motion-sensor game camera-only site in the Canada lynx analysis area. Although most stations were set up to assess for wolverine occupancy, several stations also included components to measure potential lynx presence. The cameras did not capture photographs of lynx and did not obtain lynx hair samples. Surveyors also did not observe lynx tracks during placement, servicing, or removal of the camera stations. No lynx were detected during additional winter carnivore surveys conducted in the Stibnite, Lower East Fork of the South Fork of the Salmon River (EFSFSR), and Upper Big Creek LAUs in 2013-2014.

1.2.2 Wolverine

Wolverines were photographed at four camera bait stations in the wolverine analysis area during February and March of 2013 (Strobilus Environmental 2017). It is not known how many individuals were photographed, as it is difficult to use photographs to identify individuals. Hair samples also were obtained at four gun-brush snags; DNA analysis of two hair samples indicated one male and one female wolverine during the survey, occurring roughly 7 miles apart. Though wolverines typically breed from April to October (NatureServe 2017), well outside of the survey observation dates, the presence of a male and female could indicate breeding in the wolverine analysis area. Several wolverine track sets also were observed during placement and servicing of the camera stations. Midas Gold staff observed individual wolverines in the wolverine analysis area along Stibnite Road (National Forest Service Road 50412) near the EFSFSR on May 22, 2015, and October 20, 2016. Two male wolverines also were photographed, and their DNA was analyzed by Garcia and Associates (2014) in January through March of 2014; one male, which had been observed in the prior year’s survey (Garcia and Associates 2013), and another new male.

Survey results from a cooperative agreement between IDFG, the PNF, and the Boise National Forest (BNF) confirmed six individual wolverines, with four known from previous monitoring, in the McCall/Warm Lake survey area in the PNF and BNF in the spring of 2016 (IDFG 2016, CCS 16-CS-11041200-006). It was suspected at that time that additional wolverines were using the general area. The wolverine analysis area is located in Tier 1 Wolverine Priority Conservation Areas (specifically #24 and #25; IDFG 2014b).

In 2017, the PNF and BNF participated in the Western States Wolverine Conservation Project (WSWCP). The WSWCP was set up as a four-state (Idaho, Montana, Washington, and Wyoming) project intended to establish a baseline of wolverine occurrence (probability of occupancy) across the four-state area known to be occupied by wolverines. The goal of the project was to assess future changes in occupancy that may be a result of influences of conservation actions, environmental change, or anthropogenic disturbance. Eight camera stations were set up in the PNF and BNF during the 2016/2017 field season. Results, including genetic sampling, from the WSWCP confirmed three separate wolverines in the Landmark/Yellow Pine/Stibnite area: one male and two females. The male (M4-Mason) was first captured and released in January 2011. Multiple detections over seven winters demonstrate that he occupies an area between Landmark Summit and Yellow Pine. A minimum of one female and one additional male have been detected in the same area contemporaneously with M4. Genetic analyses show M4 to have a possible parent/offspring relationship with wolverines detected as far east as Stanley. Female F5 has been known since January 2011 through April 2017. Landmark Summit marks the northern extent of her home range.

1.3 General Wildlife Species

Numerous general wildlife species (game and non-game species) are known or assumed to occur in the general Project area (Table 2 below). While sensitive species and general wildlife species are discussed in Section 3.13, additional information about some of these species and others is presented below.

Of the general wildlife species, Midas Gold staff and consultants have documented incidental sightings (unverified) of black bear (*Ursus americanus*), gray wolf (*Canus lupus*), moose (*Alces americanus*), and mountain lion (*Puma concolor*) in the general wildlife analysis area during exploration activities (Table 1). Additional information regarding these species is provided below.

Table 1 Large Mammal Observations in Project Area

Species (Common Name)	Number of Individuals	Location	Date
Black bear	1 immature	Stibnite Road	August 18, 2015
Black bear	1 adult	Stibnite Road	August 19, 2015
Black bear	1 adult	Stibnite Road	August 27, 2015
Gray wolf	1 adult	Stibnite Road	April 24, 2014
Gray wolf	4 adults	Soda pile	July 25, 2014
Gray wolf	1 adult	Stibnite airstrip	June 26, 2015
Gray wolf	2 adults	Airstrip at Hangar Flats	June 26, 2016
Gray wolf	1 adult	West End Pit	July 11, 2016
Moose	1 adult, 1 calf	Stibnite Road	May 3, 2015
Moose	1 adult	Stibnite Road	June 20, 2015
Moose	1 adult	Stibnite Road	February 14, 2017
Mountain lion	1 adult, 2 cubs	Stibnite Road	October 16, 2016

Table Source: Strobilus Environmental 2017

Gray wolf. The gray wolf is a Region 4 sensitive species. The general wildlife analysis area is within the McCall-Weiser wolf management zone.

Black bear. Black bear typically occupy riparian habitats and mixed conifer-hardwood forests with fallen logs and standing snag trees. They primarily den under fallen trees or within tree cavities. Due to wildfires, there is a large amount of tree snags and downed logs in the general wildlife analysis area that could serve as potential denning habitat. They are known to occur within the general wildlife analysis area; multiple black bears have been observed by Midas Gold staff and consultants, primarily along roadsides and in riparian areas of the EFSFSR. Home ranges in Idaho range from 1,660 to 13,030 hectares (NatureServe 2017). Portions of the general wildlife analysis area are within legal black bear hunting units.

Moose. Moose are the largest members of the deer family, and their population is secure in Idaho (NatureServe 2017). Like elk, they may make short elevational migrations between summer and winter ranges depending on depth of snow (NatureServe 2017). Moose require waterbodies for foraging in summer; summer habitat includes riparian areas, forested wetlands, shrub thickets, and bogs. Winter habitat usually includes mixed hardwood-conifer forests and old growth forests for thermal cover. Several moose have been observed within the general wildlife analysis area, mainly along roadsides during winter or crossing the road near riparian areas of the EFSFSR. Portions of the general wildlife analysis area are within legal moose hunting units.

Mountain lion. Mountain lion, also called pumas or cougars, have been observed within the general wildlife analysis area by Midas Gold staff. They have been seen along roadsides and near riparian areas of the EFSFSR. They are unlikely to den within the general wildlife analysis area due to lack of suitable terrain, but they probably hunt on the property. The property is in the McCall and Warren mountain lion data analysis units. Portions of the general wildlife analysis area are within legal mountain lion hunting units.

1.4 Big Game Species

Big game species (as defined by PNF and BNF Forest Plans) that are expected to be present and have habitat within the Project area include Rocky Mountain elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*Odocoileus virginianus*). Additional information regarding these species is provided in Section 3.13 of the Draft EIS.

Rocky Mountain elk. Rocky Mountain elk are found year-round within the Project area and use a variety of habitats. Some basic habitat components, such as the availability of food and water, are important throughout the year, and others are seasonally important. During temperature extremes, thermal cover or vegetation modifying the effects of temperature may be important. Habitats located on gentle terrain and providing a mix of lush vegetation and adjacent cover are important during the calving period. Elk also use wallow areas (typically wet meadows, stream headwater areas, and seepage areas) prior to and during the autumn breeding season. Damp soils near wallows also may contain an abundance of natural minerals and may serve as lick sites for elk in the spring and summer months. Security areas (i.e., dense vegetation and screening cover) become increasingly important during the hunting season, providing some escape from the pressures and stress of hunting season (Forest Service 2017c). Mixed aspen-conifer stands are important for calving and security cover (IDFG 2014), although there is little aspen forest in the general wildlife analysis area. Rowland et al. (2005) analyzed several research papers on elk security cover and found that in Montana, elk security areas should be at least 250 acres in size and located more than 0.5 mile away from roadways to provide a reasonable level of survival.

Food habits of elk are variable and depend on the plant species available in the habitat they are occupying. Forage preferences vary between seasons and years and appear to be strongly related to availability and phenology of plants, both of which are influenced by weather conditions. When both grasses and shrubs are available, elk usually prefer grasses. When grasses are not available, shrubs are used, and conifers and arboreal lichens may be consumed on forested winter ranges during deep snow periods. Grass comprises a high component of spring and summer diets following green-up. As grasses dry and mature, elk use shifts to forbs and woody plants. In the PNF, vegetative communities that could provide potential habitat conditions include all forest, woodland, and non-forested vegetation types (Forest Service 2017c).

Mule deer. Key forage species for mule deer are provided by early-seral plant communities where a variety of forage is available to meet energy demands throughout the year. The window of forage production typically follows a disturbance event (e.g., logging, fire, grazing, and insect/disease) by 3 to 10 years. Mule deer are primarily browsers, feeding on leaves, stems, and shoots of woody plants throughout the year. They are frequently viewed as a shrub-dependent species; however, shrub habitats do not provide the full spectrum of plants needed to support the species. Forbs and grasses are sought out during the spring green-up, a period when winter-stressed deer need good forage as soon as possible (Forest Service 2017c).

White-tailed deer. White-tailed deer are a big game species of low population densities in the PNF. White-tailed deer are habitat generalists and are expected to occur in the general wildlife analysis area as they have suitable habitat. Key forage for white-tailed deer is provided by early-seral plant communities where a variety of forage is available to meet the energy demands throughout the year. White-tailed deer are primarily browsers feeding on leaves, stems, and shoots of woody plants throughout the year; however, forbs and grasses are consumed during the spring green-up. Portions of the general wildlife analysis area are within legal white-tailed deer hunting units. The general wildlife analysis area is located in Big Game Management Units 24 and 25.

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Table 2 General Wildlife Species Potentially Present in the General Wildlife Analysis Area

MAMMALS				REPTILES		AMPHIBIANS	
Scientific Name	Common Name	Scientific Name	Common Name	Scientific Name	Common Name	Scientific Name	Common Name
Antrozous pallidus	Pallid bat	*Myotis volans*	Long-legged myotis	*Charina bottae*	Rubber boa	*Ambystoma macrodactylum*	Long-toed salamander
Callospermophilus lateralis	Golden-mantled ground squirrel	*Myotis yumanensis*	Yuma myotis	*Crotalus viridis*	Prairie rattlesnake	*Anaxyrus boreas*	Western toad
Eptesicus fuscus	Big brown bat	*Neotoma cinerea*	Bushy-tailed wood rat	*Pituophis catenifer*	Gopher snake	*Ascaphus montanus*	Rocky Mountain tailed frog
Erethizon dorsatum	Porcupine	*Ochotona princeps*	American pika	*Plestiodon skiltonianus*	Western skink	*Dicamptodon aterrimus*	Idaho giant salamander
Glaucomys sabrinus	Flying squirrel	*Ondatra zibethicus*	Muskrat	*Thamnophis elegans*	Terrestrial garter snake	*Pseudacris maculata*	Boreal chorus frog
Lasionycteris noctivagans	Silver-haired bat	*Peromyscus maniculatus*	Deer mouse	*Thamnophis sirtalis*	Common garter snake		
Lasiurus cinereus	Hoary bat	*Phenacomys intermedius*	Heather vole				
Lepus americanus	Snowshoe hare	*Procyon lotor*	Raccoon				
Lepus townsendii	White-tailed jackrabbit	*Sorex monticolus*	Dusky shrew				
Lontra canadensis	River otter	*Sorex vagrans*	Vagrant shrew				
Marmota flaviventris	Yellow-bellied marmot	*Spilogale gracilis*	Western spotted skunk				
Martes americana	American marten	*Sylvilagus nuttallii*	Mountain cottontail				
Mephitis mephitis	Striped skunk	*Tamias amoenus*	Yellow-pine chipmunk				
Microtus longicaudus	Long-tailed vole	*Tamiascurus hudsonicus*	Red squirrel				
Microtus montanus	Montane vole	*Taxidea taxus*	American badger				
Myodes gapperi	Southern red-backed vole	*Thomomys talpoides*	Northern pocket gopher				
Myotis evotis	Long-eared myotis	*Urocitellus columbianus*	Columbian ground squirrel				
Myotis lucifugus	Little brown bat	*Vulpes vulpes*	Red fox				
Myotis thysanodes	Fringed myotis	*Zapus princeps*	Western jumping mouse				

BIRDS							
Scientific Name	Common Name	Scientific Name	Common Name	Scientific Name	Common Name	Scientific Name	Common Name
Accipiter cooperii	Cooper's hawk	*Colaptes auratus*	Northern flicker	*Melospiza melodia*	Song sparrow	*Setophaga petechia*	Yellow warbler
Accipiter striatus	Sharp-shinned hawk	*Columba livia*	Rock dove	*Myadesites townsendi*	Townsend's solitaire	*Setophaga townsendi*	Townsend's warbler
Aegolius acadicus	Northern saw-whet owl	*Contopus cooperi*	Olive-sided flycatcher	*Nucifraga columbiana*	Clark's nutcracker	*Sialia currucoides*	Mountain bluebird
Aeronautes saxatalis	White-throated swift	*Contopus sordidulus*	Western wood-pewee	*Oporornis agilis*	Connecticut warbler	*Sialia mexicana*	Western bluebird
Anas crecca	Green-winged teal	*Corvus corax*	Common raven	*Oreothlypis celata*	Orange-crowned warbler	*Sitta canadensis*	Red-breasted nuthatch
Anas discors	Blue-winged teal	*Cyanocitta stelleri*	Steller's jay	*Oreothlypis ruficapilla*	Nashville warbler	*Sitta carolinensis*	White-breasted nuthatch
Anas platyrhynchos	Mallard	*Dendragapus obscurus*	Dusky grouse	*Passerella iliaca*	Fox sparrow	*Sitta pygmaea*	Pygmy nuthatch
Anas strepera	Gadwall	*Empidonax hammondii*	Hammond's flycatcher	*Perisoreus canadensis*	Gray jay	*Sphyrapicus nuchalis*	Red-naped sapsucker
Asio flammeus	Short-eared owl	*Empidonax oberholseri*	Dusky flycatcher	*Pheucticus melanocephalus*	Black-headed grosbeak	*Sphyrapicus thyroideus*	Williamson's sapsucker
Asio otus	Long-eared owl	*Empidonax occidentalis*	Cordilleran flycatcher	*Picoides arcticus*	Black-backed woodpecker	*Spinus pinus*	Pine siskin
Bombycilla cedrorum	Cedar waxwing	*Empidonax traillii*	Willow flycatcher	*Picoides pubescens*	Downy woodpecker	*Spinus tristis*	American goldfinch
Bonasa umbellus	Ruffed grouse	*Falcipennis canadensis*	Spruce grouse	*Picoides villosus*	Hairy woodpecker	*Spizella breweri*	Brewer's sparrow
Bubo virginianus	Great horned owl	*Glaucidium gnoma*	Northern pygmy-owl	*Pinicola enucleator*	Pine grosbeak	*Spizella passerina*	Chipping sparrow
Buteo jamaicensis	Red-tailed hawk	*Haemorhous cassinii*	Cassin's finch	*Pipilo maculatus*	Spotted towhee	*Strix varia*	Barred owl
Cathartes aura	Turkey vulture	*Ixoreus naevius*	Varied thrush	*Piranga ludoviciana*	Western tanager	*Tachycineta bicolor*	Tree swallow
Catharus fuscescens	Veery	*Junco hyemalis*	Dark-eyed junco	*Poecile atricapillus*	Black-capped chickadee	*Tachycineta thalassina*	Violet-green swallow
Catharus guttatus	Hermit thrush	*Loxia curvirostra*	Red crossbill	*Poecile gambeli*	Mountain chickadee	*Troglodytes aedon*	House wren
Catharus ustulatus	Swainson's thrush	*Loxia leucoptera*	White-winged crossbill	*Regulus calendula*	Ruby-crowned kinglet	*Turdus migratorius*	American robin
Certhia americana	Brown creeper	*Megaceryle alcyon*	Belted kingfisher	*Regulus satrapa*	Golden-crowned kinglet	*Vireo cassinii*	Cassin's vireo
Chaetura vauxi	Vaux's swift	*Megascops kennicottii*	Western screech-owl	*Selasphorus calliope*	Calliope hummingbird	*Vireo gilvus*	Warbling vireo
Chordeiles minor	Common nighthawk	*Melanerpes lewis*	Lewis's woodpecker	*Selasphorus rufus*	Rufous hummingbird	*Vireo olivaceus*	Red-eyed vireo
Cinclus mexicanus	American dipper	*Meleagris gallopavo*	Wild turkey	*Setophaga coronata*	Yellow-rumped warbler	*Zonotrichia leucophrys*	White-crowned sparrow
Coccothraustes vespertinus	Evening grosbeak	*Melospiza lincolnii*	Lincoln's sparrow				

Source: IDFG 2017a

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1.5 Life History and Habitat Descriptions

The species in Table 3 are listed by the PNF and BNF as threatened (T), endangered (E), proposed (P), Regional Forester's Sensitive Species (S); Management Indicator Species (MIS); or Big Game (BG).

Table 3 Listed and Sensitive Wildlife Species in Project Area

Scientific Name	Common Name	Status on PNF	Status on BNF	Source Habitat Family	Analyzed in EIS
Picoides albolarvatus	White-headed woodpecker	S/MIS	S/MIS	Family 1 – Low Elevation Old Forest	Yes
Picoides tridactylus	American three-toed woodpecker	S	S	Family 2 – Broad Elevation Old Forest	Yes
Aegolius funereus	Boreal owl	S	S	Family 2 – Broad Elevation Old Forest	Yes
Martes pennanti	Fisher	S	S	Family 2 – Broad Elevation Old Forest	Yes
Otis flammeolus	Flammulated owl	S	S	Family 2 – Broad Elevation Old Forest	Yes
Strix nebulosa	Great gray owl	S	S	Family 2 – Broad Elevation Old Forest	Yes
Accpiter gentilis	Northern goshawk	S	S	Family 2 – Broad Elevation Old Forest	Yes
Dryocopus pileatus	Pileated woodpecker	MIS	MIS	Family 2 – Broad Elevation Old Forest	Yes
Picoides arcticus	Black-backed woodpecker	N/A	MIS	Family 2 – Broad Elevation Old Forest	Yes
Lynx canadensis	Canada lynx	T	T	Family 3 – Forest Mosaic	Yes
Oreortyx pictus	Mountain quail	S	S	Family 3 – Forest Mosaic	Yes
Gulo gulo	Wolverine	PT	PT	Family 3 – Forest Mosaic	Yes
Passerina amoena	Lazuli bunting	N/A	N/A	Family 4 – Early-seral Montane and Lower Montane	Not in Project area
Canis lupus	Gray wolf	S	S	Family 5 – Forest and Range Mosaic	Yes
Falco peregrinus	Peregrine falcon	S	S	Family 5 – Forest and Range Mosaic	Not in Project area
Ovis canadensis	Rocky Mountain bighorn sheep	S	S	Family 5 – Forest and Range Mosaic	Yes
Cervus canadensis	Rocky Mountain elk	BG	Listed / no designation	Family 5 – Forest and Range Mosaic	Yes
Odocoileus hemionus	Mule deer	BG	Listed / no designation	Family 5 – Forest and Range Mosaic	Yes

Scientific Name	Common Name	Status on PNF	Status on BNF	Source Habitat Family	Analyzed in EIS
Euderma maculatum	Spotted bat	S	S	Family 7 – Forests, Woodlands, and Sagebrush	Yes
Corynorhinus townsendii	Townsend's big-eared bat	S	S	Family 7 – Forests, Woodlands, and Sagebrush	Yes
Sialia mexicana	Western bluebird	N/A	N/A	Family 8 – Rangeland and Early- and Late-Seral Forest	Not in Project area
Centrocercus urophasianus	Greater sage grouse	S	S	Family 11 – Sagebrush	Not in Project area
Urocitellus brunneus	Northern Idaho ground squirrel	T	T	Family 12 – Grassland and Open-canopy Sagebrush	Yes
Urocitellus endemicus	Southern Idaho ground squirrel	S	S	Family 12 – Grassland and Open-canopy Sagebrush	Not in Project area
Tympanuchus phasianellus	Columbian sharp-tailed grouse	S	S	Family 12 – Grassland and Open-canopy Sagebrush	Not in Project area
Haliaeetus leucocephalus	Bald eagle	S	S	Family 13 – Riverine Riparian and Wetland	Yes
Rana luteiventris	Columbia spotted frog	S	S	Family 13 – Riverine Riparian and Wetland	Yes
Coccyzus americanus	Yellow-billed cuckoo	T	T	Family 13 – Riverine Riparian and Wetland	Not in Project area
Histrionicus histrionicus	Harlequin duck	S	N/A	Family 13 – Riverine Riparian and Wetland	Yes
Gavia immer	Common loon	S	S	Family 14 – Non-riverine Riparian and Wetland	Not in Project area

The life histories and habitat descriptions for each species are organized by Source Habitat Family in the following subsections.

1.5.1 Family 1 – Low Elevation Old Forest

Species within Family 1 depend on late-seral multi- and single-storied lower montane forests as source habitat and require large diameter ($\geq$21 inches diameter at breast height [dbh]) snags or trees with cavities for nesting or foraging (Wisdom et al. 2000). Habitat is generally depicted as relatively homogeneous patches of predominantly large trees in lower canopy cover conditions dominated by ponderosa pine (Forest Service 2010, Appendix E). Family 1 source habitat occurs in potential vegetation groups (PVGs) 1, 2, and 5 and those drier habitat types of

PVGs 3 and 6 where ponderosa pine is a major seral species (Nutt et al. 2010). Historically, these types were maintained in a relatively open condition by frequent, nonlethal fire.

1.5.1.1 White-headed Woodpecker (Sensitive/Management Indicator Species)

In Idaho, white-headed woodpeckers are found mainly in open and mature ponderosa pine and mixed ponderosa pine/Douglas-fir forests (Moore and Frederick 1991, Wisdom et al. 2000). A strong correlation exists between white-headed woodpecker presence and large diameter (≥20 inches dbh) live and dead ponderosa pines (i.e., snags) (Blair and Servheen 1995; Dixon 1995a, 1995b, 1998; Moore and Frederick 1991). Densities of white-headed woodpeckers have been shown to increase as old forest ponderosa pine habitat increases (Dixon 1995b). Important source habitat components are an abundance of large diameter ponderosa pine trees with prolific seed production, a relatively open canopy, and availability of snags for nest cavities (Garrett et al. 1996).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 1, 2, 3, 5, and 6 (Nutt et al. 2010). While the drier habitat types in PVGs 3 and 6 can develop cover types with ponderosa pine in the larger size classes and open canopies, these conditions are not found as commonly as in PVGs 1, 2, and 5. Large diameter snags are an essential habitat feature for white-headed woodpecker.

White-headed woodpecker large tree and old forest source habitat patches should be relatively homogenous with inclusions of smaller tree size classes generally <1 acre in nonlethal fire regimes or inclusions ranging from 1 to 600 acres in mixed1 fire regimes. The amount of area required to support white-headed woodpeckers in fragmented landscape patches is larger than in landscapes with contiguous habitat patches (Dixon 1995a). Median sizes of home ranges in fragmented mixed-conifer habitat have been documented as 845 acres, compared with 523 acres in contiguous ponderosa pine habitat (ibid).

Risks to the species include changes in ecological processes; the loss of live and dead large diameter (>20 inches dbh) ponderosa pine trees and snags; and high road densities. Changes in ecological processes through fire suppression and forest fragmentation of late-seral or old forest stands has resulted in both direct and indirect loss of habitat. Fire suppression encourages the seral replacement of ponderosa pine forests often by Douglas-fir, leading to dense, closed-canopy forest stands avoided by white-headed woodpeckers. Fire suppression also increases the risk of stand-replacing fires that eliminate source habitat. Large diameter live and dead ponderosa pine tree losses are primarily from regeneration harvest methods, uncharacteristic fires, and snag removal. Timber harvest can also fragment source habitat patches (size, distribution, and juxtaposition), diminishing their value to white-headed woodpeckers and potentially isolating populations (Ritter 2000). Lastly, high road densities facilitate human access into forest stands and increase the risk of losing snags for fuelwood (Wisdom et al. 2000). Often, these roads were constructed to facilitate timber harvest, which may have already reduced the densities of large diameter live and dead ponderosa pine trees in these areas.

1.5.2 Family 2 – Broad Elevation Old Forest

Species in Family 2 use late-seral, multi-, and single-layered stages of the montane community as source habitats (Wisdom et al. 2000). Source habitats for some species also include late-seral stages of the subalpine community or the lower montane community, or both. Source habitat for Family 2 overlaps Family 1 but encompasses a broader array of cover types and elevations than habitats for Family 1 (Wisdom et al. 2000). Family 2 source habitat occurs primarily in PVGs 3 through 11 (Forest Service 2010a, Appendix E), although some species use lower elevation types. Historical fire regimes in Family 2 vary by PVG, but are dominated by mixed severity and lethal regimes (Forest Service 2010a, Appendix A). Many species within Family 2, including pileated woodpeckers and northern goshawks, are able to take advantage of departed conditions (Nutt et al. 2010).

Species that comprise Family 2 tend to be habitat generalists that use a wide range of conditions. Many are associated with both the large and medium tree size class forests in moderate- to high-stand canopy conditions. Some Family 2 species can take advantage of PVGs that exhibit uncharacteristically high tree densities and amounts of shade-tolerant tree species that have resulted from fire suppression and/or past management activities. In contrast to Family 1 species, as forest conditions increase in density and shade-tolerant species become more common throughout the landscape, either from suppression of fire or past vegetation management, the quantity and interconnectedness of Family 2 habitat increases.

Source habitats for Family 2 occur in all watersheds on the Forest (Nutt et al. 2010). While there have been declining source habitat trends for some Family 2 focal species assessed at the scale of the Forest, quantities of source habitat have stayed primarily within the historical range of variability. Declining source habitat trends of individual focal species assessed at the Forest scale are attributed in part to management practices that favored removing larger diameter trees (Nutt et al. 2010). Restoration of fire disturbance regimes, natural and managed development of the large tree size class, and management to retain large diameter snags and coarse woody debris would provide for the maintenance and, as needed, restoration of source habitat conditions.

1.5.2.1 American Three-toed Woodpecker (Sensitive)

American three-toed woodpeckers inhabit mature and overmature stands containing bark beetles, disease, and heart rot (Goggans et al. 1987), and recent stand-replacing burns with abundant woodboring insects (Caton 1996, ; Hutto 1995). Trees with heart rot may be necessary for nest sites (Lester 1980), and the presence of trees affected by insects and diseases is important for a sufficient prey base (Goggans et al. 1987). Foraging has been described on dead trees averaging 9 inches dbh (Bull et al. 1986) and 15.5 inches dbh (Goggans et al. 1989). Although these tree sizes are not the larger diameter classes typically found in late-seral old forests, studies have found that use of these 9- to 15-inch-diameter trees for nesting and foraging is not occurring in mid-seral stands consisting of mostly trees in this size range but rather in late-seral forest where dead and dying trees in the 9- to 15-inch range occur within a matrix of larger, dense trees. Late-seral old forest would be expected to have higher incidences of heart rot or disease or to have the early stages of decay present (Goggans et al. 1989; Bull et al. 1986). Three-toed woodpecker populations typically peak during the first 3 to 5 years after a fire. Home range size for this species is highly variable (Leonard 2001); three radio-tagged birds in central Oregon had home ranges of 131, 363, and 751 acres (Goggans et al. 1987). An average of these documented home range sizes, 415 acres, was used for this analysis.

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 8, 9, 10, and 11 in the medium and large tree size classes and with moderate or high canopy cover (Nutt et al. 2010). PVG 5 can also provide source habitat when outside of the HRV. Mountain pine beetle infestations and/or high intensity fire events are primary recycling agents in these PVGs; both are disturbances associated with three-toed woodpecker habitat and population irruptions. Snags are a special habitat feature for three-toed woodpeckers and provide nesting and foraging opportunities.

1.5.2.2 Boreal Owl (Sensitive)

Source habitat for boreal owls includes old forest and unmanaged young-forest stages of subalpine and montane forests and riparian woodlands (Wisdom et al. 2000). Specific cover types and structural stages that provide source habitat are the old forest, multi-story stages of Engelmann spruce–subalpine fir, Pacific silver fir–mountain hemlock, and aspen and the old forest single- and multi-story stages of interior Douglas-fir, western larch, and lodgepole pine. Unmanaged young-forest stages of all these cover types and of grand fir–white fir also serve as source habitats if suitable large-diameter snags are present. Source habitats typically support abundant lichens and fungal sporocarps, which provide important foods for southern red-backed voles, the principal prey of boreal owls (Hayward 1994). These lichens and fungi are associated with coarse woody debris. Boreal owls are secondary cavity nesters and readily use artificial nest boxes and structures. The nesting period for boreal owl is March through mid-July (Hayward et al. 1993). Home ranges average 3,586 acres in size (Hayward and Hayward 1993).

On the Forests, PVGs 3, 4, 7, 8, 9, and 11 in the medium and large tree size classes and moderate or high canopy cover classes could provide source habitat conditions (Nutt et al. 2010). These types are capable of exhibiting tree species compositions and structural characteristics consistent with descriptions of boreal owl nesting habitat in literature. Snags and down wood, for nest sites and prey habitat, are special habitat features for the boreal owl. In Idaho, occupied forests are generally located above 5,000 feet in elevation.

1.5.2.3 Fisher (Sensitive)

The diverse diet of the fisher probably requires a mix of forest habitat types to provide optimal foraging conditions (Arthur et al. 1989). In the Rocky Mountains, fishers show a preference for late-seral coniferous forests (Jones and Garton 1994). Late-seral forests are used preferentially during summer months while early- or late-seral forests may be used in winter (Jones 1991). In Idaho and Montana, mesic forest habitats at low or mid elevations are important fisher habitat (Heinemeyer 1993; Jones 1991). Deep snow accumulation appears to limit fisher movements and distribution (Arthur et al. 1989; Aubry and Houston 1992; Heinemeyer 1993). Fisher tend to select forested stands with relatively high canopy cover, although tree cover may be discontinuous (Aubry and Houston 1992; Buskirk and Powell 1994). Riparian corridors provide important travel routes and prey patches for fisher. The high canopy cover and structural complexity of riparian habitat support relatively abundant and diverse populations of prey (small mammals and birds). The fisher denning period typically occurs from March through early-to-mid June, during which the kits are moved from the natal to a maternal den site (Powell and Zielinski 1994). Fisher home ranges in Idaho average 20,400 acres for males (range of 7,140–29,500 acres) and 10,100 acres for females (range of 1,260–10,100 acres) (Jones 1991; Heinemeyer 1993).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 3, 6, 8, 9, and 10 in medium and large tree size classes and moderate or high canopy cover classes (Nutt et al. 2010). These PVGs have the capability to develop mesic, old forest, multi-layer conditions with moderate and high canopy closures that would provide for the structural diversity that is characteristic of fisher source habitat. Special habitat features include riparian corridors (travel, prey patches), down logs (resting and den sites), and snags (resting and den sites).

1.5.2.4 Flammulated Owl (Sensitive)

Breeding habitat for flammulated owls combines open, mature montane pine forests for nesting, scattered thickets of saplings or shrubs for roosting and calling, and grassland edge habitat for foraging (IDFG 2005; Reynolds and Linkhart 1987; Goggans 1986), which are all necessary across multiple spatial scales (e.g., microhabitat, home range, landscape) (Wright 1996). In Idaho, flammulated owls were documented occupying mid-elevation, old forest or mature stands of open ponderosa pine, Douglas-fir, or stands codominated by both species (Groves et al. 1997). Old forests of ponderosa pine and Douglas-fir are key components of home ranges for flammulated owl (Reynolds and Linkhart 1992), as these forest types apparently support a particular abundance of favored lepidopteran prey (McCallum 1994). Flammulated owls nest in cavities that have been previously excavated in snags and live, large diameter trees (Bull et al. 1990, McCallum and Gehlback 1988). Habitat for flammulated owls is strongly associated with the upper slopes or ridges (Groves et al. 1997; Bull et al. 1990, Barnes 2007). Flammulated owls are obligate cavity nesters (IDFG 2005) and can take advantage of insect irruptions, such as spruce budworm outbreaks (McCallum 1994; O'Neil et al. 2001; Marcot 1997). Home ranges average 31 acres in size (Barnes 2007).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 2, 3, 5, and 6 in the medium and large tree size classes and moderate canopy cover class (Nutt et al. 2010). These types are most likely to have the habitat types that develop late-seral stages of open forest with stands dominated by ponderosa pine or Douglas-fir, or codominated by both. Historical fire regimes in these PVGs include nonlethal, mixed1, and mixed2 (Forest Plan 2010, Appendix A). Snags are a special habitat feature for flammulated owls and provide nesting sites.

1.5.2.5 Great Gray Owl (Sensitive)

Great gray owls are year-round residents of the Interior Columbia Basin and occupy source habitats in subalpine and montane forest and woodlands (Wisdom et al. 2000). Great gray owl is a contrast species that requires the juxtaposition of open habitats for foraging with forested habitats for roosting and nesting. They are associated with forested habitats that are near meadows, marshes, bogs, open forests, and herbaceous habitats (Duncan and Hayward 1994). Key forested features include remnant giant- to medium-size trees and snags (15–30 inches dbh) (O’Neil et al. 2001; Marcot 1997; Wisdom et al. 2000). Juvenile great gray owls are flightless and depend on leaning and deformed trees to navigate from forest floors to tree canopies (Bull et al. 1988; Franklin 1988). Great gray owls rely on existing stick nests built by other large birds, natural platforms formed by dwarf mistletoe brooms, broken-topped snags, stumps, and artificial boxes for nesting (Marcot 1997; O’Neil et al. 2001; Duncan and Hayward 1994). The nesting period for the great gray owl is March through mid-July (Munts and Powers 1991). Average winter home range size for this species is 16,630 acres, which includes summer ranges (Bull et al. 1988).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 3, 7, 8, 9, 10, and 11 in the medium and large tree size classes and low, moderate, or high canopy cover classes (Nutt et al. 2010). These vegetative communities are capable of developing stand characteristics compatible with great gray owl needs. Historical fire regimes for these PVGs include mixed2 and lethal and can create the juxtaposition of open and forested habitats used by the owls. Snags are a special habitat feature for the species.

1.5.2.6 Northern Goshawk (Sensitive)

Northern goshawks use a variety of forest ages, structural conditions, and successional stages (Griffith 1993) and are associated with shrubland and grassland habitats. Nest sites are typically located next to the trunk of large diameter trees and in older stands where trees are widely spaced (Hayward and Escano 1989). Deformities (multiple trunks and mistletoe), especially in smaller diameter trees, are used as nest site substrates. Snags are often used as plucking posts. Northern goshawks prefer transitional zones for hunting. Mosaics of forested and open areas and riparian zones are equally important (Griffith 1993). This species is an opportunist and kills a wide diversity of prey, depending on region, season, vulnerability, and availability. Main foods include ground and tree squirrels, rabbits and hares, large passerines, woodpeckers, game birds, and corvids and occasionally reptiles and insects. Prey can be taken in the air or on the ground. The typical nesting home range for northern goshawks is estimated at 5,931 acres and includes three components: nesting, foraging, and post-fledging family areas (Reynolds et al. 1992). Aspect and slope have been found to be important microsite factors for goshawk nesting habitat, as nests are commonly found within northern or eastern aspects and moderate slopes (Reynolds et al. 1982; Hayward and Escano 1989; Moore and Henny 1983; all in Kennedy et al. 2003). The nesting period for the goshawk occurs from late March through early-August (Squires and Reynolds 1997).

On the Forests, source habitat for northern goshawks occurs in all PVGs except 1 and 11 in the medium and large tree size classes and moderate and high canopy cover class (Nutt et al.

2010). PVGs 2 through 9 are capable of developing multi-layered, mature, and late-seral stands with a dense canopy. For some PVGs, such as PVG 6, these conditions occur under historical fire regimes, while other PVGs, such as PVGs 2 and 5, develop these conditions from fire suppression and altered fire regimes. No special habitat features have been identified for northern goshawk.

1.5.2.7 Pileated Woodpecker (Management Indicator Species)

The pileated woodpecker is a Forest Plan management indicator species (Forest Plan 2010, Appendix E). The species serves a variety of functional roles within the community and is associated with habitat elements used by other species in the family.

Pileated woodpeckers occupy dense deciduous, coniferous, or mixed forests; open woodlands; second-growth forests; and parks and wooded residential areas of towns (NatureServe 2012b). The species prefers habitats with tall closed canopies and high basal areas. General characteristics of habitat provide opportunities for nesting, roosting, and foraging and include the presence of large diameter trees and snags, multiple canopy layers, decaying wood on the forest floor, and a somewhat moist environment that promotes fungal decay, and ant, termite, and beetle populations to forage upon (NatureServe 2012b). Source habitats for pileated woodpeckers are typically late-seral stages of subalpine and montane community types. Home ranges average 1,006 acres (Bull and Jackson 2011).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 2, 3, 5, 6, 8, and 9 in the large tree size classes and moderate and high canopy cover class (Nutt et al. 2010). Some PVGs are capable of providing source habitat conditions under historical fire regimes while others do so because of altered fire regimes (i.e., PVGs 2 and 5). Special habitat features for pileated woodpecker include large diameter (>21 inches dbh) snags and hollow live trees for nesting and roosting, and large standing dead and downed trees for foraging.

1.5.2.8 Black-backed Woodpecker (Management Indicator Species)

Black-backed woodpecker is a Forest Plan management indicator species (Forest Plan 2010, Appendix E). The species was included in this analysis to facilitate Forest Plan monitoring of management indicator species. In addition, the species serves a variety of functional roles within the community and is associated with habitat elements used by other species in the family.

Black-backed woodpeckers are associated with mature, late-seral boreal and montane coniferous forests (NatureServe 2012a). This species is a year-round resident in the Interior Columbia Basin (Wisdom et al. 2000). Source habitats of the black-backed woodpecker include old forest stages of subalpine, montane, and lower montane forest and riparian woodlands (Wisdom et al. 2000). Both managed and unmanaged young-forest stages of lodgepole pine also provide source habitat (Wisdom et al. 2000). Burned conifer forests (Saab and Dudley 1998; Hoffman 1997; Caton 1996; Hutto 1995; Marshall 1992) and other insect-infested forests (Goggans et al. 1988) provide key conditions necessary for both nesting and foraging. Habitat requirements for nesting include mature and old trees affected by disease and heart rot or in early stages of decay (Goggans et al. 1988). This species forages almost exclusive on the larvae of bark beetles and wood-boring beetles (Marshall 1992). Black-backed woodpecker home ranges are approximately 72-131 hectares (175-324 acres) (Dudley and Saab 2007).

On the BNF, vegetative communities that could provide source habitat conditions include PVGs 3, 4, 6, 7, 8, 9, and 10 (Nutt et al. 2010). Historical fire regimes within these PVGs range from mixed to lethal, creating a variety of patch sizes depending on the fire regime (Forest Plan 2010, Appendix A). Source habitat can also occur in recent burned areas (<5 years). Snags are a special habitat feature for black-backed woodpecker. Adequate numbers of snags < 20 inches dbh for nesting and foraging habitat is a key habitat component (Nutt et al. 2010).

1.5.3 Family 3 – Forest Mosaic

Species within this family tend to be habitat generalists in montane forests. Most species also use subalpine forests, lower montane forests, or riparian woodlands as source habitats. A few species use upland shrub and upland herb communities. Source habitat occurs across all PVGs and structural stages.

The Wildlife Conservation Strategy assessed the condition of source habitats for Family 3 on the BNF. Historically, source habitat occurred in 64 watersheds. Current source habitat estimates indicate that source habitat has declined in 72 percent of watersheds, increased in 5 percent of watersheds, and remained neutral in 23 percent of watersheds. Decreasing trends are tied primarily to the reduction in forests dominated by large trees. Neutral and increasing trends appear to be largely tied to increased stand densities as a result of departed landscapes. Family 3 has been identified as a family of greatest concern due to the effects of negative human interactions.

1.5.3.1 Canada Lynx (Threatened)

Lynx are typically associated with large tracts of higher elevation boreal or coniferous forest that are often interspersed with rock outcrops, bogs, and thickets. In Idaho, Canada lynx typically inhabit montane and subalpine coniferous forests above 4,000 feet (McKelvey et al. 2000; Ruediger et al. 2000). In central Idaho, primary habitat has been identified as lodgepole pine, subalpine fir, and Engelmann spruce habitat types (Ruediger et al. 2000). Cool, moist Douglas-fir, where interspersed with subalpine forest, also provides habitat (Ruediger et al. 2000).

Source habitats for lynx are provided by most of the coniferous forest structural stages with the exception of old forest, single-storied stands. Riparian woodlands and shrublands are also source habitats. Key components of lynx habitat include denning, foraging, and travel corridors provided by a mosaic of forest habitats (Ruggiero et al. 1994).

Late-seral forests are used for denning and rearing young and for hunting alternative sources of prey (Ruggiero et al. 1999). Relatively small patches of old forest are required for dens, although these areas must be near and connected to high-quality foraging habitat (Koehler and Brittell 1990). Denning habitat is used during parturition and rearing of young until they are mobile. The common component appears to be large amounts of coarse woody debris, either down logs or root wads, which provide escape and thermal cover for kittens. Denning habitat may be found either in older mature forest of conifer or mixed conifer-deciduous types, or in regenerating stands older than 20 years. Denning habitat must be located within daily travel distance of foraging habitat (Ruediger et al. 2000). Habitat quality, as measured by the availability of alternate den sites, appears to be an important factor in kitten survival when disturbance occurs (Ruggiero et al. 1994). Den sites occur primarily on north-to-northeast aspect slopes in mature forest types and are often in large hollow logs, beneath windfall or upturned roots, or in brush piles in dense thickets. Optimal denning stands have minimal human disturbance, are in proximity to foraging areas, and are at least 2.4 acres in size. Late-successional stands also provide refuge from inclement winter weather and drought (Terra-Berns et al. 1998). Denning activities typically occur from early to mid-March through June (Ruggiero et al. 1994).

Foraging habitat supports primary prey (snowshoe hare) and/or important alternate prey (especially red squirrels) that are available to lynx. Lynx primarily forage in early-seral forests and in some mid-seral forests that support high numbers of prey. The highest quality snowshoe hare habitats are those that support a high density of young trees or shrubs (4,500 stems or branches per acre), especially with branches that protrude above the snow levels. These conditions may occur in early successional stands following some type of disturbance or in older forests with a substantial understory of shrubs and young conifer trees. Red squirrel densities tend to be highest in mature cone-bearing forests with substantial quantities of coarse woody debris (Ruediger et al. 2000). Although snowshoe hares are the primary food of lynx throughout its range, they also rely on mice, squirrels, and grouse, especially during summer months (Ruggiero et al. 1994).

Lynx are known to move long distances, but open areas, whether natural or artificial, will discourage use by lynx and disrupt their movements (Ruggiero et al. 1994). Although they will cross openings less than 330 feet wide, they do not hunt in these areas. Travel cover allows for movement of lynx within their home ranges and provides access to denning sites and foraging habitats. In general, suitable travel cover consists of coniferous or deciduous vegetation 2 feet taller than the average snowfall with a closed canopy that is adjacent to foraging habitat. Most successional stages serve as travel cover, provided they offer vegetative cover in sufficient quantity and arrangement to allow for the movement of lynx. Narrow forested mountain ridges or plateaus may provide a linkage between more extensive areas of lynx habitat. Wooded riparian communities may provide travel cover across otherwise open valley floors between mountain ranges. Linkages may be provided by forest stringers that connect large forested areas or by low, forested passes that connect subalpine forests on opposite sides of a mountain range (Ruediger et al. 2000).

Home range size varies considerably and usually depends on prey base availability. Typical home range territories across southern Canada and the lower 48 states vary between 15 to 147 square miles (Ruediger et al. 2000). Lynx movement and dispersal distances vary greatly. Documented daily movement distances have varied from 1.6 to 3.2 miles, depending upon prey densities. Exploratory movements, usually in the summer and outside of identified home range boundaries, have varied between 9 and 25 miles. Both adult and sub-adults have been documented making long-distance movements during periods of prey scarcity. Recorded distances have been up to 600 miles (Ruediger et al. 2000).

Existing information on the behavioral responses of lynx toward humans shows that lynx “can tolerate human disturbance and even continued presence” (Ruggiero et al. 1999, p. 280). Other anecdotal reports also suggest that lynx are not displaced by human presence, including moderate levels of snowmobile traffic and ski area activities (Ruediger et al. 2000, pp. 1–13). To date, most investigations of lynx have not shown human presence to influence how lynx use the landscape, but further research is needed on this topic (Ruediger et al. 2000, pp. 2–8).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 3, 7, 8, 9, 10, and 11 (Nutt et al. 2010). These are the PVGs capable of developing characteristics of source habitat as described in the literature. Down logs and root wads are a special habitat feature for lynx (Wisdom et al. 2000; Ruggiero et al. 1999; Koehler 1990) and provide important natal and maternal denning sites.

1.5.3.2 Mountain Quail (Sensitive)

Source habitats for mountain quail include all structural stages, except stem exclusion, of interior Douglas-fir, Sierra Nevada mixed conifer, ponderosa pine (Pacific and interior), and chokecherry-serviceberry-rose (Wisdom et al. 2000). Habitat is characterized by brushy slopes and shrub-dominated communities ranging in elevation from 2,300 to more than 9,850 feet. Mountain quail are most often associated with steep slopes or rugged terrain but this is not always present in occupied habitat (Brennan et al. 1987). Breeding often occurs at high elevations during spring and summer, with migrations to lower elevations generally occurring prior to snowfall. High elevation aspen stands surrounded by sagebrush and riparian habitats associated with forest habitats that have a significant shrub component are also used (Brennan et al. 1987). Fires in source habitat can have a short-term negative impact on source habitat but can promote long-term growth and development of shrub habitats (Gutierrez and Delehanty 1999).

In Idaho, mountain quail distribution appears to be closely associated with riparian shrub habitats (Vogel and Reese 1995). These areas may or may not have a forest canopy associated with them and typically occur along waterways and secondary drainages that are within a few hundred meters of water (Vogel and Reese 1995). Mountain quail require drinking water during hot weather, and juveniles must drink soon after hatching to survive (Brennan et al. 1987). South-facing slopes are arid and dominated by grasses such as bluebunch wheatgrass and Idaho fescue together with several species of forbs. In draws or on north-facing slopes, serviceberry, hawthorn, ninebark, snowberry, and wild rose are common. Moist sites have elderberry, alder, red-osier dogwood, and cottonwood, and higher elevation sites contain ponderosa pine and Douglas-fir (Vogel and Reese 1995).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 1, 2, 4, 5, 7, and 11 (Nutt et al. 2010). Historical fire regimes are nonlethal in low elevation types (PVGs 1, 2, and 5) and mixed1 or mixed2 in other PVGs. Riparian shrubland is a special habitat feature. In the Interior Columbia Basin, mountain quail are usually found within 100 to 200 meters (328 to 656 feet) of a water source (Brennan 1989).

1.5.3.3 Wolverine (Proposed Threatened)

Source habitats for wolverine include alpine tundra and all subalpine and montane forests. Within forest types, all structural stages except the closed canopy stem exclusion stage provide source habitat (Wisdom et al. 2000). Primary habitat during winter is mid-elevation conifer forest; summer habitat is subalpine areas associated with high-elevation cirques (Copeland 1996). Summer use of high-elevation habitats is related to the availability of prey and den sites and possibly human avoidance. Lower-elevation forests likely contain the greatest amount of ungulate carrion in winter (Copeland 1996).

Spring snow cover (April 15 to May 14) is the best overall predictor of wolverine occurrence (Aubry et al. 2007). Snow cover during the denning period is essential for successful wolverine reproduction range-wide (Hatler 1989; Magoun and Copeland 1998; Inman et al. 2007). Wolverine dens tend to be in areas of high structural diversity such as logs and boulders with deep snow (Magoun and Copeland 1998; Inman et al. 2007). Reproductive females dig deep snow tunnels to reach the protective structure of logs and boulders where they produce offspring. This behavior presumably protects the vulnerable kits from predation by large carnivores, including other wolverines (Pulliainen 1968, p. 342; Zyryanov 1989, pp. 3-12), but may also have physiological benefits for kits by buffering them from extreme cold, wind, and desiccation (Pulliainen 1968). All of the areas in the lower 48 states for which good evidence of persistent wolverine populations exists (i.e., Cascades, Sierra Nevada, northern and southern Rockies) contain large and well-distributed areas with deep snow cover that persists through the wolverine denning period (Brock et al. 2007; Aubry et al. 2007).

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 7, 8, 9, 10, and 11 (Nutt et al. 2010). Persistent snow data were used to model wolverine source habitat (Nutt et al. 2010). Special habitat features include deep persistent snow above timberline and den sites (talus slopes, boulder fields, beaver lodges, old bear dens, fallen logs, root wads of fallen trees, large cavities). Denning habitat may be a factor limiting distribution and abundance (Copeland 1996), and wolverines may abandon dens in response to disturbance (Copeland 1996; Magoun and Copeland 1998).

1.5.4 Family 4 – Early-seral Montane and Lower Montane

Lazuli bunting is the only member of this family. Lazuli bunting was assigned a separate family because of its unique dependence on early-seral, shrub-dominated conditions in forested environment. Source habitat for the family includes the stand initiation stages of subalpine, montane, lower montane, and riparian woodland communities (Wisdom et al. 2000). Most cover types that serve as source habitat are in the montane community. Source habitat occurs in PVGs 1 through 6 (Nutt et al. 2010). Historical fire regime varies by type and includes nonlethal, mixed1, and mixed2 (Forest Plan 2010, Appendix A). Source habitat also occurs in shrub and grassland communities (ESPs): mountain and Wyoming big sagebrush and montane shrub.

Historically, 60 watersheds supported source habitat for Family 4. These watersheds are broadly distributed across all districts and have a dominant increasing trend (historical to current). This is due to the past timber harvesting in combination with the large-scale stand-replacing wildfires that have occurred over the past three decades. Though these disturbances create growth stages suitable for lazuli bunting, landscape patterns and shrub-herb communities are likely altered from historical conditions.

1.5.5 Family 5 – Forest and Range Mosaic

Family 5 species use a broad range of forest, woodlands, and rangelands as source habitat (Wisdom et al. 2000). Source habitats occur in all PVGs and structural types, as well as woodland and non-forested types. Human disturbance is a primary factor affecting some species as is altered fire regimes (Wisdom et al. 2000).

1.5.5.1 Gray Wolf (Sensitive)

The species was recently removed from the list of endangered and threatened species and is currently managed as a big game species in Idaho and is Region 4 Sensitive species for the Forest. Gray wolves utilize a wide array of forested and non-forested habitats. They have large home ranges and make seasonal movements in pursuit of their primary prey (ungulates). The primary threat to wolves is human-caused mortality. Human factors have been the greatest source of documented mortality for wolves in Idaho (Nadeau et al. 2009). Roads, trails, and their associated human use and development increase the potential for human-wolf conflict as does the presence of livestock.

Wolves typically breed during January through March, after which pups are born from March to May. After about 6 to 10 weeks, in late May to early July, the pack leaves the den for rendezvous sites, often meadows adjacent to timbered hillsides (Spahr et al. 1991).

On the Forests, vegetative communities that could provide source habitat conditions include all forest, woodland, and non-forested vegetation types. All structural conditions are used (Nutt et al. 2010). Key features of habitat include sufficient ungulate prey and limited human conflict.

1.5.5.2 Peregrine Falcon (Sensitive)

Peregrine falcons have historically been cliff nesters in the Interior Columbia River Basin (Pagel 1995), using cliffs from 30 to 400 meters (98 to 1,312 feet) high. Habitat surrounding the cliffs may be variable, ranging from old forests to second growth and sagebrush steppe environments. Common features of nesting habitat include proximity (1,312 to 2,953 feet) to water, abundant avian prey, and lack of human disturbance during the breeding season (Pagel 1995). Although greater distances may be traveled, peregrines usually hunt within 10 miles of their nests with 80 percent of foraging occurring within 1 mile. Major threats that continue to limit populations include eggshell thinning from pesticide contamination and human disturbance at nesting sites that lower reproduction.

Peregrines were once listed as endangered under the Endangered Species Act, but were removed from the list in 1999. Pagel (1995) reviewed the status of peregrines in the Columbia

River Basin. Major and minor potential threats to peregrines were identified. Major threats were described as continuing concerns to the short- and long-term viability of the population. These included contaminants and disturbance near nest sites. Minor threats were described as potential problems that at the time of the review did not appear to be limiting population recovery. Weather, predation, competition, disease, accidents, falconry, shooting, and prey population declines were identified as minor threats.

On the Forests, vegetative communities that could provide source habitat conditions include all forest and non-forest vegetation types (Miller et al. 2008a). These types provide source habitat when located within 10 miles of suitable cliffs.

1.5.5.3 Rocky Mountain Bighorn Sheep (Sensitive)

Early explorers and settlers reported that bighorn sheep were quite abundant in Idaho during the 1800s and early 1900s (Smith 1954). Abundant species included both California (*O. c. californiana*) and Rocky Mountain bighorn sheep (*O. c. canadensis*). Human settlement of Idaho in the mid-1800s increased harvest of bighorn sheep and introduced domestic sheep, resulting in a major loss of the species. Disease transmission from domestic sheep to bighorn sheep have resulted in substantial die-offs dating back to the 1870s in the Salmon River Mountains (Smith 1954). Current estimates place bighorn sheep numbers at 10 percent or less of the historical population levels.

Bighorn sheep occupy rugged canyons, foothills, and mountainous terrain at elevations ranging from 1,450 to 10,500 feet and slopes of 45 percent or greater. Key habitat features include steep, rugged escape terrain, such as cliffs and rock slides; grasses and forbs for forage; and limited amount of tall vegetation. Wisdom et al. (2000) describe source habitats for bighorn sheep in alpine, subalpine, upland shrubland, and upland herbland community groups. Alpine and subalpine community groups are primarily summer range and upland herbland and shrubland are used in both seasons, depending on elevation (Wisdom et al. 2000).

On the Forests, PVGs 1, 2, 4, 5, 7, 9, 10, and 11 in all tree size classes and with a low canopy cover provide summer source habitat when this habitat is within 2 miles of rock, cliff, or talus slopes with greater than 27 percent gradient. Winter source habitat is composed of numerous sagebrush-dominated cover types when the canopy cover class is low and these cover types are within 2 miles of rock, cliff, or talus slopes with greater than 27 percent gradient.

1.5.5.4 Rocky Mountain Elk (Big Game)

Elk were once distributed across most of North America and inhabited all of the major forest and plains plant communities, except the western deserts and the humid ecosystems of the southeastern United States (Skovlin et al. 2002). Elk are considered habitat generalists and are found across the Forests in a variety of habitats. Habitat use and distribution change seasonally and can be generalized by seasonal movements. During the winter, snow forces elk to move to lower elevation winter ranges. Winter ranges are often of mixed ownership and include portions of the Forests as well as other public and private lands. As snows recede, elk follow the spring green-up back to mid- and high-elevation summer ranges located on the Forests.

1.5.5.5 Mule Deer (Big Game)

Mule deer were described by Christensen et al. (1995) as one of the greatest habitat generalists known to game managers. Mule deer occupy almost every habitat within the Columbia River Basin from agricultural to shrub steppe and virtually every forest type. The same general statement may be made for their occupation of habitats on the forest.

Habitat use and mule deer distribution varies seasonally. Mule deer are migratory and commonly travel distances of 20 to 100 miles from summer to winter range. Winter range is a critical component of mule deer habitat and occurs on the forest primarily in the South Fork Payette and South Fork Boise River drainages. Use of these winter ranges may vary from year to year depending on snow depth and conditions. Snow depths of 18-20 inches will push mule deer to lower elevation ranges, the majority of which are located off forest. Habitats on the forest are most likely occupied by mule deer during the summer months, although some spring and fall transitional ranges also occur on the forest. Spring range is a key component of year-round habitat, and the quality of forage available on these transitional ranges affects production and fawn survival. Summer and fall habitats are important, as this is where deer build up the fat reserves that carry them through the winter months.

On the PNF and BNF, vegetative communities that could provide source habitat conditions include all forest, woodland, and non-forested vegetation types.

1.5.6 Family 7 – Forests, Woodlands, and Sagebrush

Species in Family 7 use a complex pattern of forest, woodlands, and sagebrush cover types (Wisdom et al. 2000). A distinguishing feature of the family is that most species have specialized requirements for nesting and roosting, which often limits population size and distribution.

1.5.6.1 Spotted Bat (Sensitive)

Spotted bats are found in a variety of habitats, ranging from desert scrub to montane coniferous forests (IDFG 1995). These bats forage for moths in open habitats. Their distribution appears to be patchy and limited to areas with suitable roost sites. Spotted bats roost predominantly in small crevices in substantial cliff faces (IDFG 1995). Loss of suitable roost sites pose a threat to spotted bats, as does human disturbance at roost sites. Populations are small and are often geographically isolated, which places individual populations at risk of extirpation from human-caused or natural events. The spotted bat has been known to travel up to 6 miles to forage (Wisdom et al. 2000). It is unknown whether spotted bats are migratory in the Interior Columbia River Basin.

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 1, 2, and 5 and the following nonforest vegetation types: perennial grass slopes, perennial grass montane, mountain and Wyoming big sagebrush, low sagebrush, montane shrub, and shrub-forest transition (Miller et al. 2008b). These types provide source habitat when located within 6 miles of roost sites (cliffs and canyons).

1.5.6.2 Townsend's Big-eared Bat (Sensitive)

The Townsend's big-eared bat is a year-round resident of the Interior Columbia River Basin and is considered a forest generalist within the subalpine, montane, upland woodland, and riparian woodland community groups (Wisdom et al. 2000). This species uses caves, mines, and buildings for roosting where they aggregate in large colonies. Townsend's big-eared bats forage for moths in sagebrush, bitterbrush, and open ponderosa pine forests. The distribution of this species is patchy due to its specialized roosting requirements. Primary threats are related to human disturbance at, and loss of, roost sites and hibernacula. Townsend's big-eared bats are negatively affected by the presence of roads at roosting sites and hibernacula because of increased potential for harassment of bats (Wisdom et al. 2000). Use of pesticides that would impact Lepidoptera populations can also affect this species by reducing food availability.

On the Forests, vegetative communities that could provide source habitat conditions include PVGs 1, 2, 3, 4, 5, 6, and 7 in all size classes and the low canopy cover class and the following non-forest vegetation types: low sagebrush, mountain and Wyoming big sagebrush, montane shrub, and shrub-forest transition in all size classes and canopy cover classes (Geier-Hayes and Nutt 2008c). These types provide source habitat when located within the maximum foraging distance (15 miles) from roost (caves, mines, and other suitable structures) locations.

1.5.7 Family 8 – Rangeland and Early- and Late-Seral Forest

The western bluebird is the sole member of this family because its source habitats are a unique combination of woodlands, shrublands, grasslands, and early- and late-seral forests (Wisdom et al. 2000). Source habitats for Family 8 are early-seral and late-seral single-storied montane and lower montane forests, riparian and upland woodlands, and upland shrub and herblands. Burned areas likely also provide source habitat. The juxtaposition of open areas and forests is a necessary component of source habitat. Snags less than 21 inches are a special habitat feature and are used for nesting. Source habitat occurs in PVGs 1, 2, 3, 4, 5, and 6 and in the following ESPs: perennial grass slopes, perennial grass montane, montane shrub, mountain and Wyoming big sagebrush and shrub-forest transition (Miller et al. 2008c).

1.5.8 Family 11 – Sagebrush

Species in Family 11 use open and closed stages of big sagebrush, low sage, and mountain big sagebrush (Wisdom et al. 2000). Some species also use herbaceous wetlands, antelope bitterbrush-bluebunch wheatgrass, upland woodlands, and salt desert shrub.

1.5.8.1 Greater Sage Grouse (Sensitive)

The greater sage grouse is dependent on sagebrush-grassland vegetation to meet its habitat requirements. Some populations migrate long distances and others do not. Despite wide-ranging annual movements, sage grouse have high fidelity to seasonal ranges for both nesting and wintering, and birds need extensive areas of native sagebrush-grassland year-round. Abundant native grass-forb composition appears to be important within the sagebrush-grassland communities during all life stages in the snow-free season. In summer, shrubs are used for cover, and grass and forbs are used as food along with insects. Forbs and insects are essential nutritional components for chicks. Therefore, early brood-rearing habitat must provide adequate cover adjacent to areas rich in forbs and insects to assure chick survival during this period (mid-May to mid-June) (Connelly et al. 2004). During winter, sagebrush increases in importance because it protrudes above the snow in wintering areas, and sagebrush leaves are used exclusively as food during the winter and early spring.

On the BNF, vegetative communities that could provide source habitat conditions include mountain and Wyoming big sagebrush, and low sagebrush (Miller et al. 2008d). Special habitat features include native herbaceous understory, access to succulent forbs, large landscape areas, and juxtaposition of habitat (Miller et al. 2008d). Special habitat features include native herbaceous understory, access to succulent forbs, large landscape areas, and juxtaposition of habitat. Sage grouse habitat occurs only at the southern end of the BNF (USDA FS 2010d).

1.5.9 Family 12 – Grassland and Open-canopy Sagebrush

Species in Family 12 are closely associated with fescue-bunchgrass herblands (Wisdom et al. 2000). Many species also use open-canopied sagebrush communities, with a few using other shrub- and herbland types. Only the northern Idaho ground squirrel occurs on the Cascade Ranger District.

1.5.9.1 Northern Idaho Ground Squirrel (Threatened)

Northern Idaho ground squirrels are known to occur in shallow, dry, rocky meadows usually associated with deeper, well-drained soils and surrounded by ponderosa pine and Douglas-fir forests at elevations of about 3,000 to 7,500 feet (Evans Mack 2006). Consequently, ponderosa pine/shrub-steppe habitat associated with south-facing slopes less than 30 percent at elevations below 6,000 feet is considered to be potentially suitable habitat (Evans Mack 2006). This species typically emerges in late March or early April (USDI FWS 2003).

The northern Idaho ground squirrel is confined to a small area of Adams and adjacent Valley County, Idaho, and occurs no place else in the world. Most known populations are critically low in numbers and distribution. Evidence suggests that where Columbian ground squirrels exist, northern Idaho ground squirrels have been out-competed (Yensen and Sherman 1997). The replacement of open, park-like forests with dense stands of younger trees has greatly reduced the amount of forage species such as grasses and other forbs. Thus the current rarity of the northern Idaho ground squirrel is likely a result of limited available sites stemming from both habitat loss from fire exclusion and competition with Columbian ground squirrels (Yensen and Sherman 1997). These factors have isolated northern Idaho ground squirrel to a few meadows that have not yet filled in with trees (Yensen 1991).

Historical population sites (no longer occupied) on or near the BNF include Woods (in Round Valley, approximately 15 miles south of Cascade, Idaho), Cabarton, and Van Wyck (now underneath Cascade Reservoir). The nearest known active population of northern Idaho ground squirrel is a population in Round Valley. The Round Valley population occurs on private land and is considered to be one of the largest currently known populations and the most isolated of populations.

Many active populations of northern Idaho ground squirrel also exist on the PNF. A population was discovered in July 2005 near the Lick Creek Lookout at an elevation of around 7,500 feet, more than 2,000 feet higher than known existing populations. This finding resulted in a more broad approach to identifying northern Idaho ground squirrel habitat, and subsequently other small populations were found at higher elevations in the Lick Creek Lookout area.

On the Forests, vegetative communities that could provide source habitat conditions include those associated with grass, forb, and shrub dominated communities in addition to low-density aspen, ponderosa pine, Douglas-fir, and riparian cover types (Nutt and Crist 2008). These vegetative communities provide source habitat when they coincide with slopes <15 percent, aspects between 90 and 290 degrees, and specific soil types (ibid). The northern Idaho ground squirrel habitat model (NIDGS Habitat Model) (ibid) uses 15 cover types and 50 land types in addition to slope and aspect parameters to model potential habitat. This model was used to identify potential source habitat within the Project area.

1.5.9.2 Southern Idaho Ground Squirrel (Candidate/Sensitive)

Southern Idaho ground squirrels are found in the lower elevation shrub-steppe habitat of the Weiser River Basin. Adults have a relatively short above-ground active season, lasting only 4 to 5 months (USDI FWS 2002). They inhabit areas dominated by big sagebrush, bitterbrush, and a variety of native forbs and bunchgrasses (Yensen 1991). Southern Idaho ground squirrels prefer areas with a high percentage of native cover types; however, some non-native features may enhance their survival as well, specifically alfalfa fields, haystacks, or fence lines (Prescott and Yensen 1999). On the Forests, habitat (current and historical) occurs only on the Emmett Ranger District.

1.5.9.3 Columbian Sharp-tailed Grouse (Sensitive)

The Columbian sharp-tailed grouse inhabits sagebrush-grassland and mountain shrub habitats within the Columbia Plateau and Great Basin (Connelly et al. 1998). Breeding habitat consists of dense herbaceous cover and shrubs that allows concealment during activities at lek sites. Food items consist of forbs and grasses, insects, fruits, and flowers during the spring and summer and buds, seeds, herbaceous matter, and fruits during winter. Breeding season occurs from March through July, depending on geographic area.

1.5.10 Family 13 – Riverine Riparian and Wetland

Source habitat for species in Family 13 occurs in conjunction with riverine riparian and wetland areas. Some species within the family also use non-riverine riparian and wetland habitats. Adjacent forests and woodlands provide nesting sites for some species.

1.5.10.1 Bald Eagle (Sensitive)

Two key habitats have been identified for bald eagles: the nesting territory and wintering habitat. Nesting territories are typically associated with large rivers, lakes, reservoirs, or ponds that produce fish (Marcot et al. 1997; Buehler 2000). Territories are used in successive years and may include more than one nest site. In the Interior Columbia River Basin Ecosystem Area, nest stands consist primarily of conifer stands with large trees. Bald eagles nest relatively close to water (1.25 miles) with suitable foraging opportunities (Buehler 2000). The majority of nest sites are located within one-half mile of a major stream or water body (USFWS 1986).

Wintering habitat is also typically associated with aquatic habitats with some open water for foraging (Buehler 2000). Winter habitat suitability is defined by food availability, the presence of roost sites that provide protection from inclement weather, and the absence of human disturbance (Buehler 2000). Winter food sources (fish, waterfowl, and ungulate carrion) and their availability varies across bald eagle winter range. Bald eagles scavenging on carcasses off highways are susceptible to motor-vehicle impact injuries. Bald eagles will tolerate some level of human activity in areas of high prey availability.

Key features of source habitat for the bald eagle include available food resources and suitable sites for nesting and roosting. These features can be correlated with watershed pathways used to assess the conditions of the watershed. The pathways that have relevance to the bald eagle include watershed condition, water quality, channel conditions and dynamics, and flow/hydrology.

1.5.10.2 Columbia Spotted Frog (Sensitive)

Columbia spotted frogs are aquatic and typically occur in or near permanent bodies of water, such as lakes, ponds, slow-moving streams, and marshes (Gomez 1994). The frogs generally occur along the marshy edges of such sites where emergent vegetation (e.g., grasses, sedges, cattails) is fairly thick and where an ample amount of dead and decaying vegetation exists. Some occupied sites may also have a layer of algae or small vegetation (e.g., duckweed) on the surface of the water. During summer, they may travel away from breeding sites but are still typically associated with aquatic sites with vegetated margins (Gomez 1994). Given the altitudinal range of the species, occupied aquatic sites may be surrounded by a wide variety of terrestrial vegetation, including mixed coniferous and subalpine forests, grasslands, and shrub-steppe communities.

Patla and Keinath (2005) describe three seasonally occupied habitats: breeding, foraging, and over-wintering. Breeding sites are used for egg deposition and larval development. These sites consist of stagnant or slow-moving water with some shallow (3.9 to 7.9 inches deep) water available. Emergent vegetation (sedges) is usually present. Foraging habitat is used by all post-larval stages of frogs for prey acquisition. These sites can occur as ephemeral pools in forests and meadows, intermittent and perennial streams, edges of rivers, riparian zones, and lake margins and marshes. Over-wintering sites provide wet, well-oxygenated habitat that is protected from freezing temperatures. While some sites may be suitable for all three habitats, in many areas, these sites are spatially separated, requiring frogs to migrate between sites within the course of a year.

Key features of source habitat for the Columbia spotted frog include the aquatic site itself, its banks and bank-side vegetation, and the conditions of the surrounding uplands. These features can be correlated with watershed pathways used to assess the conditions of the watershed. The pathways that have relevance to the Columbia spotted frog include watershed condition, water quality, channel conditions and dynamics, and flow/hydrology. No special habitat features have been identified for the Columbia spotted frog.

1.5.10.3 Yellow-billed Cuckoo (Threatened)

The yellow-billed cuckoo is a rare visitor and breeder in Idaho. The species is associated with large blocks of riparian habitat dominated by an overstory of tall deciduous trees like cottonwoods or within willows adjacent to tall deciduous trees. Fragmentation and loss of this breeding habitat have contributed to the yellow-billed cuckoo’s decline, but loss of wintering habitat might also contribute to their diminishing abundance (USFWS 2002). This species is a neotropical migrant that overwinters from Columbia and Venezuela south to northern Argentina. Their breeding season occurs between May and August. In Idaho, they have been sighted primarily in the Snake River Valley (USFWS 2002).

Riparian vegetation is a key feature of source habitat for yellow-billed cuckoos. This feature can be correlated with watershed pathways used to assess the conditions of the watershed. The pathways that have relevance to the yellow-billed cuckoo include channel condition and dynamics, flow/hydrology, and watershed conditions.

1.5.11 Family 14 – Non-riverine Riparian and Wetland

Source habitat for species in Family 14 occurs in conjunction with non-riverine riparian and wetland areas. Some species within the family also use riverine riparian and wetland areas.

1.5.11.1 Common Loon (Sensitive)

Common loons breed in clear, oligotrophic (with fish) lakes with forested, tundra, or rocky shorelines, bays, islands, and floating bogs (McIntyre and Barr 1997). Lakes are usually larger than 22 acres in size and below 5,905 feet elevation, and support adequate prey fish populations and nesting and nursery habitat. Nest sites are selected that provide shelter from wind, adequate cover, and views of open water. They typically are located near a drop-off steep enough to allow for underwater approaches. Islands, floating bogs, marshes, tops of muskrat houses, logs, and artificial nest platforms are all used for nest sites. The common loon is usually found on large, open lakes where it feeds primarily on live fish that it catches by diving from the surface, routinely to depths of 15 feet and more.

Key features of source habitat for the common loon include the aquatic site itself, its banks and bank-side vegetation, and the conditions of the surrounding uplands (because aquatic site conditions are often correlated with upland conditions). These features can be correlated with watershed pathways used to assess the conditions of the watershed. The pathways that have relevance to the common loon include watershed condition, water quality, channel conditions and dynamics, and flow/hydrology.

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K-4: Figures

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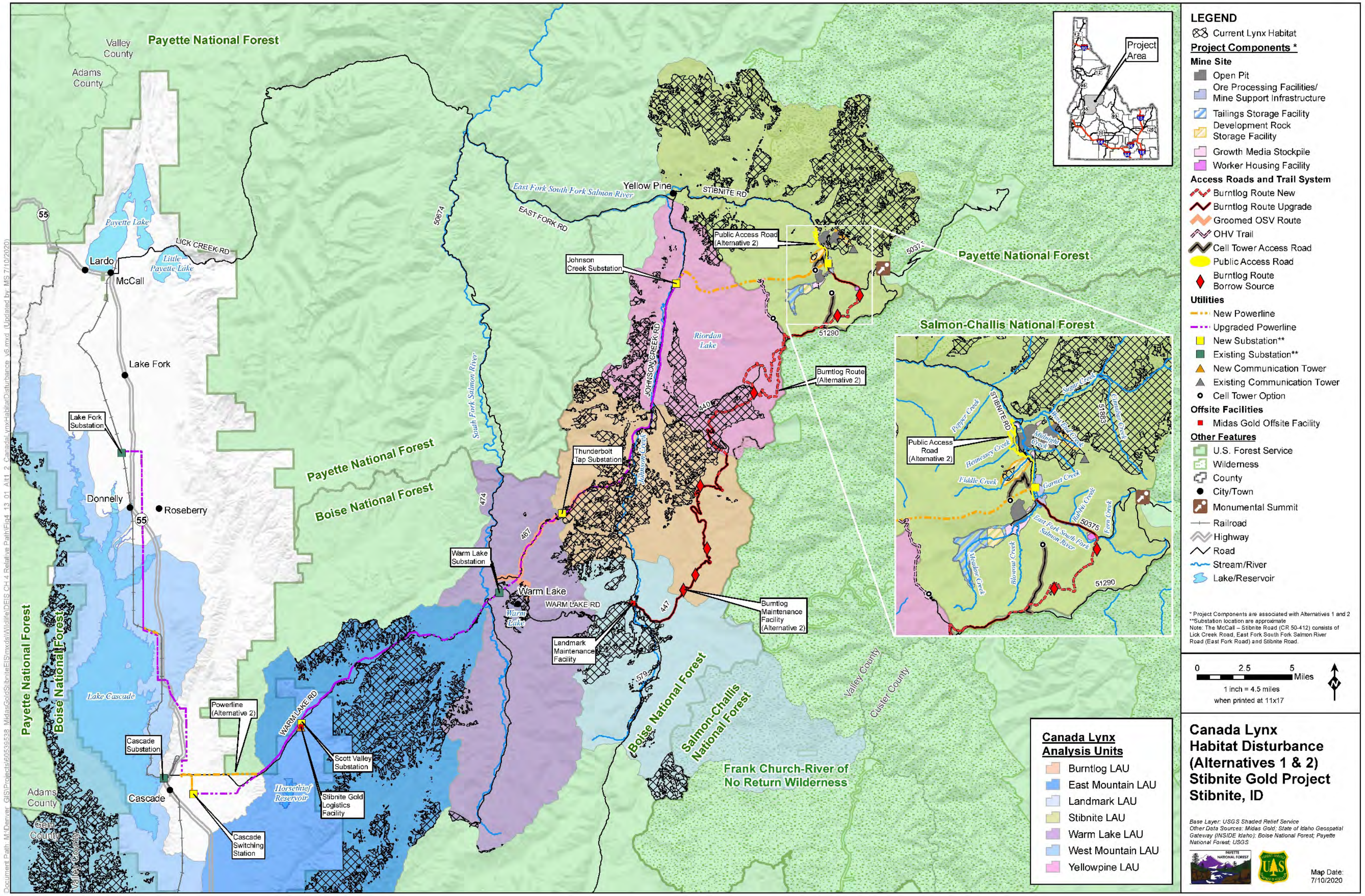

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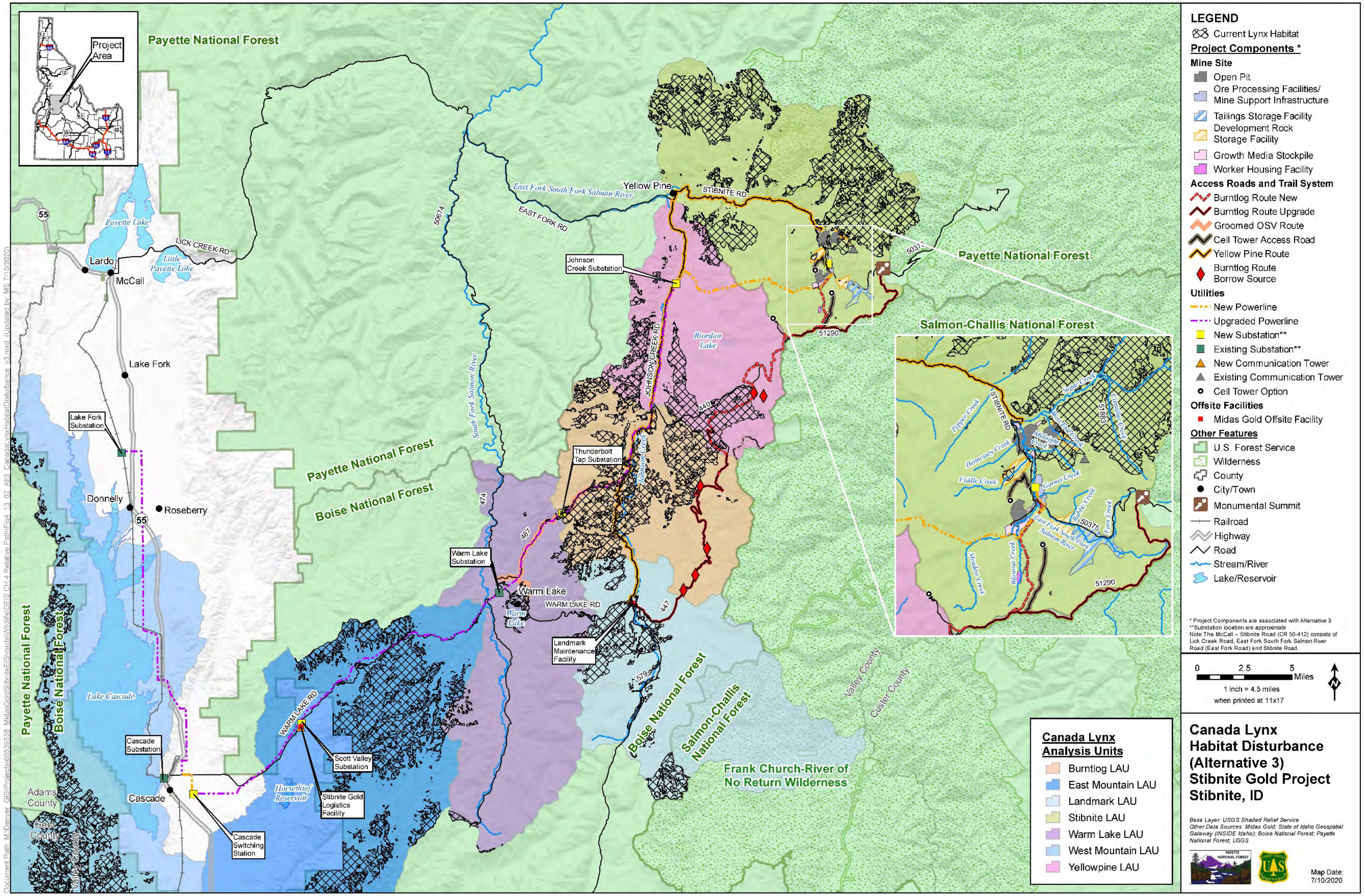
Figure 4.13-1 Canada Lynx Habitat Disturbance (Alternatives 1 & 2)



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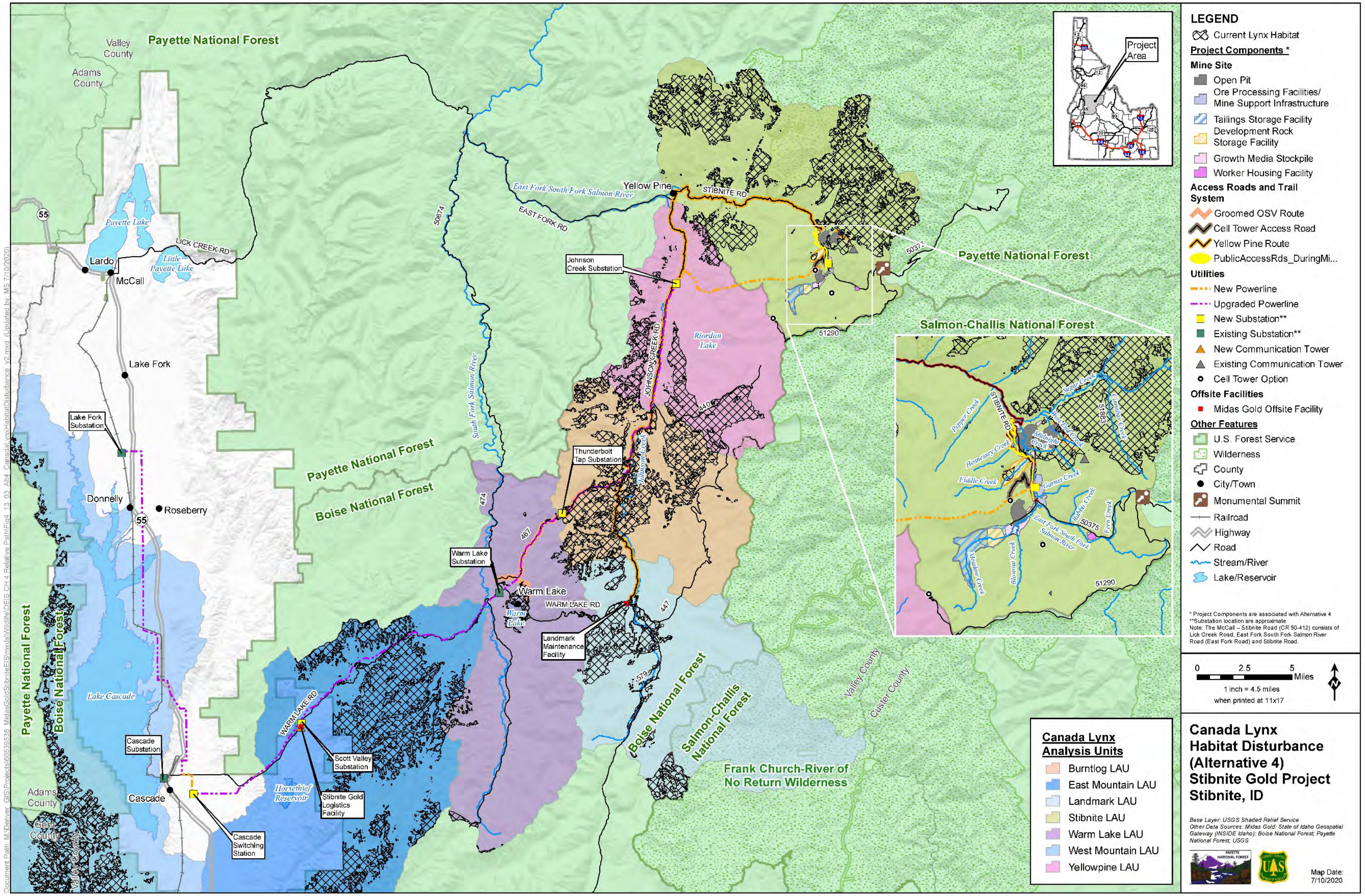

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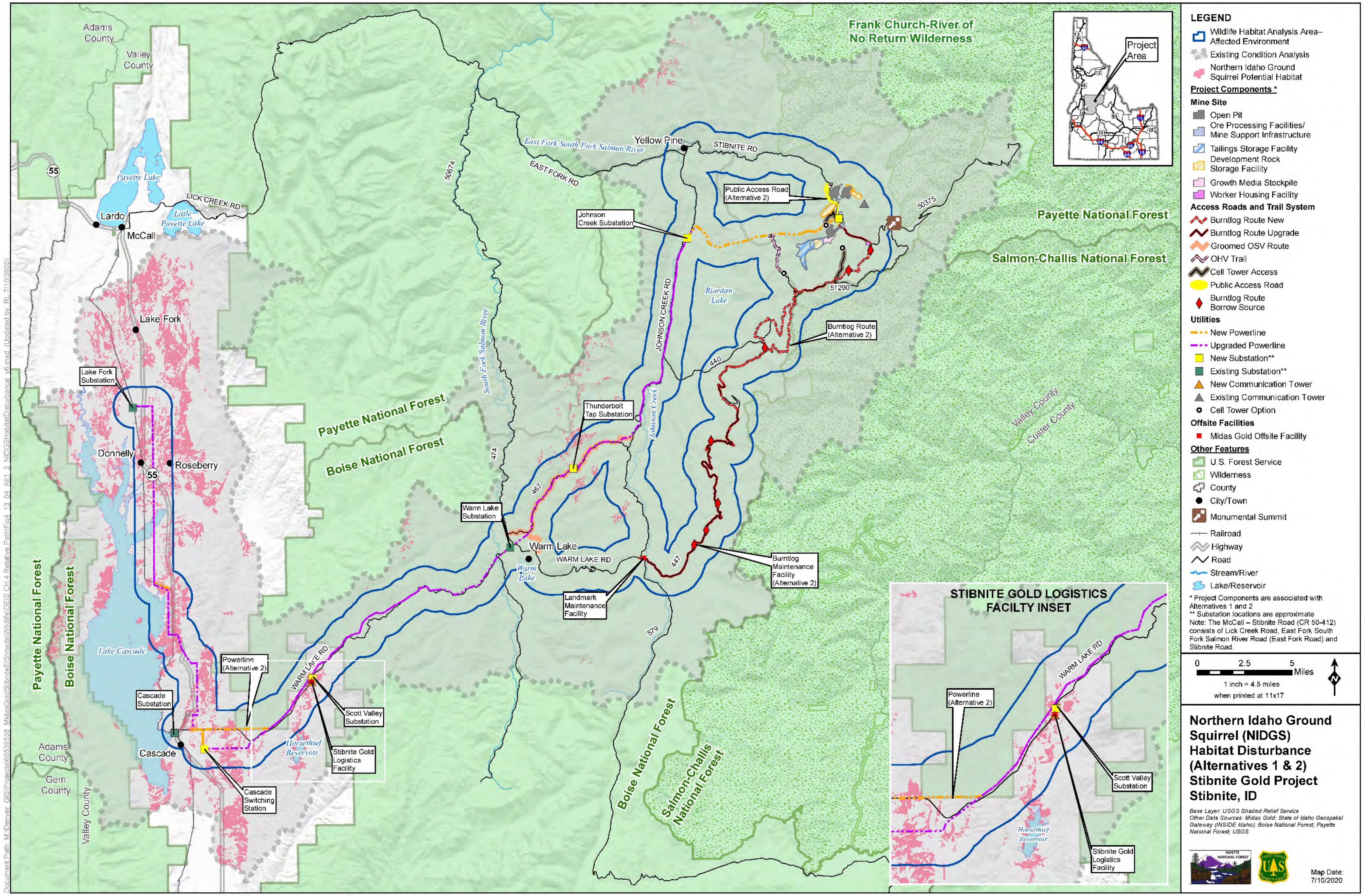

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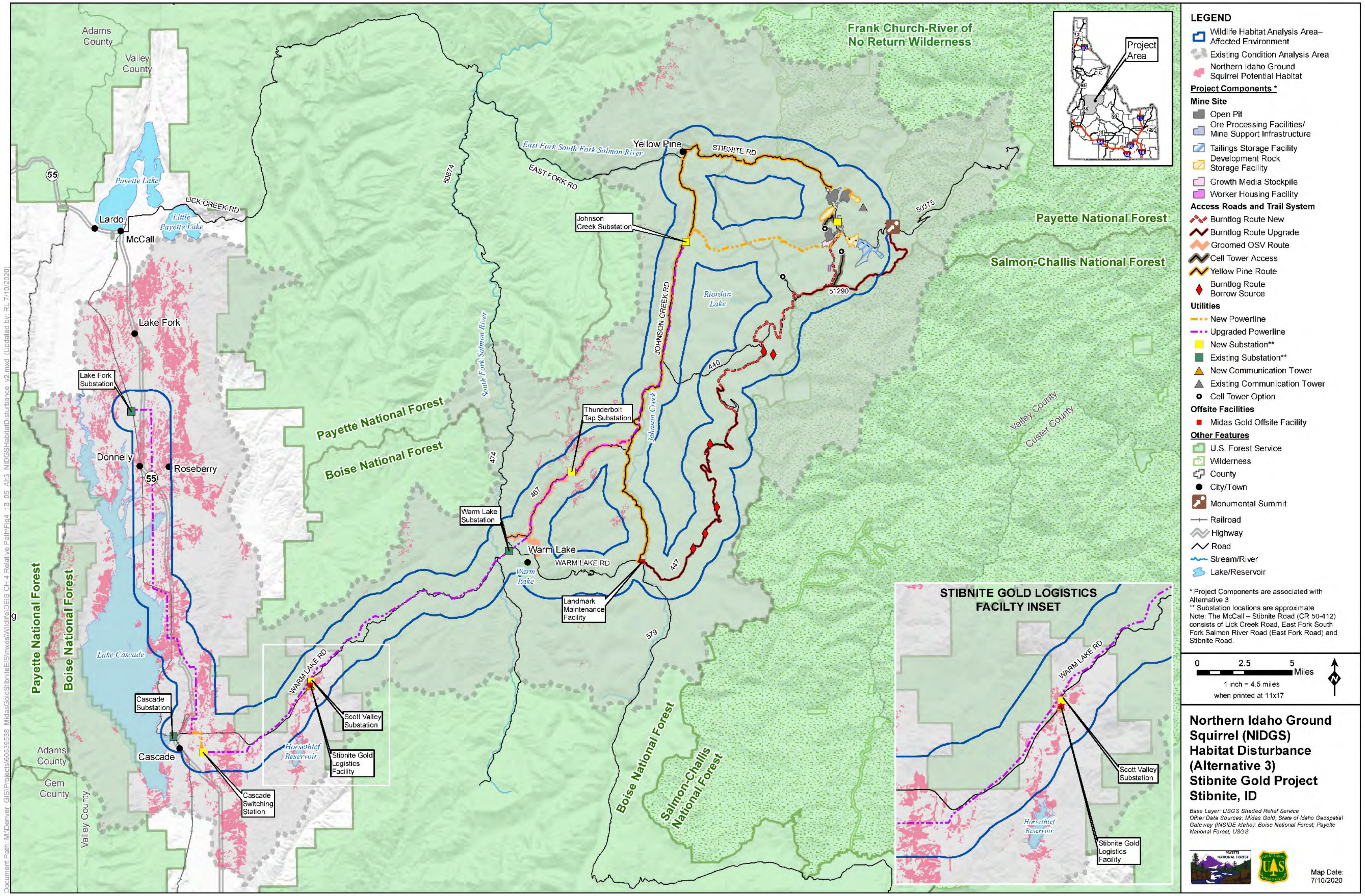

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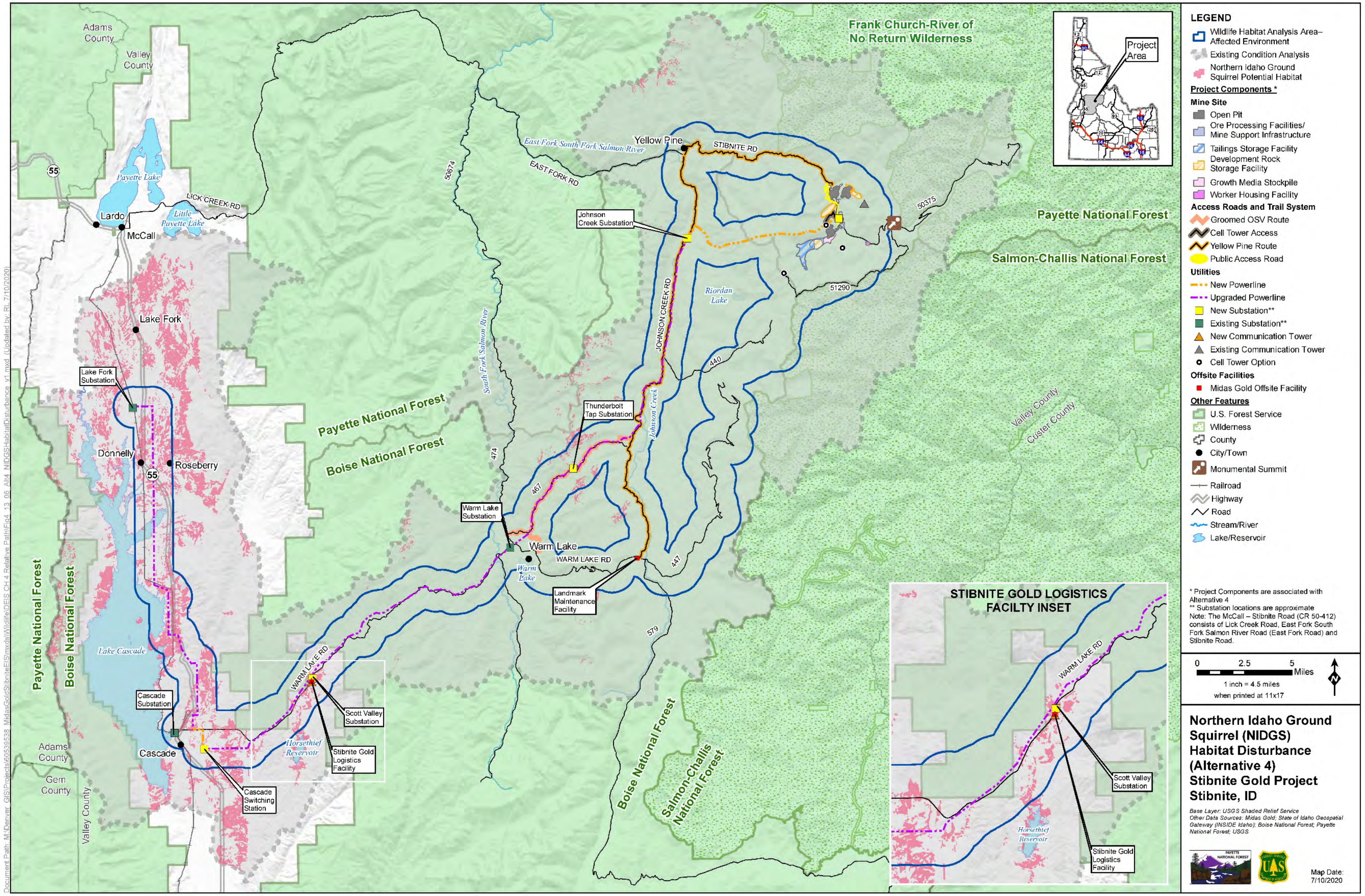

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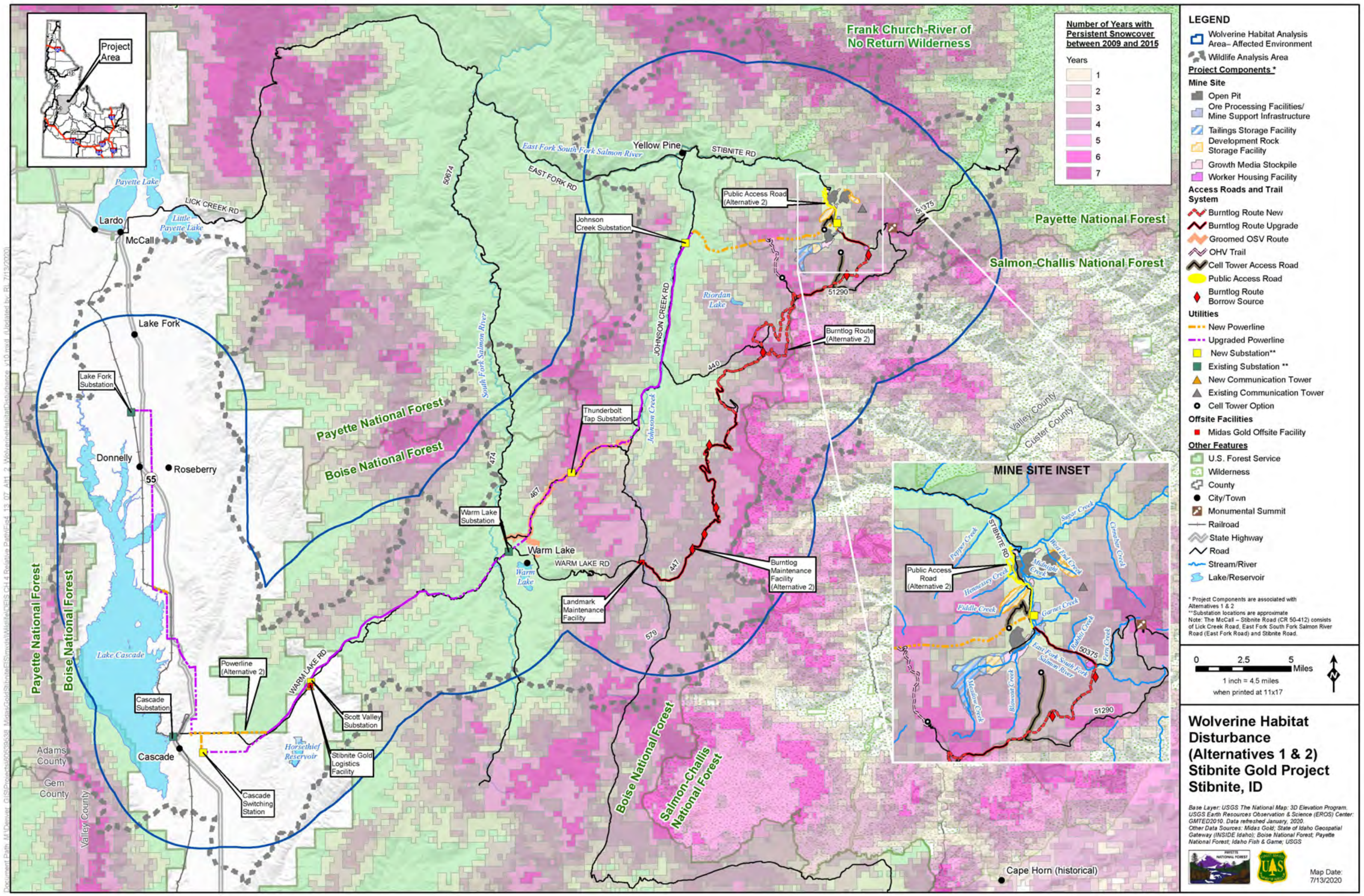

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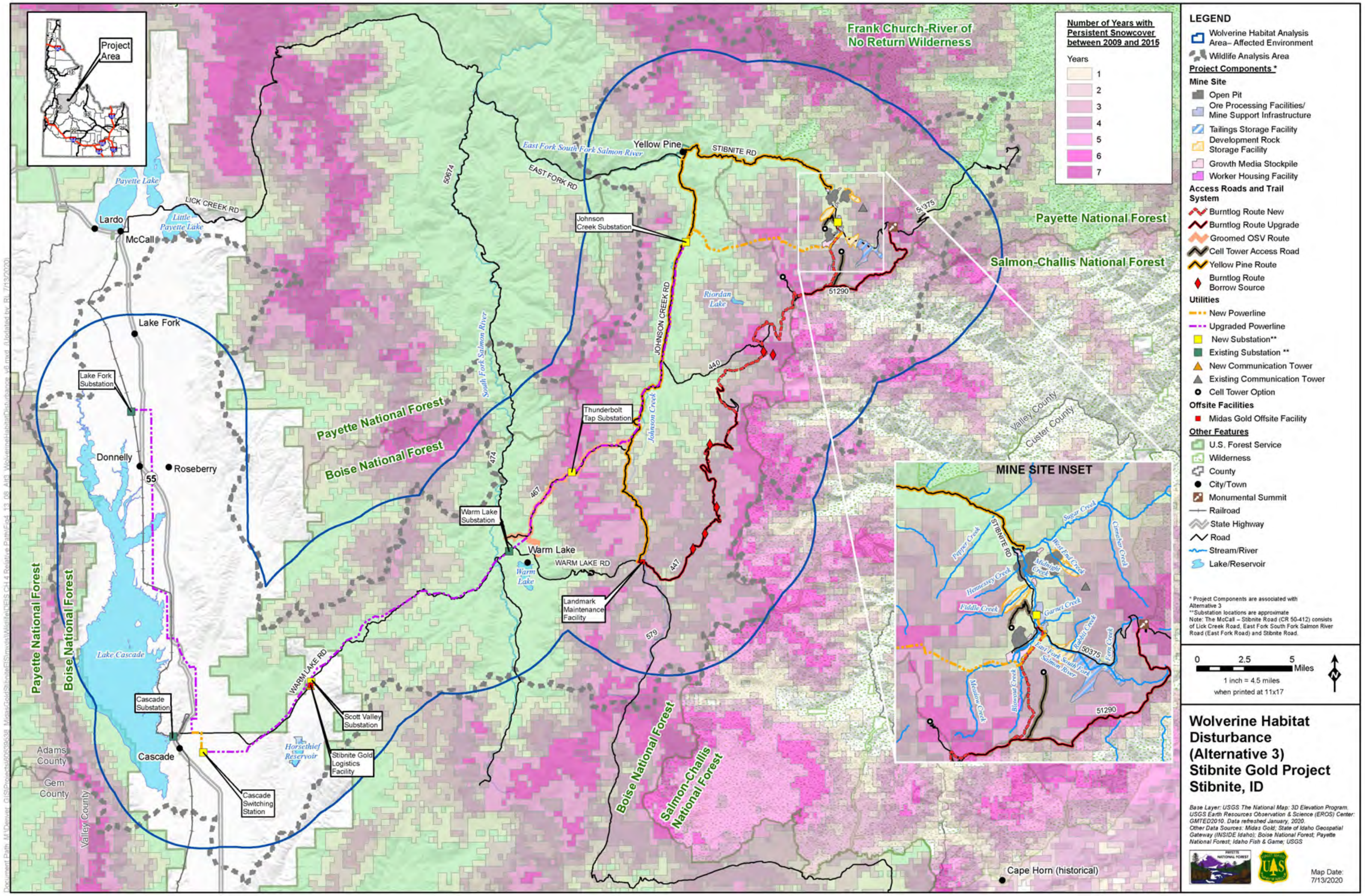

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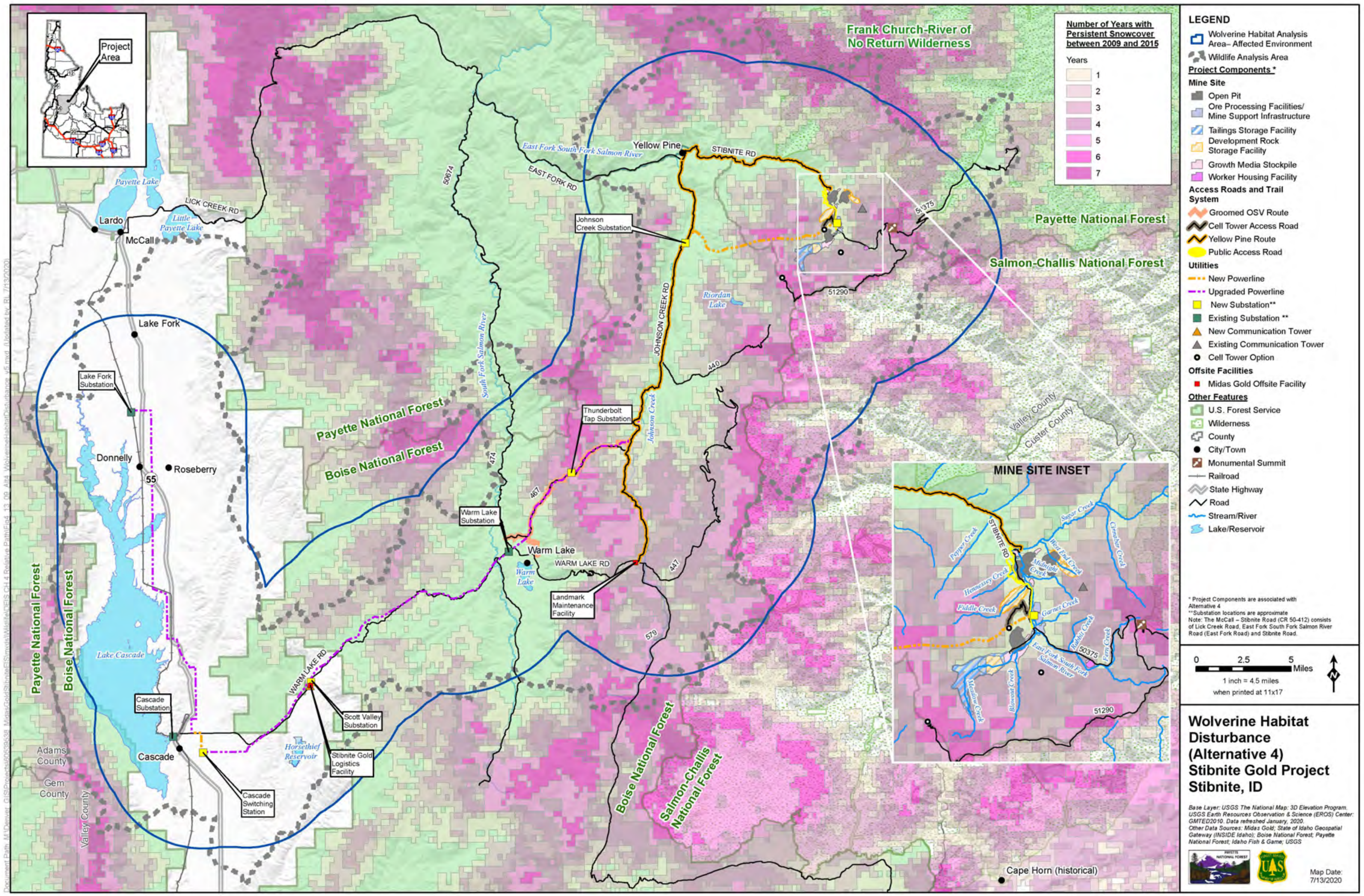

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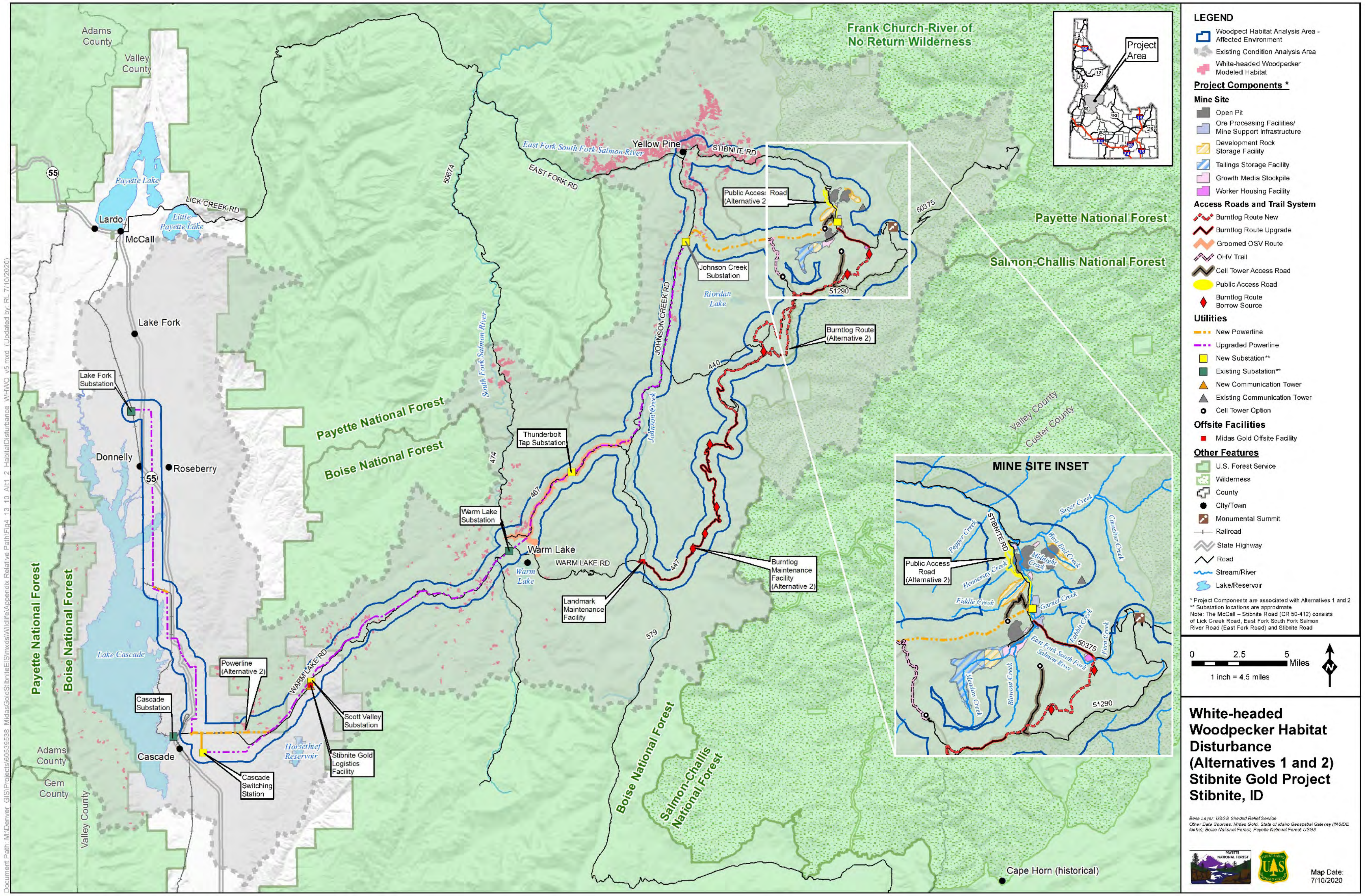

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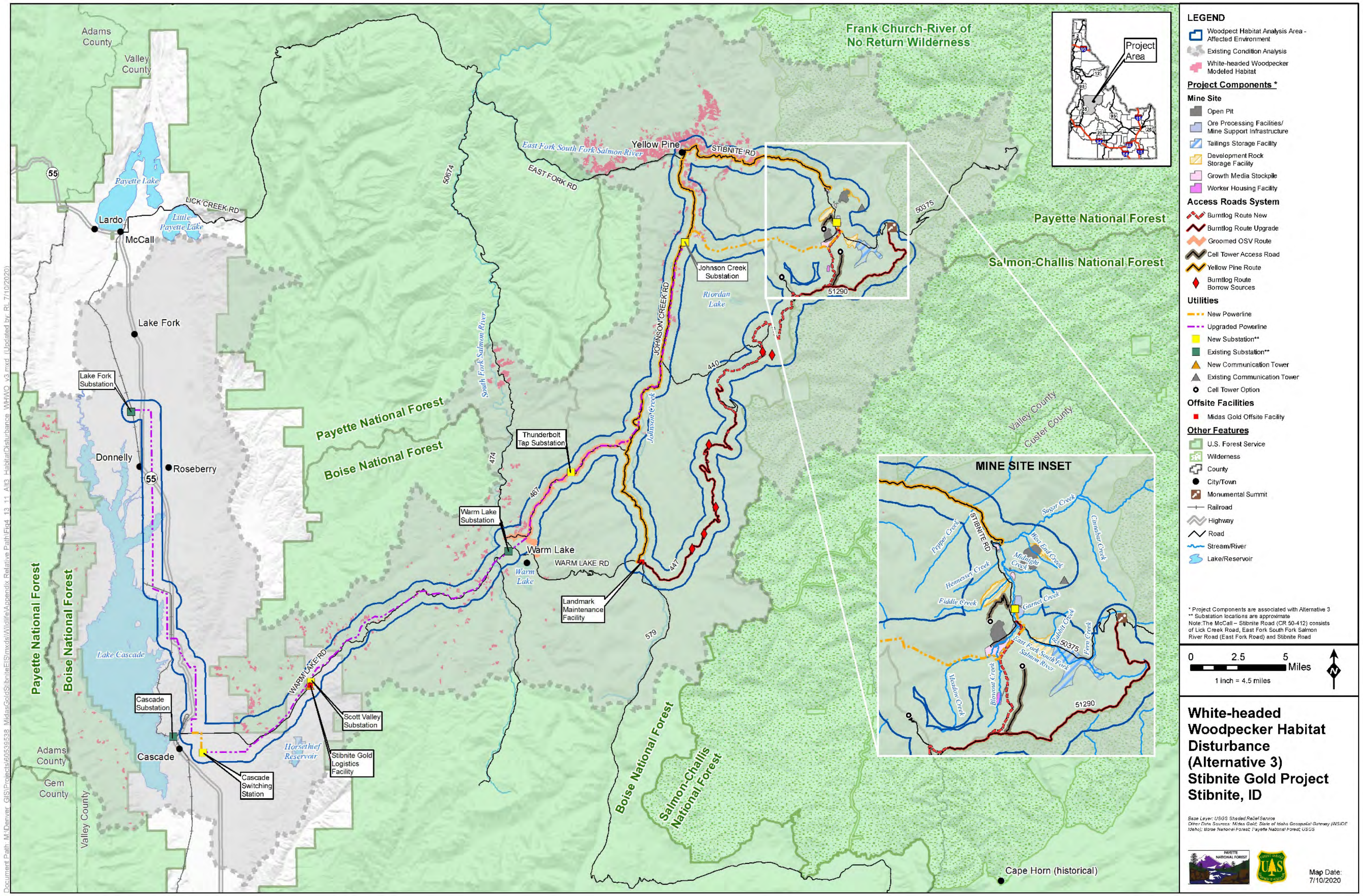

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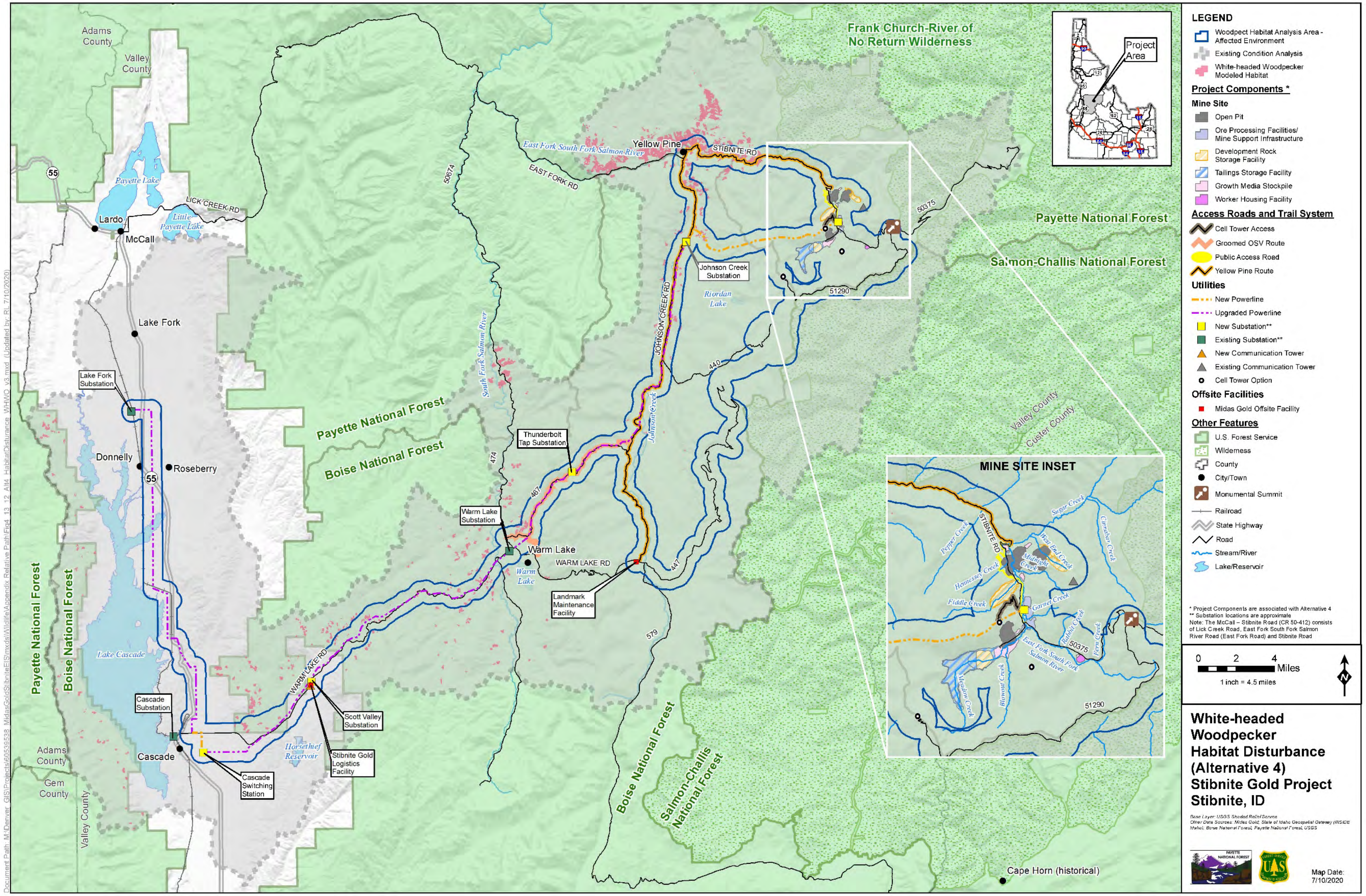

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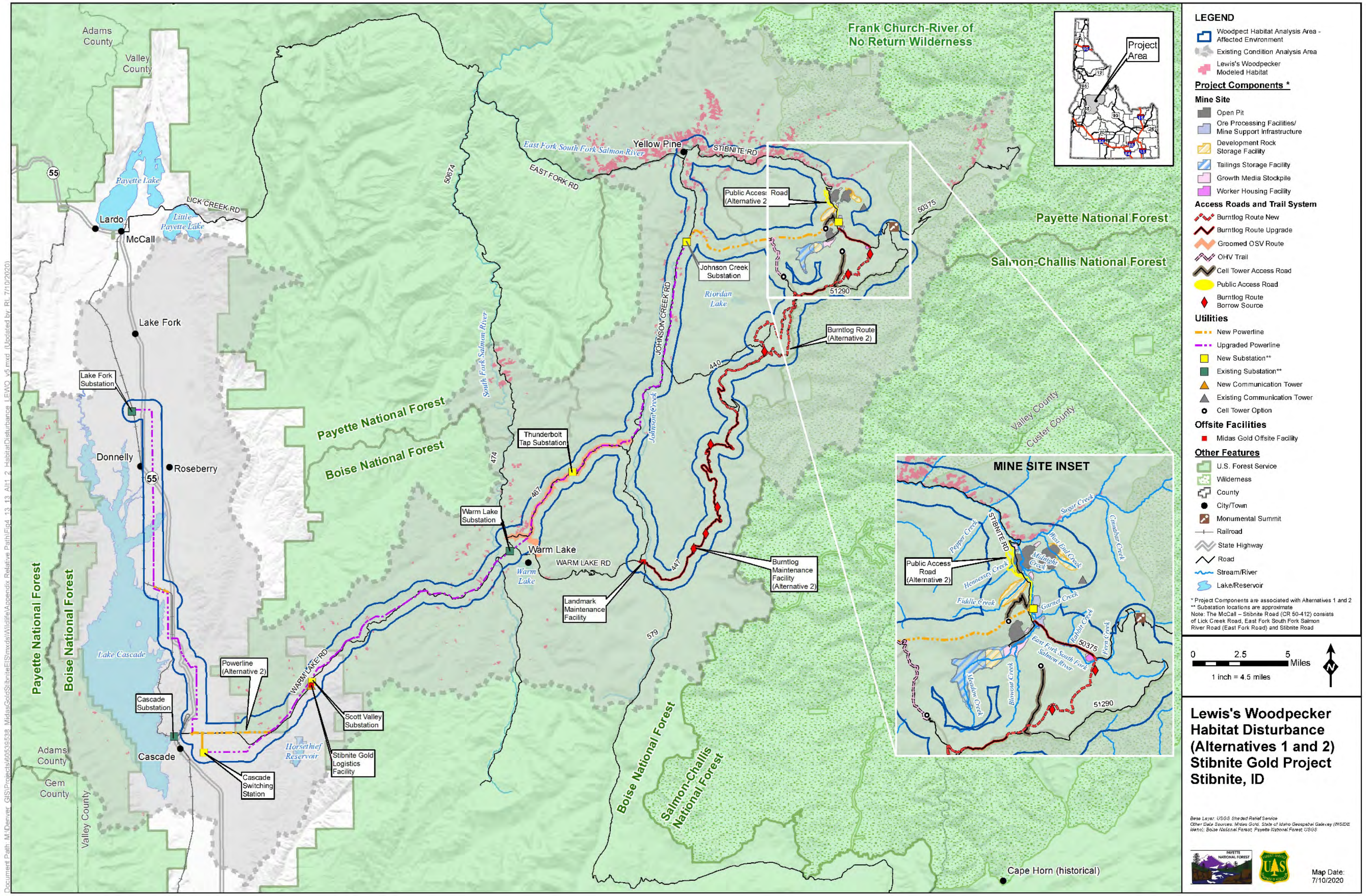

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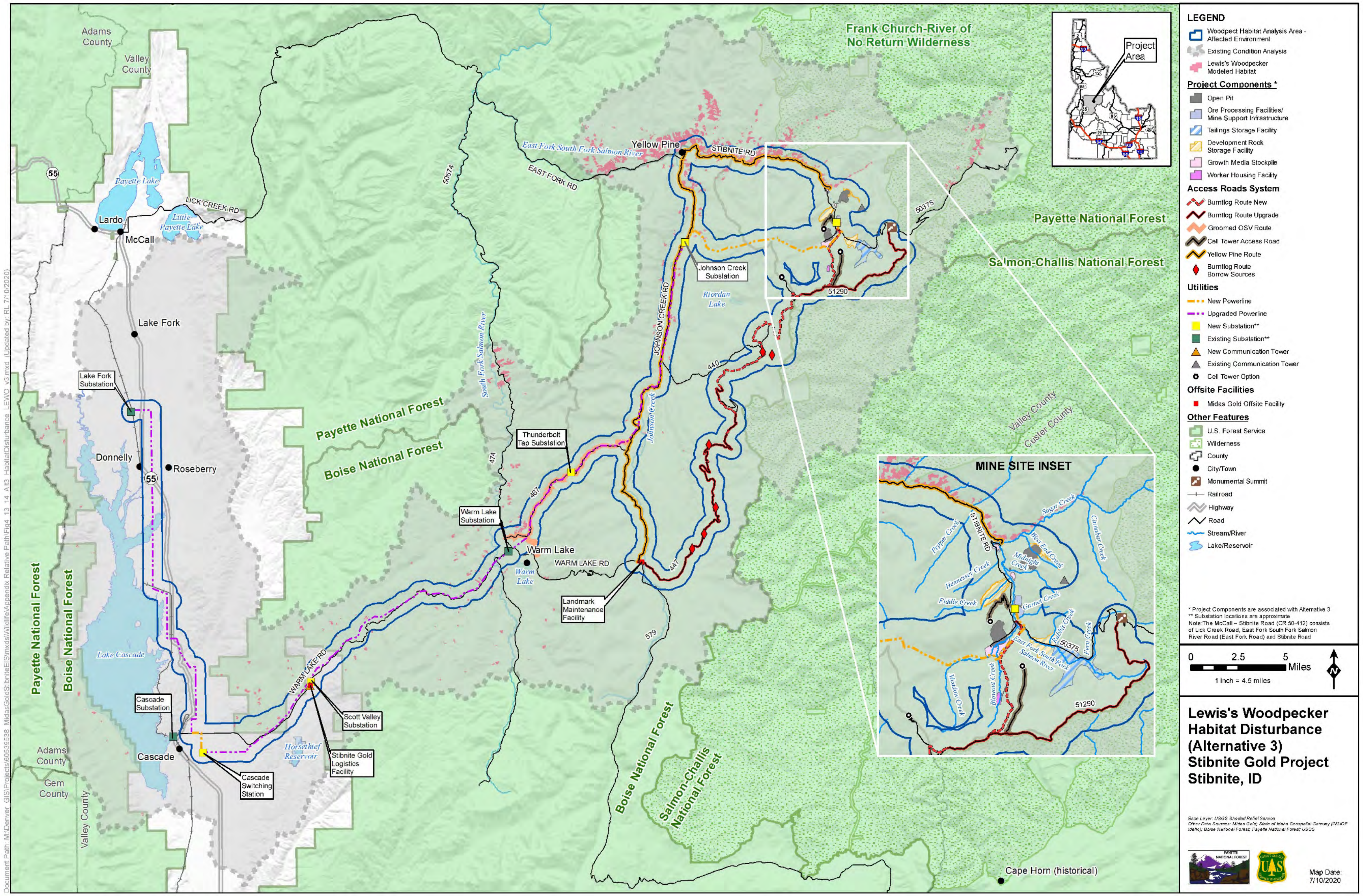

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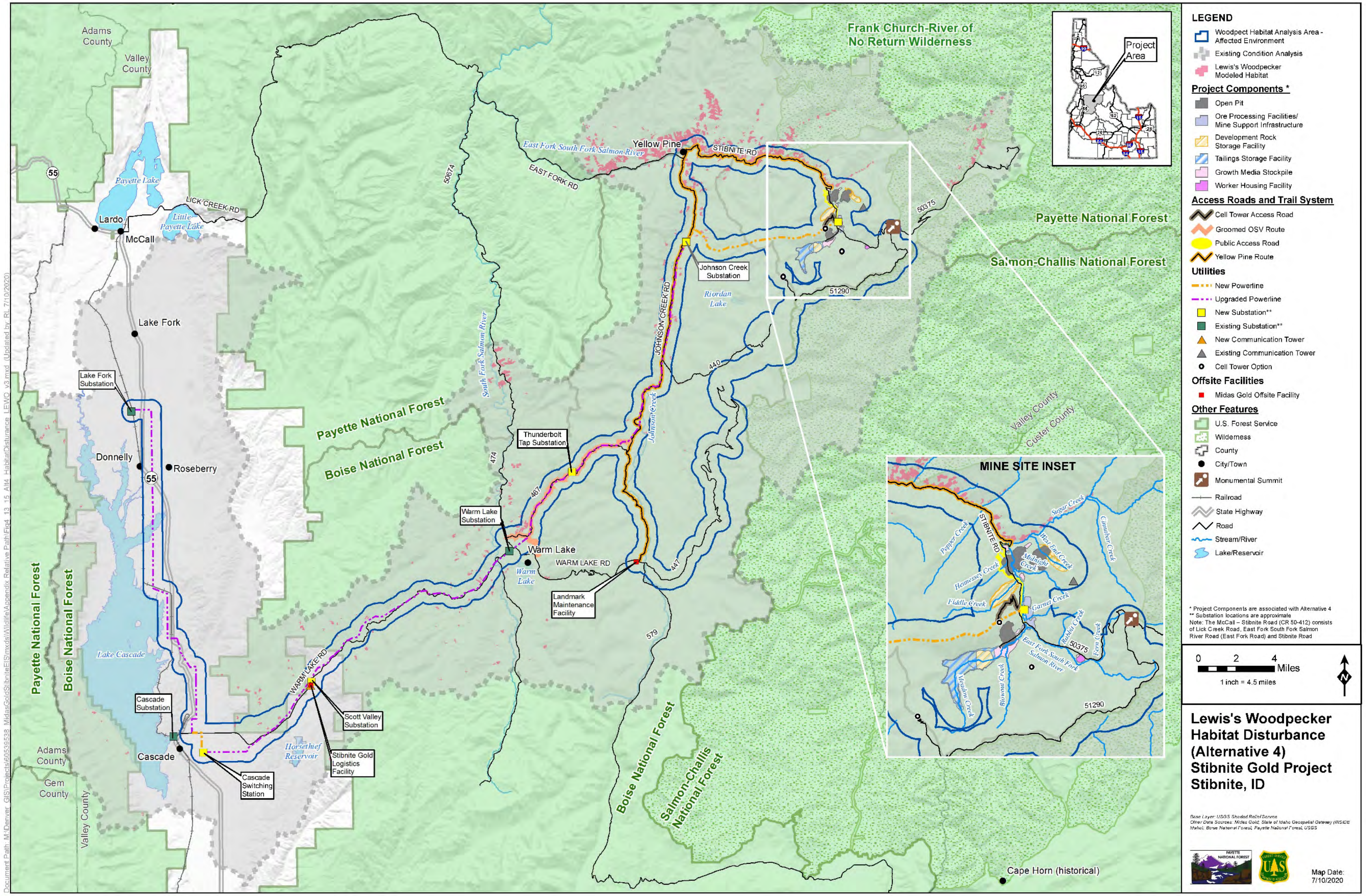

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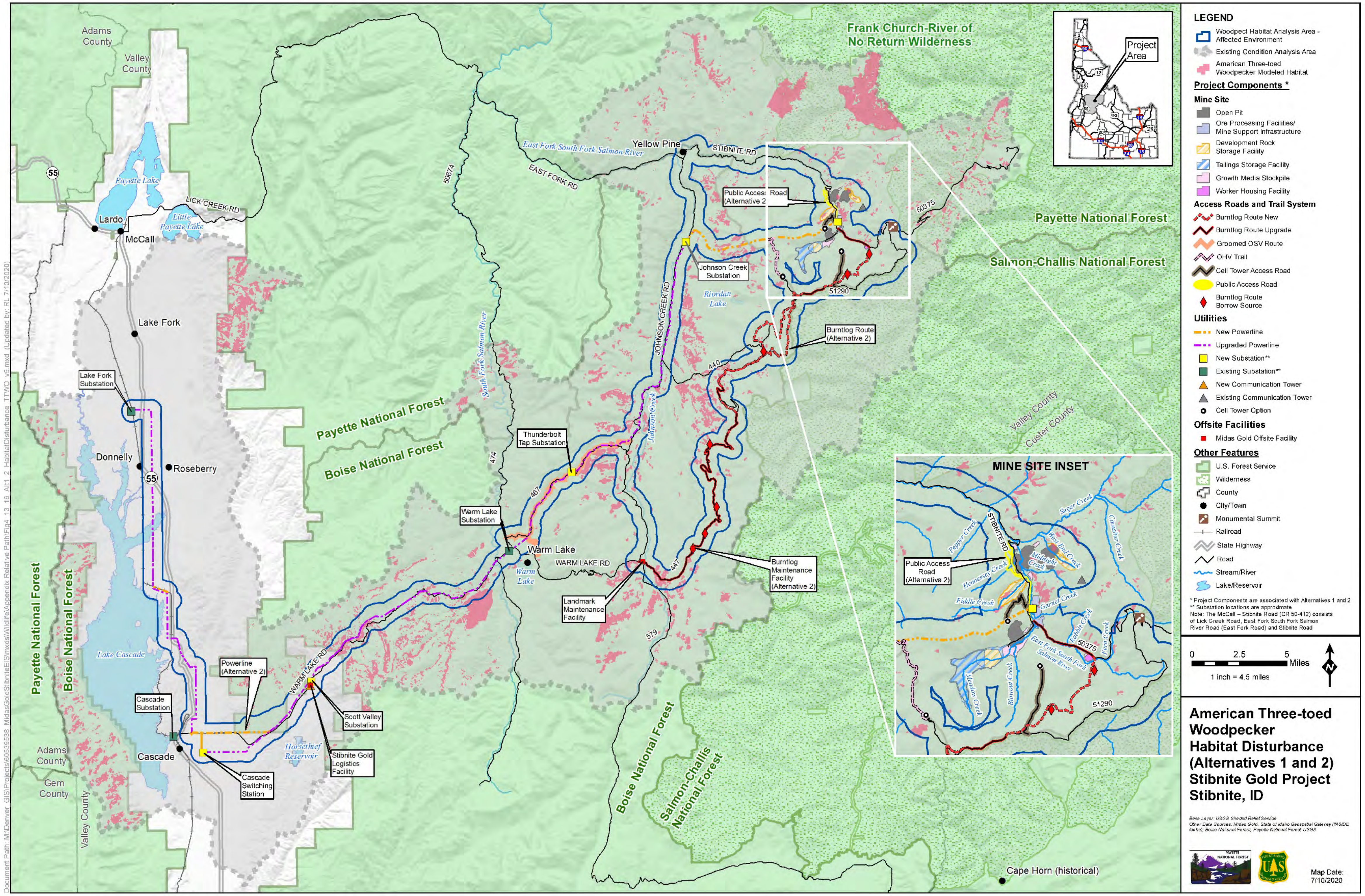

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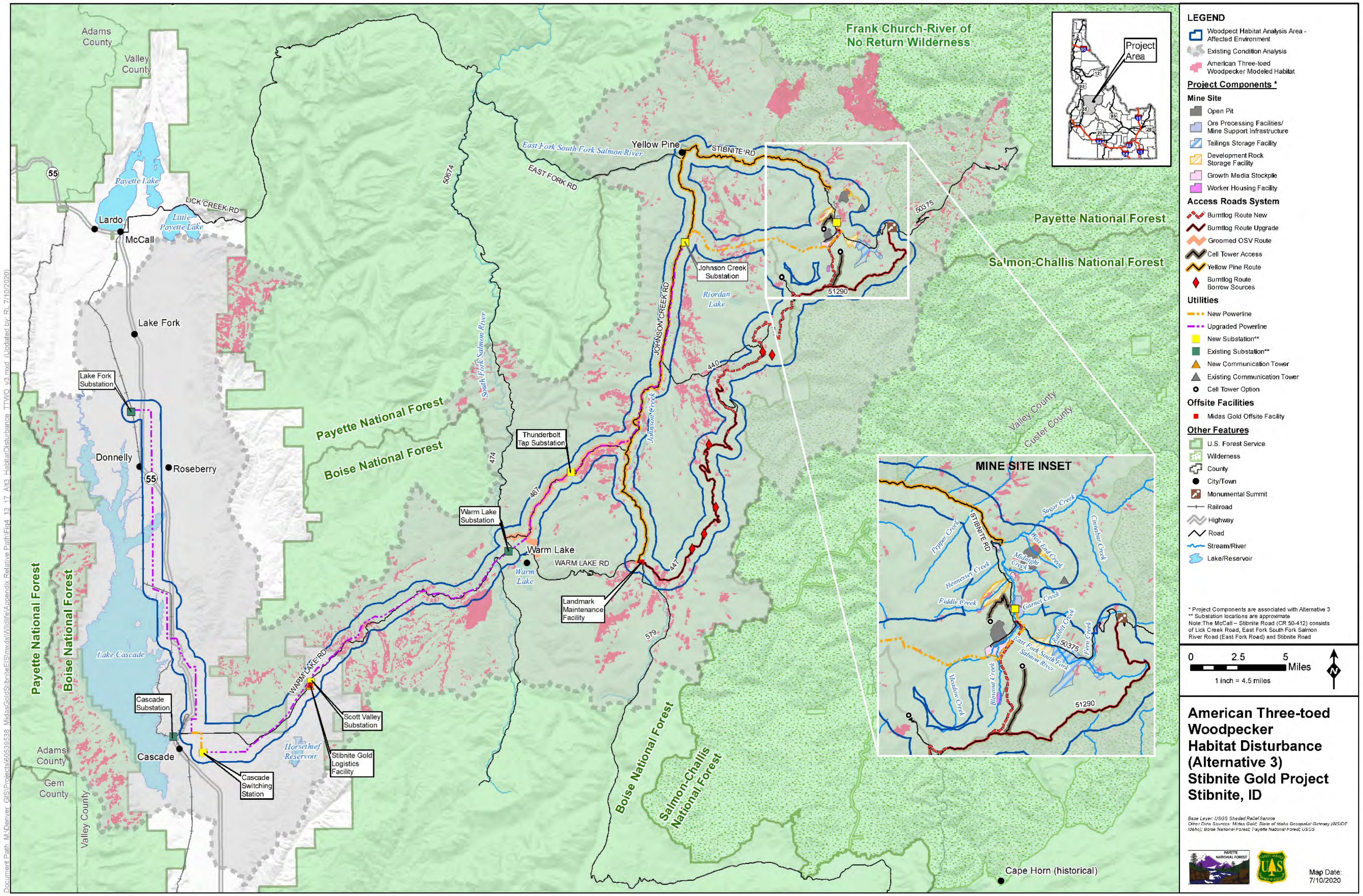

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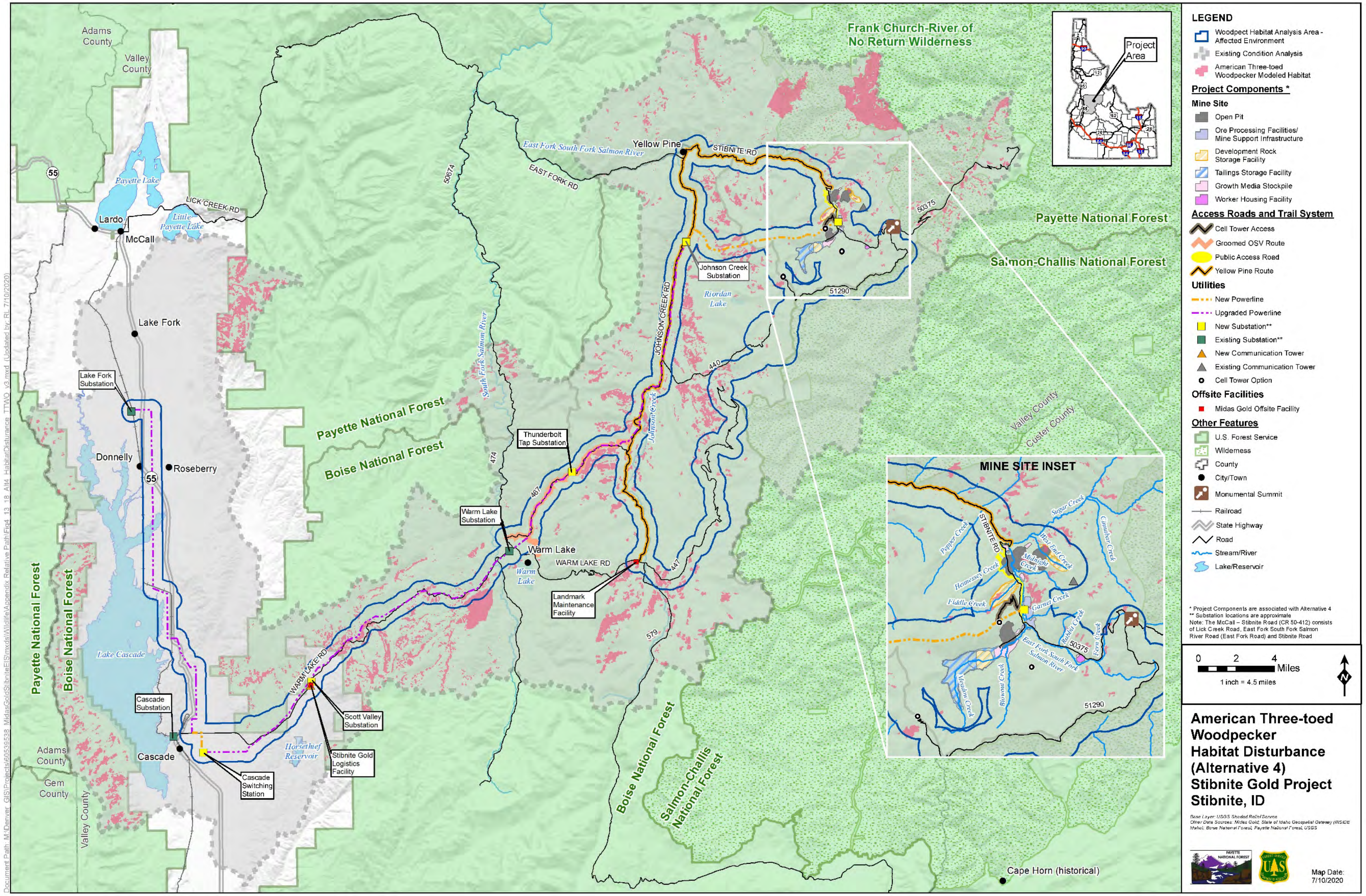

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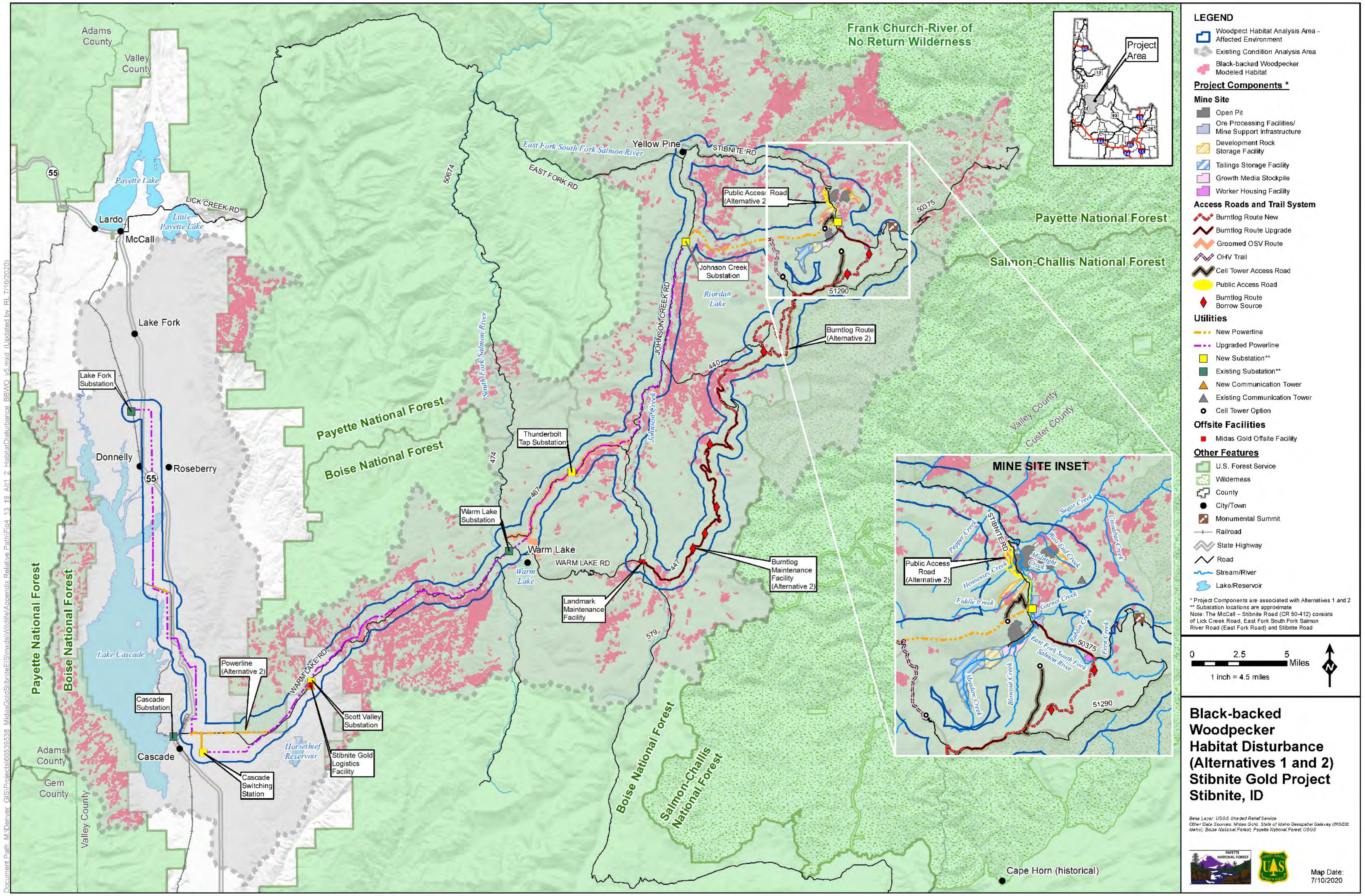

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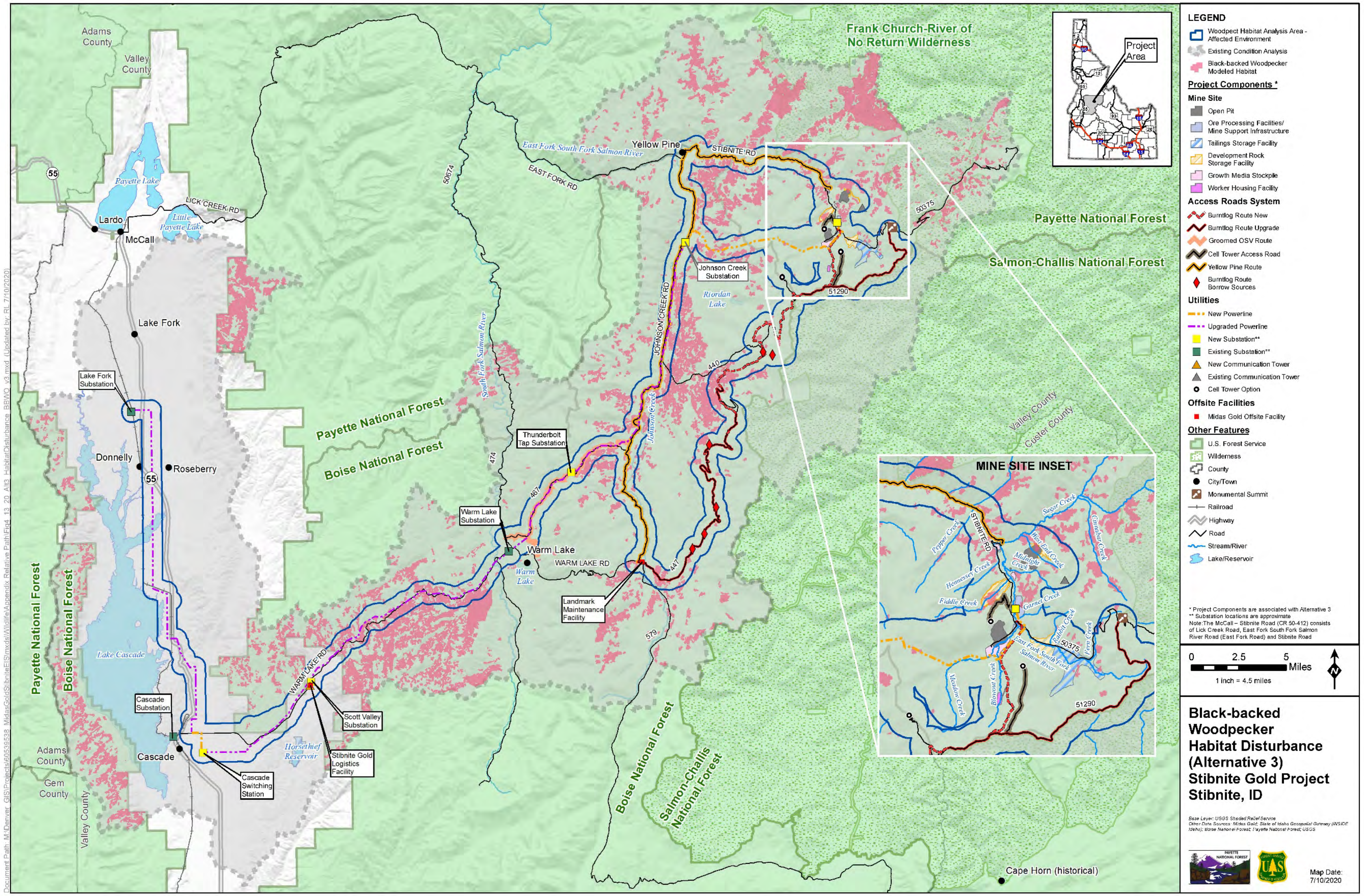

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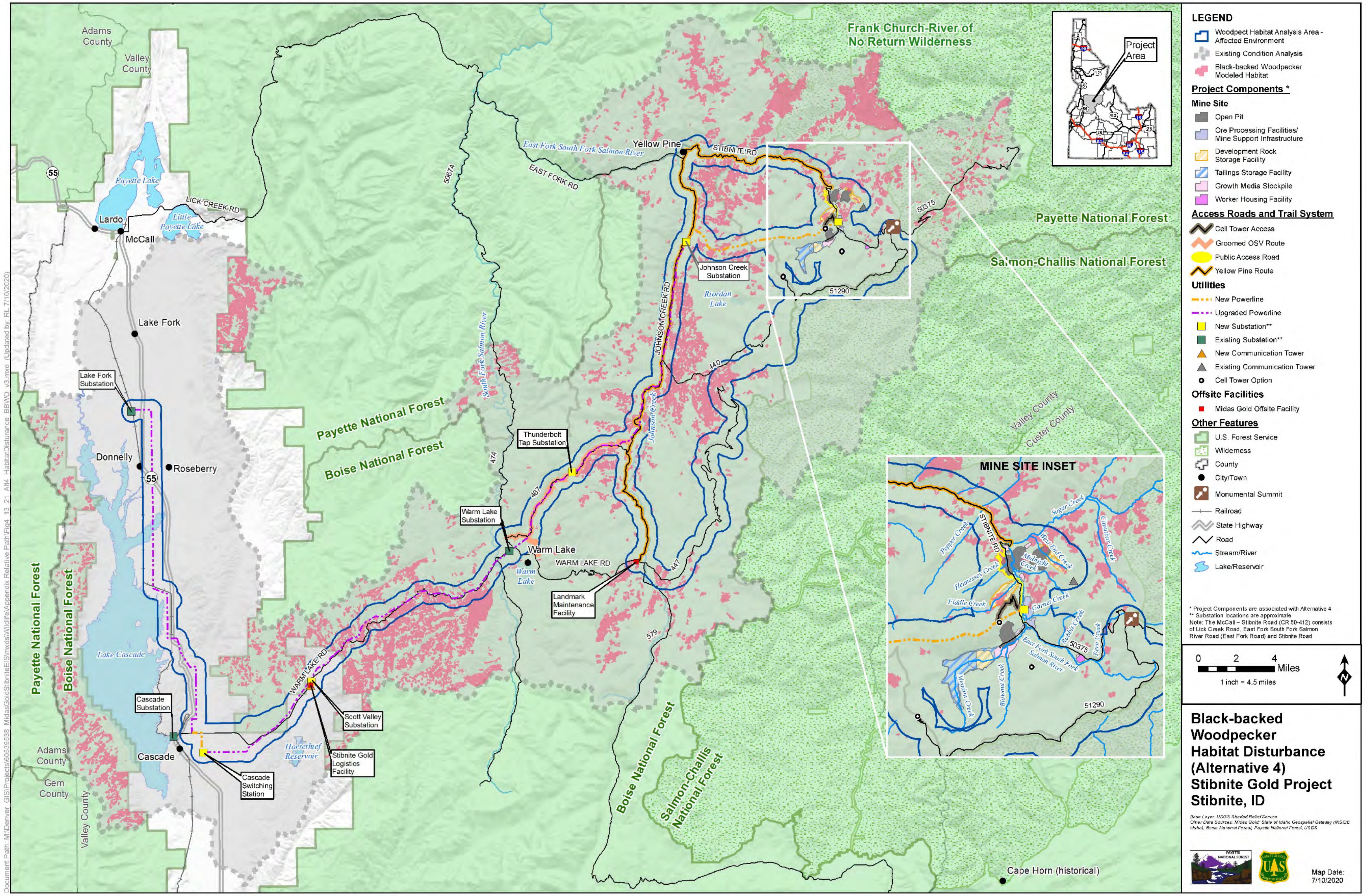

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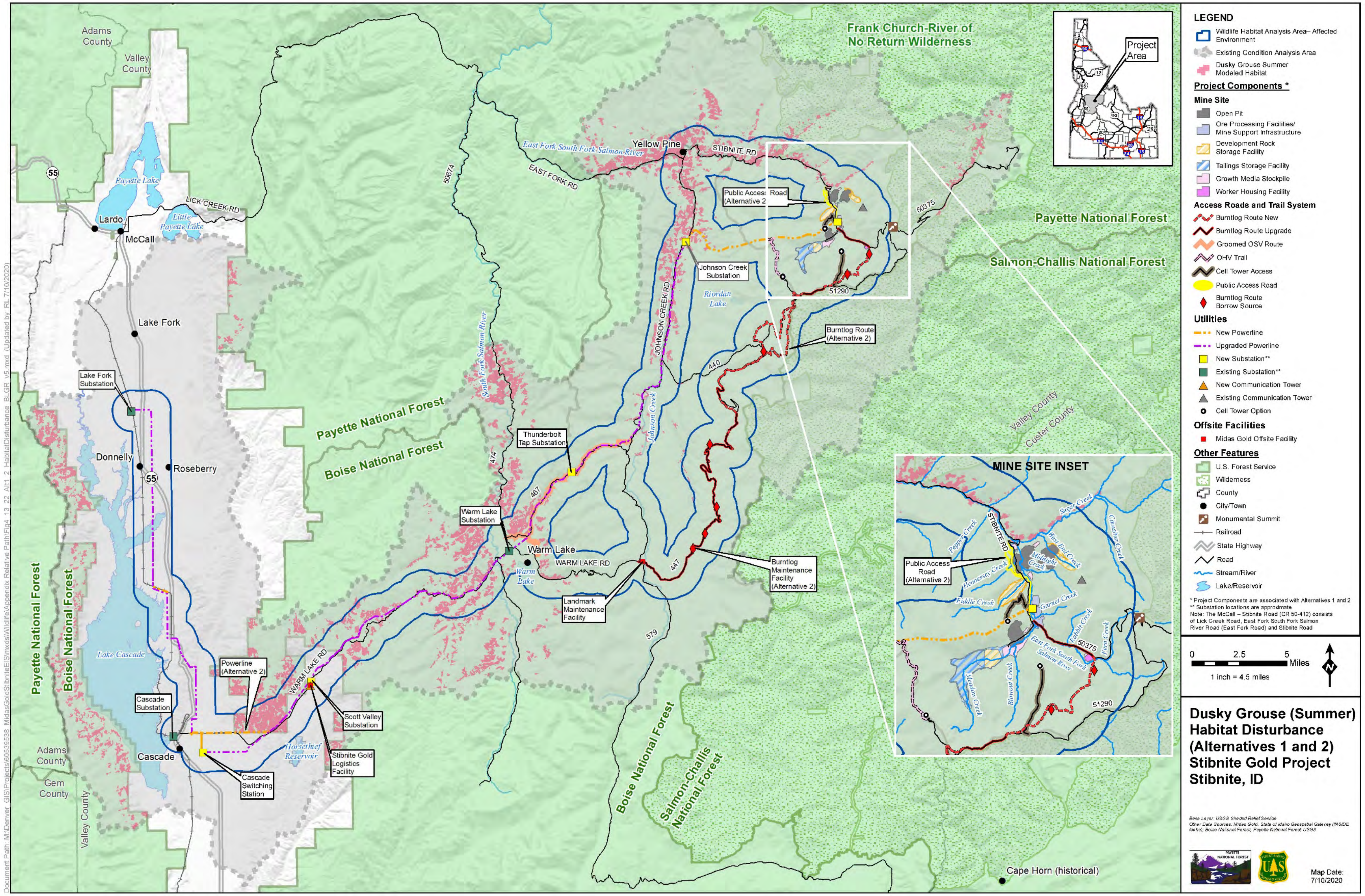

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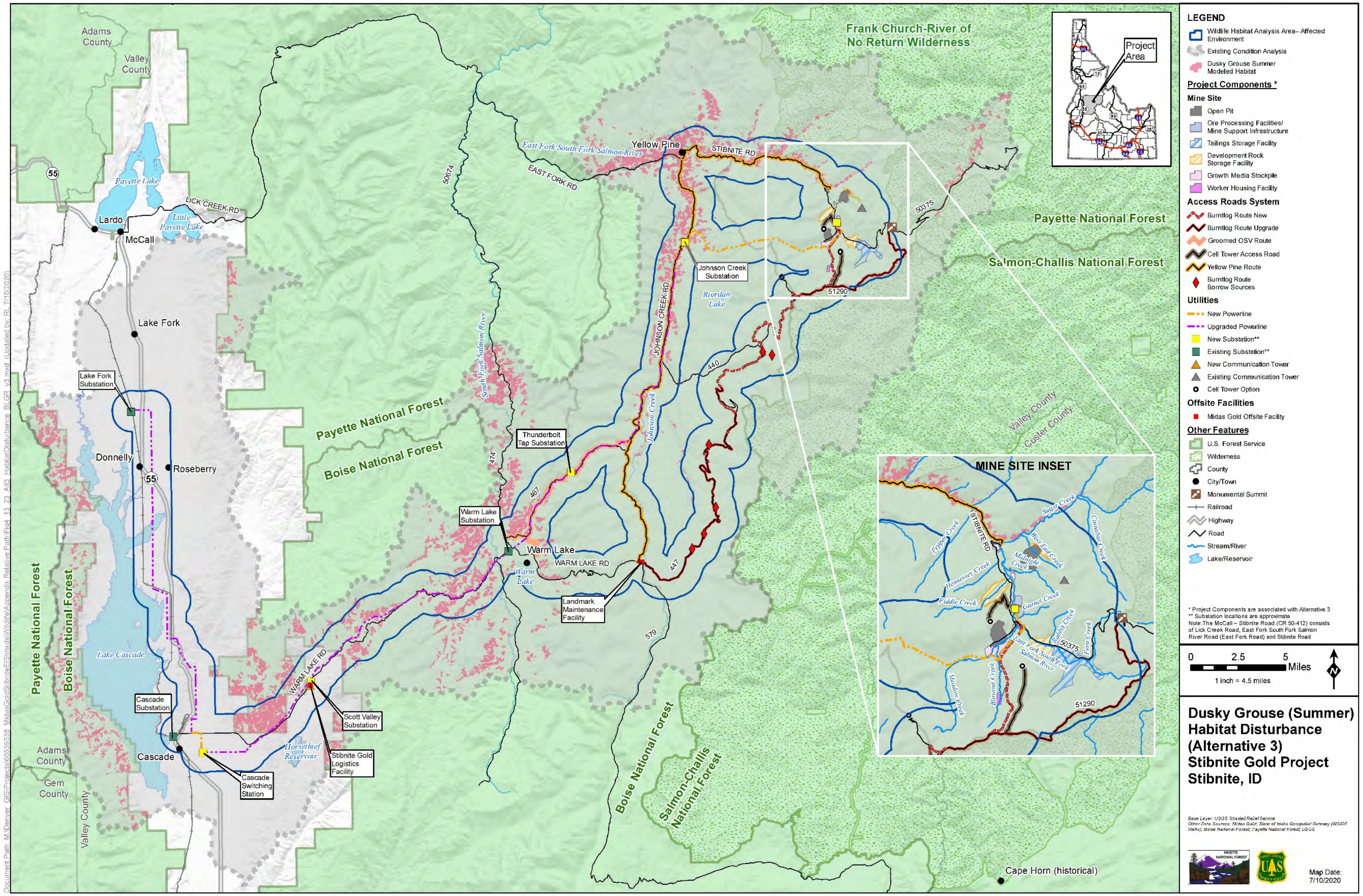

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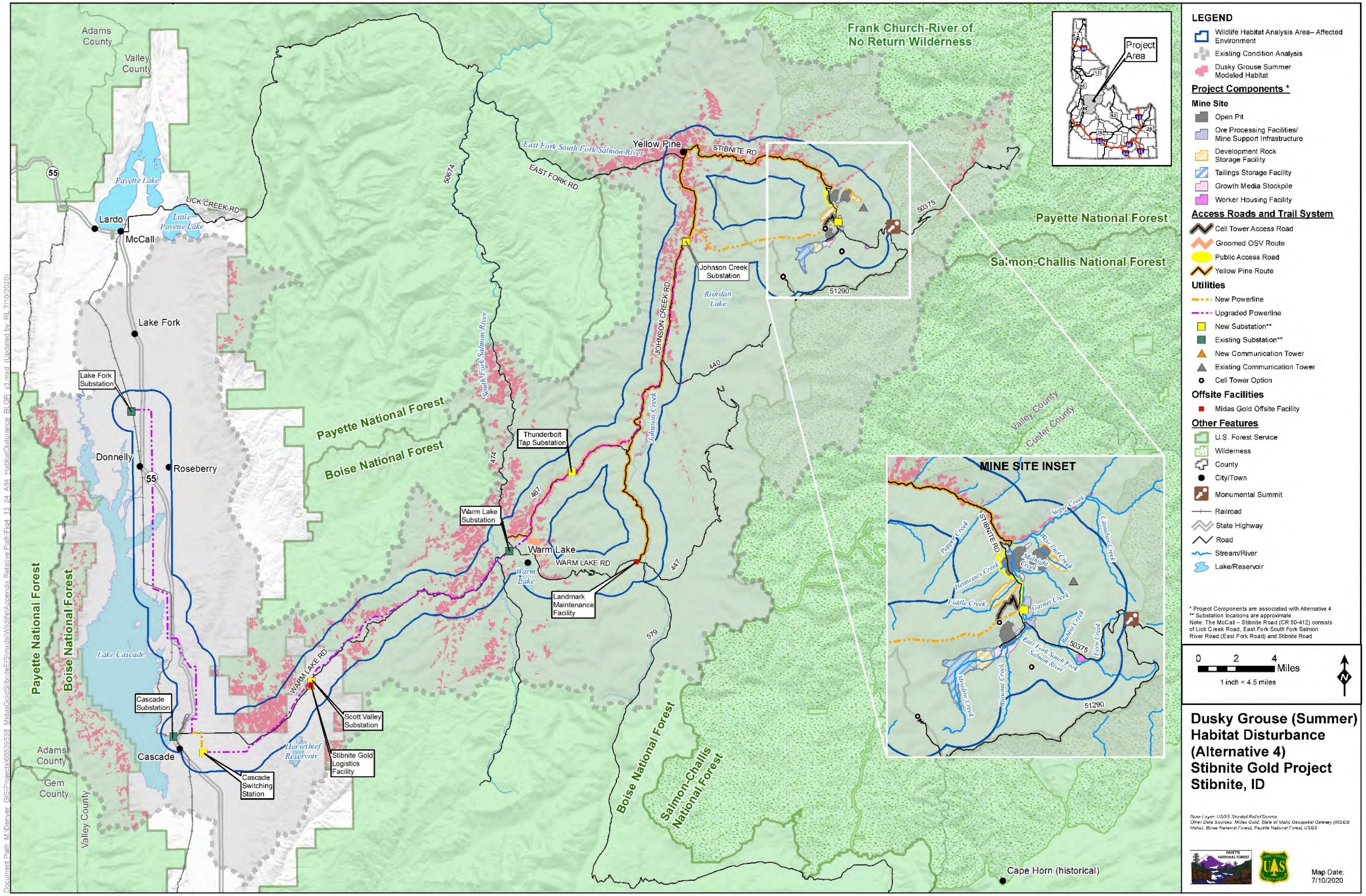

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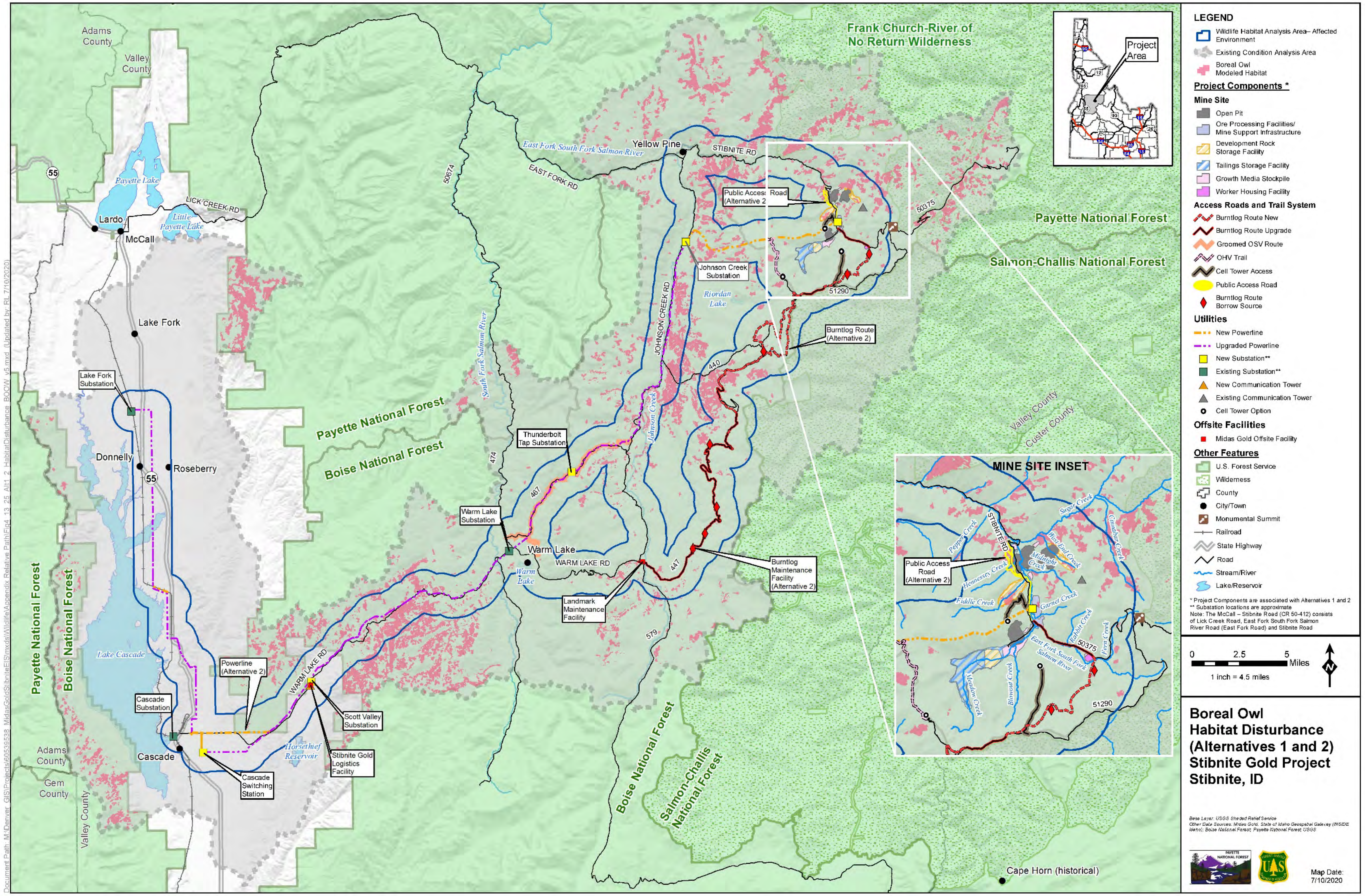

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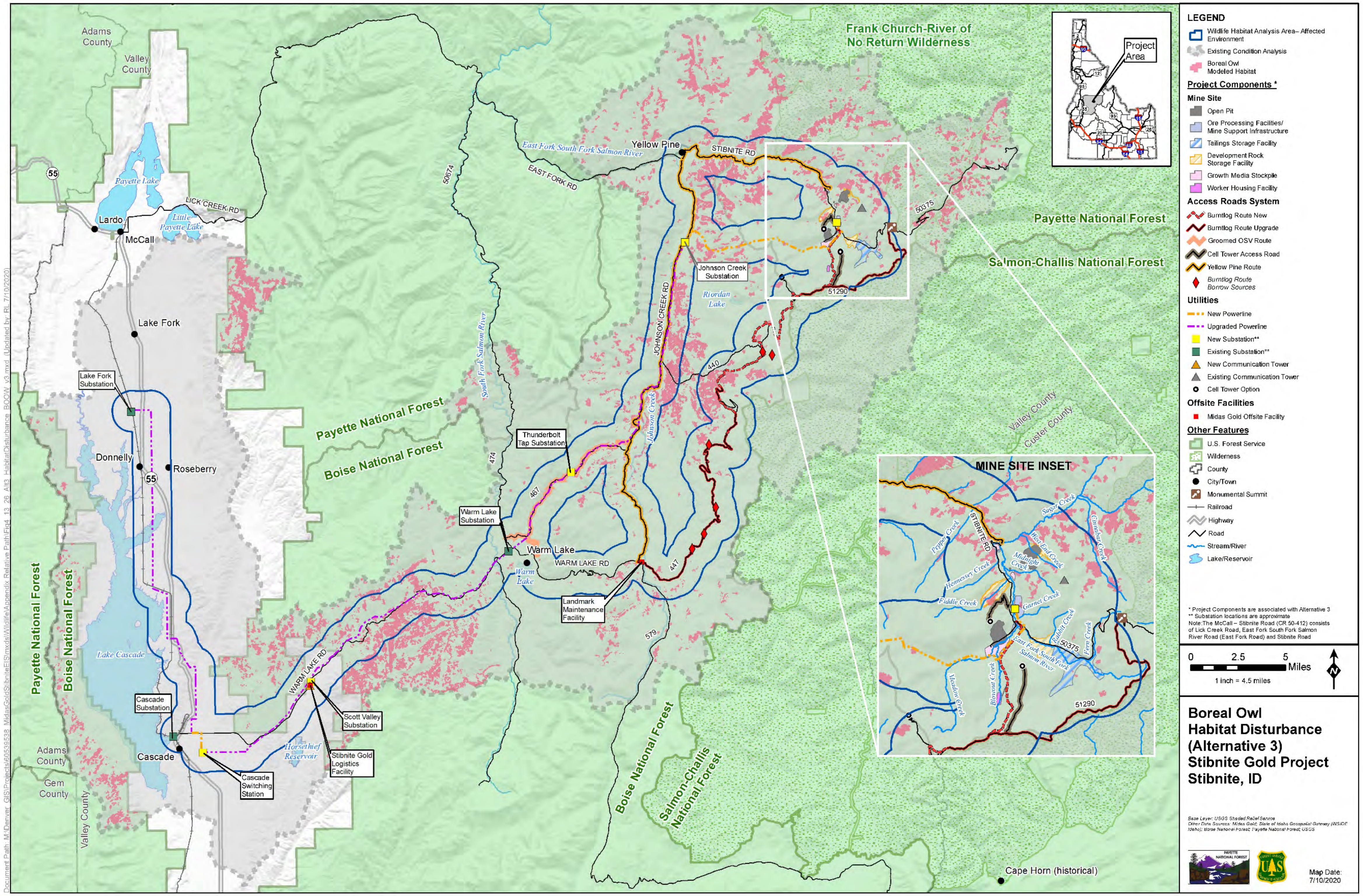

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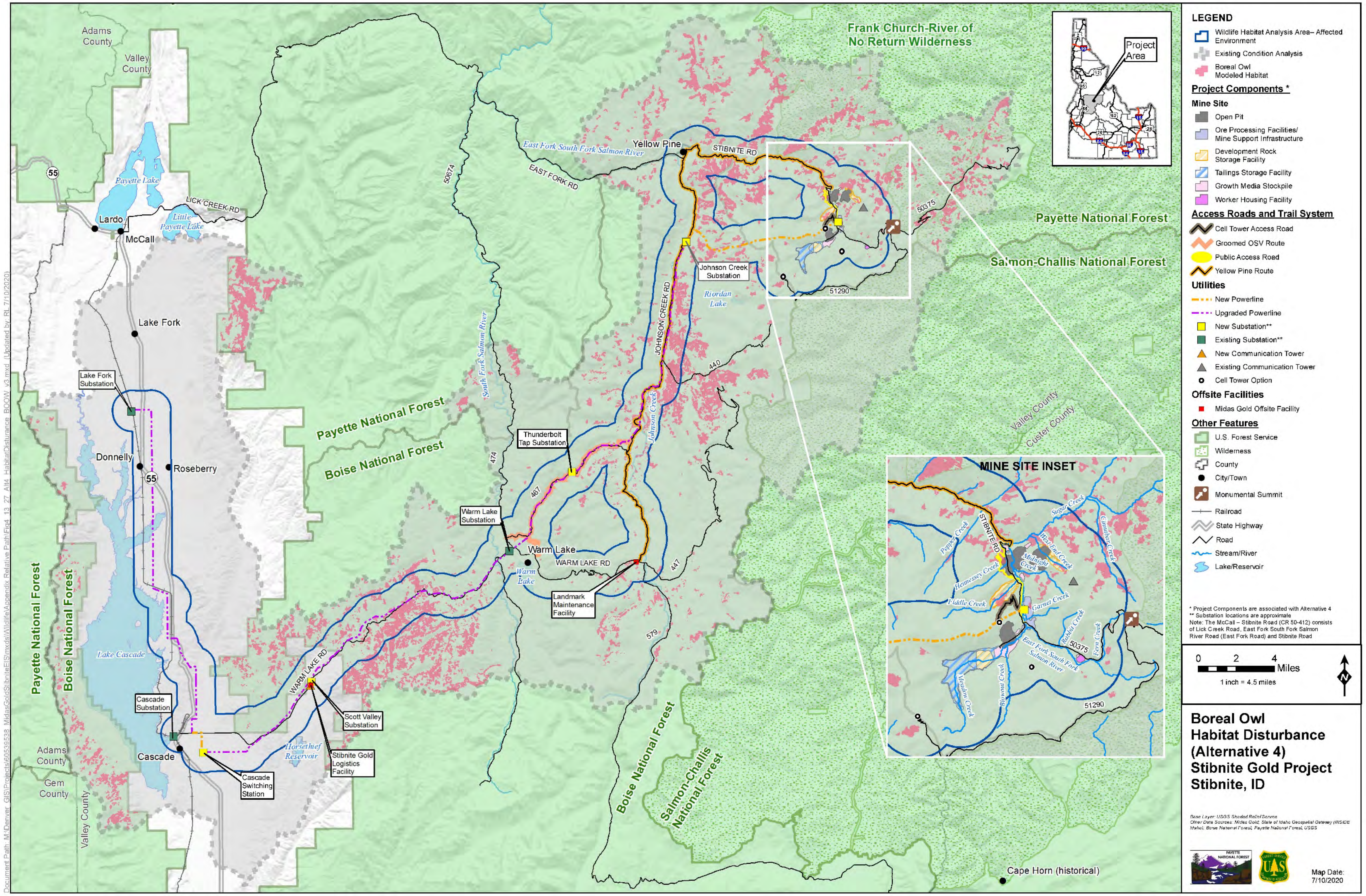

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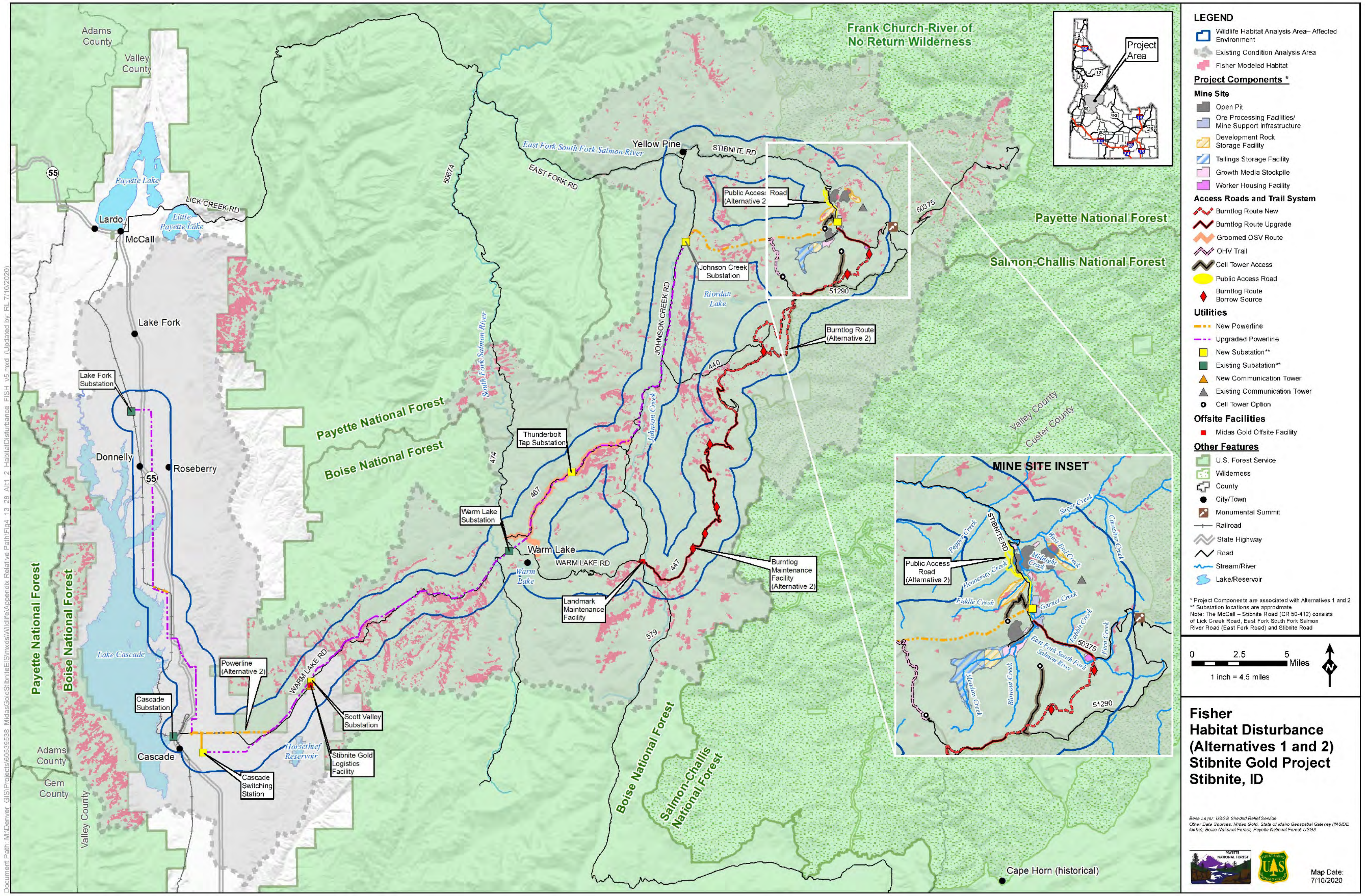

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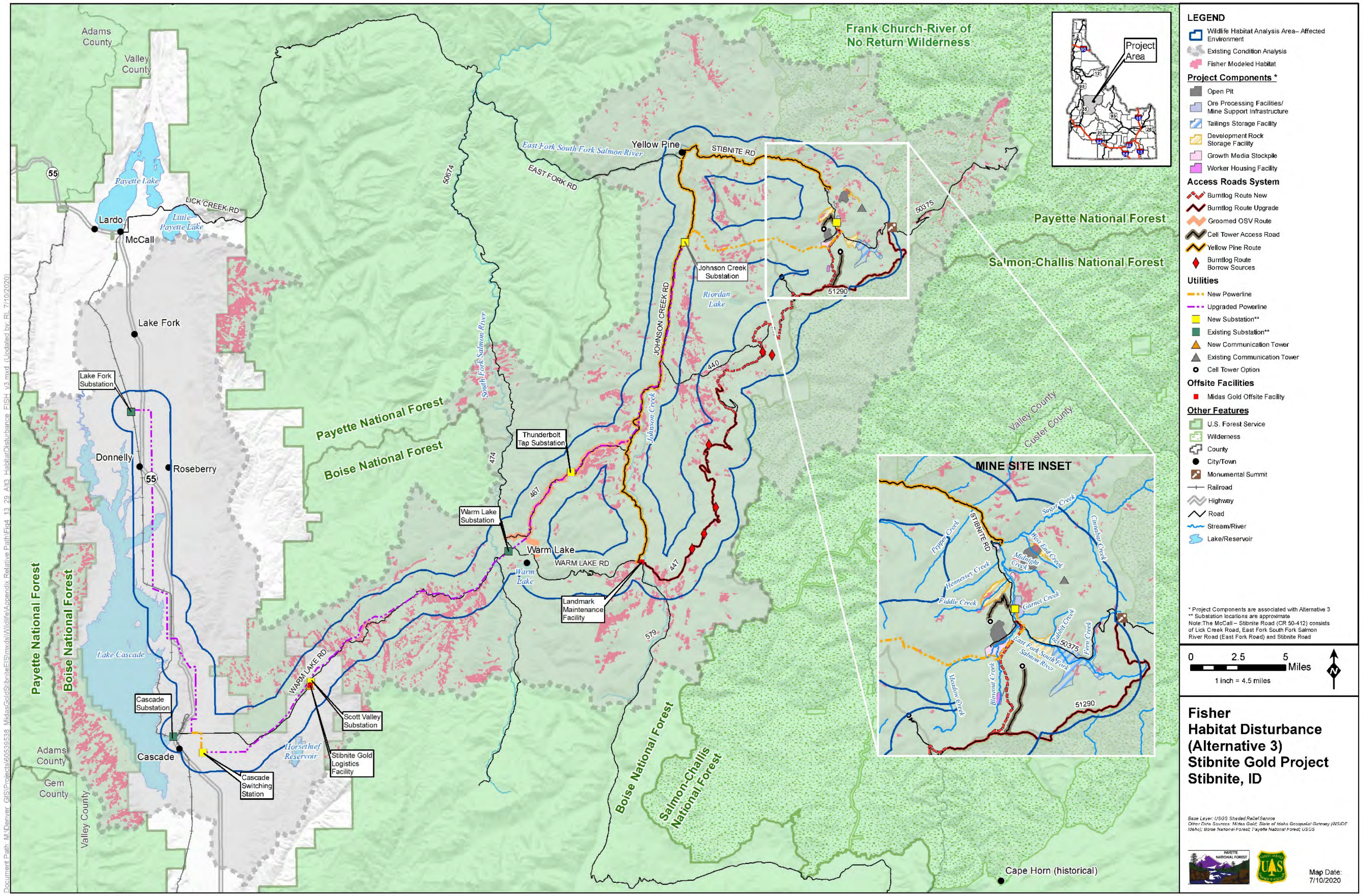

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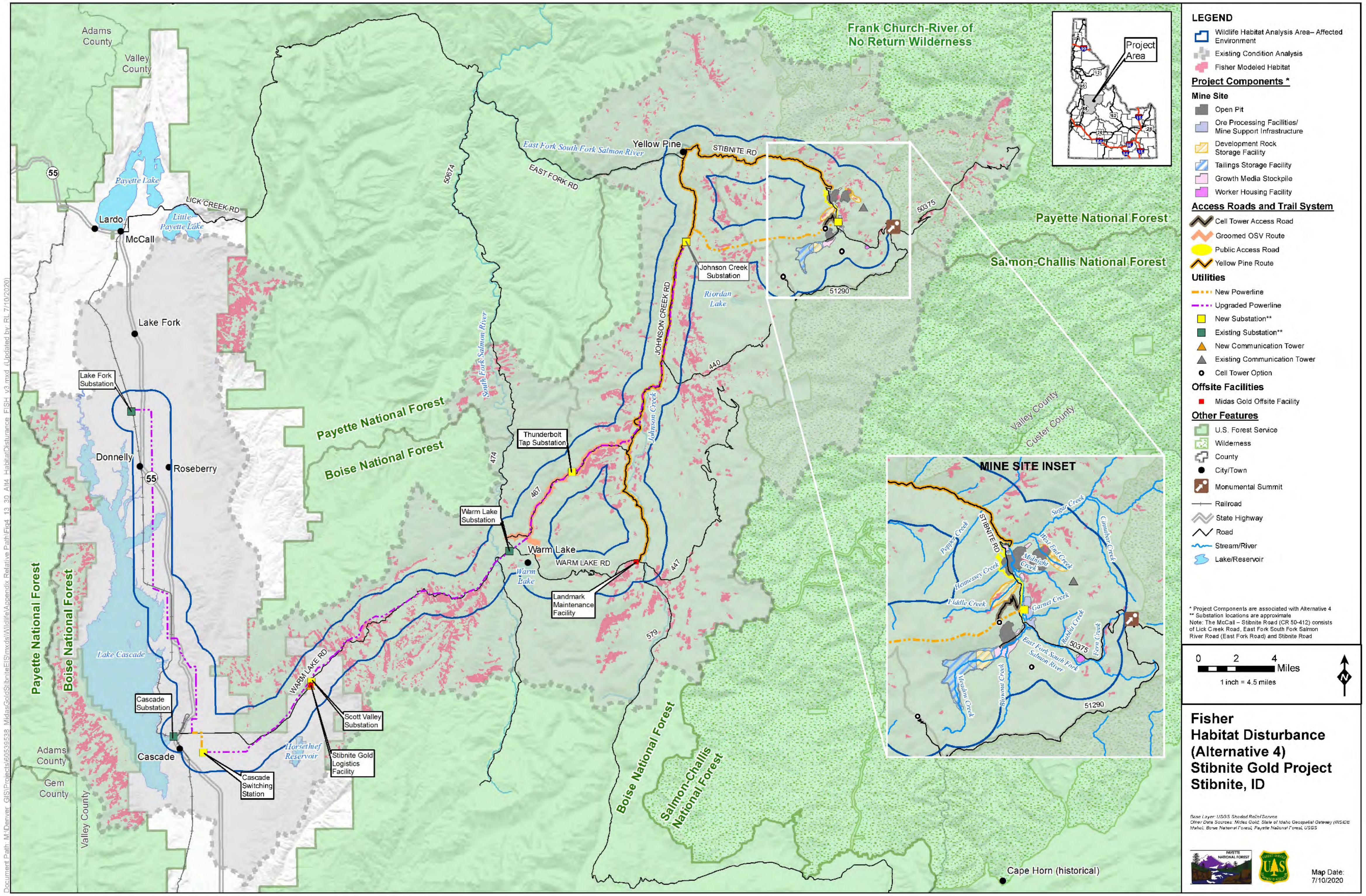

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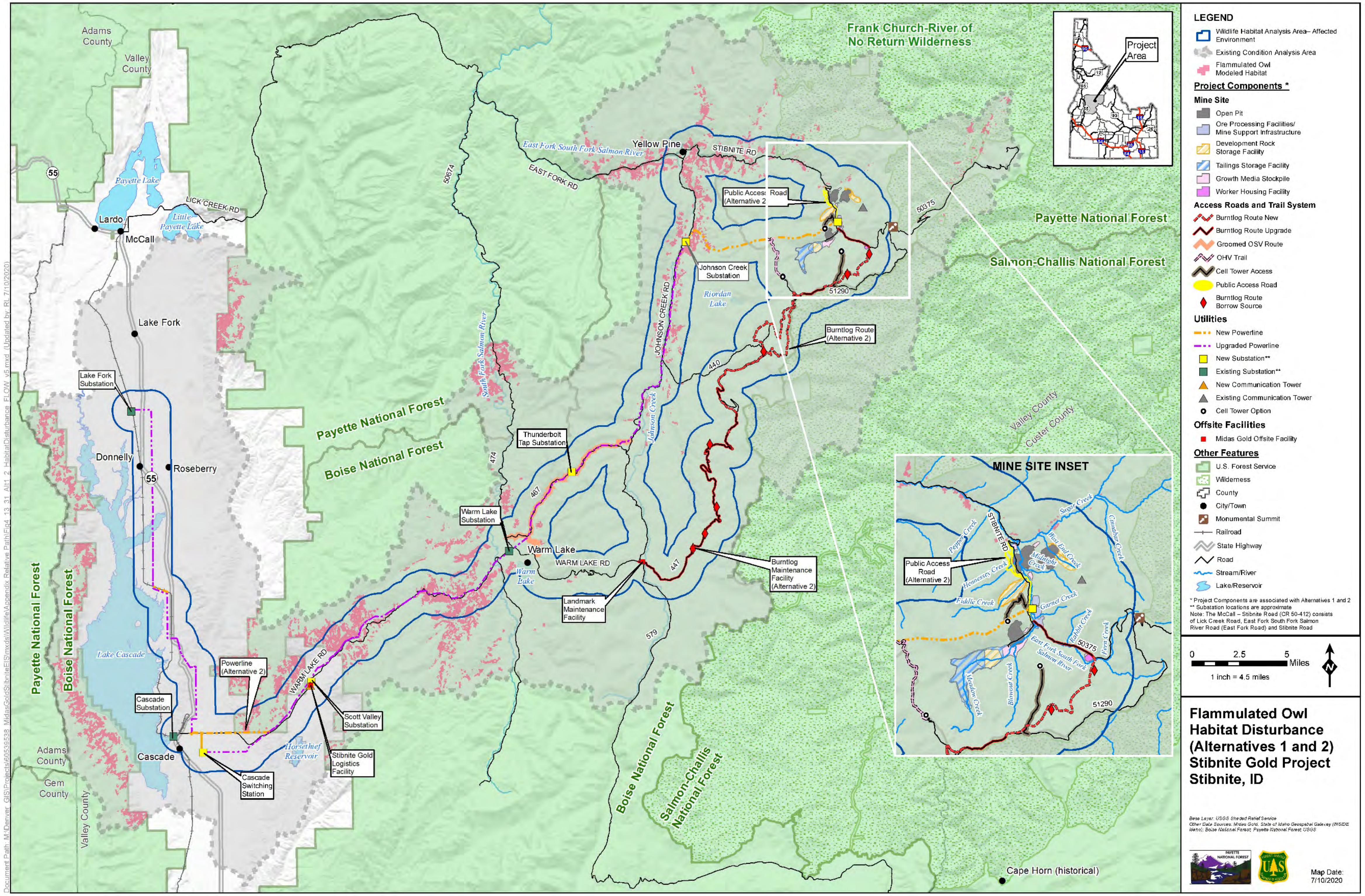

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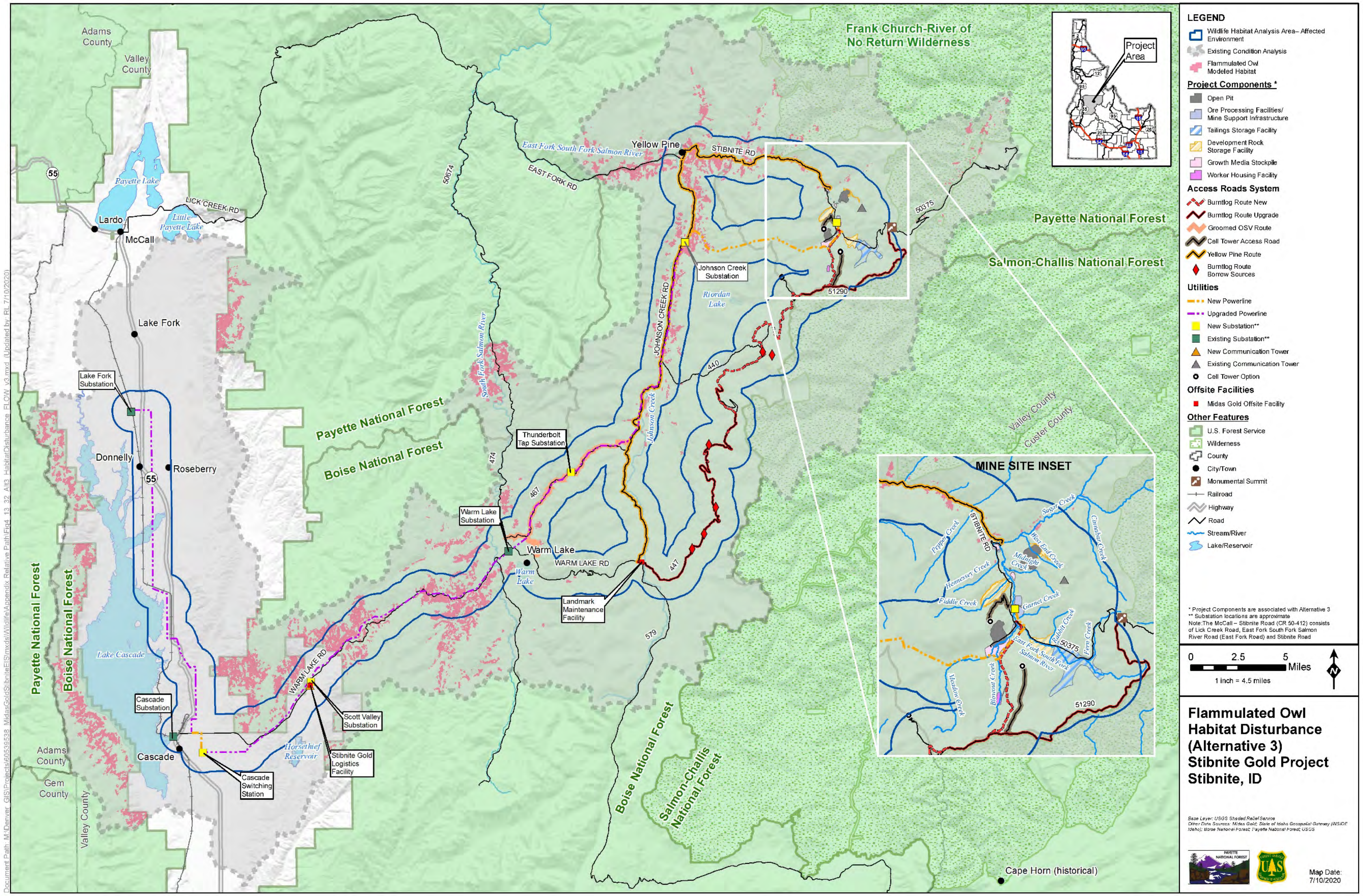

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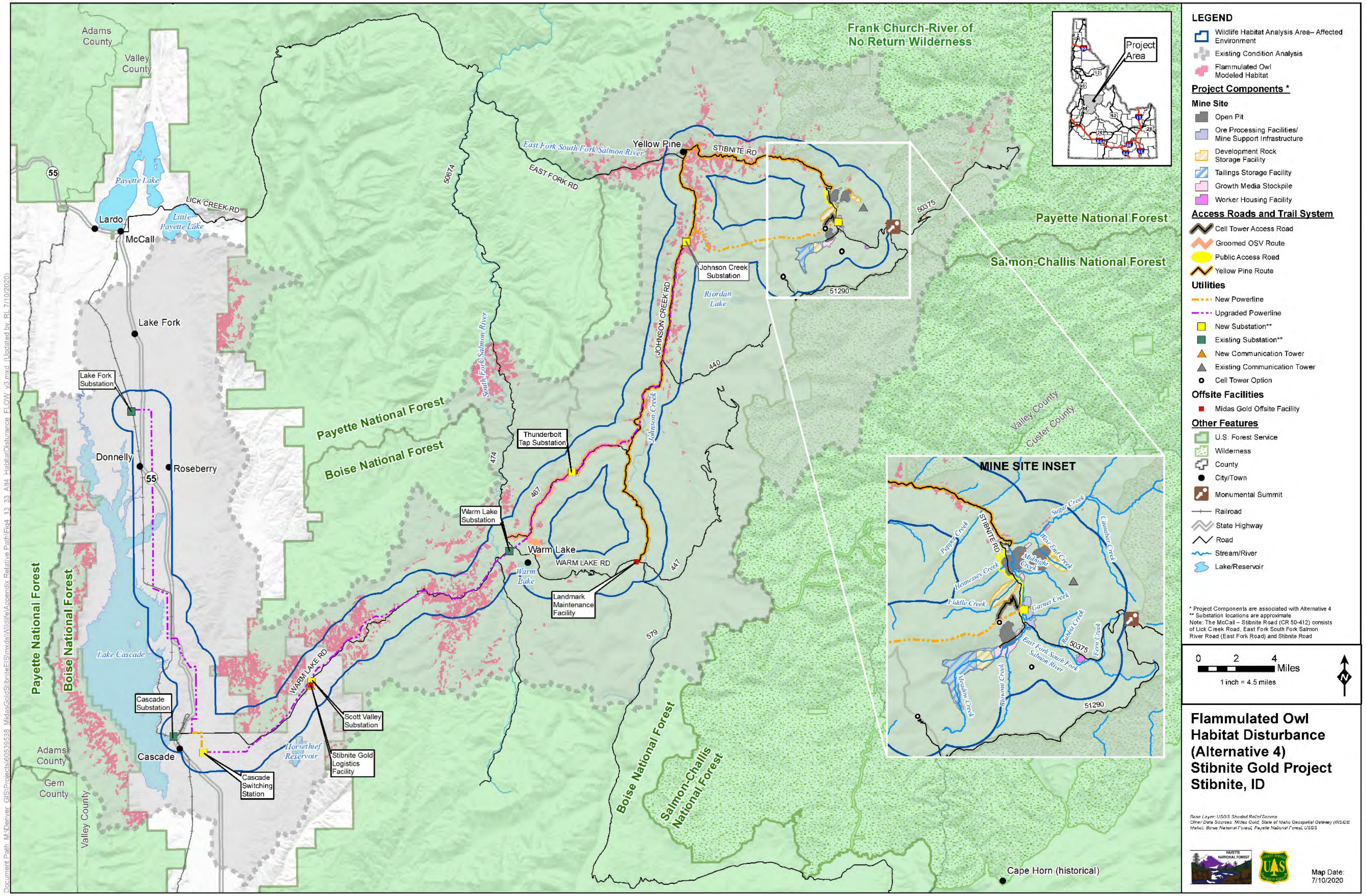

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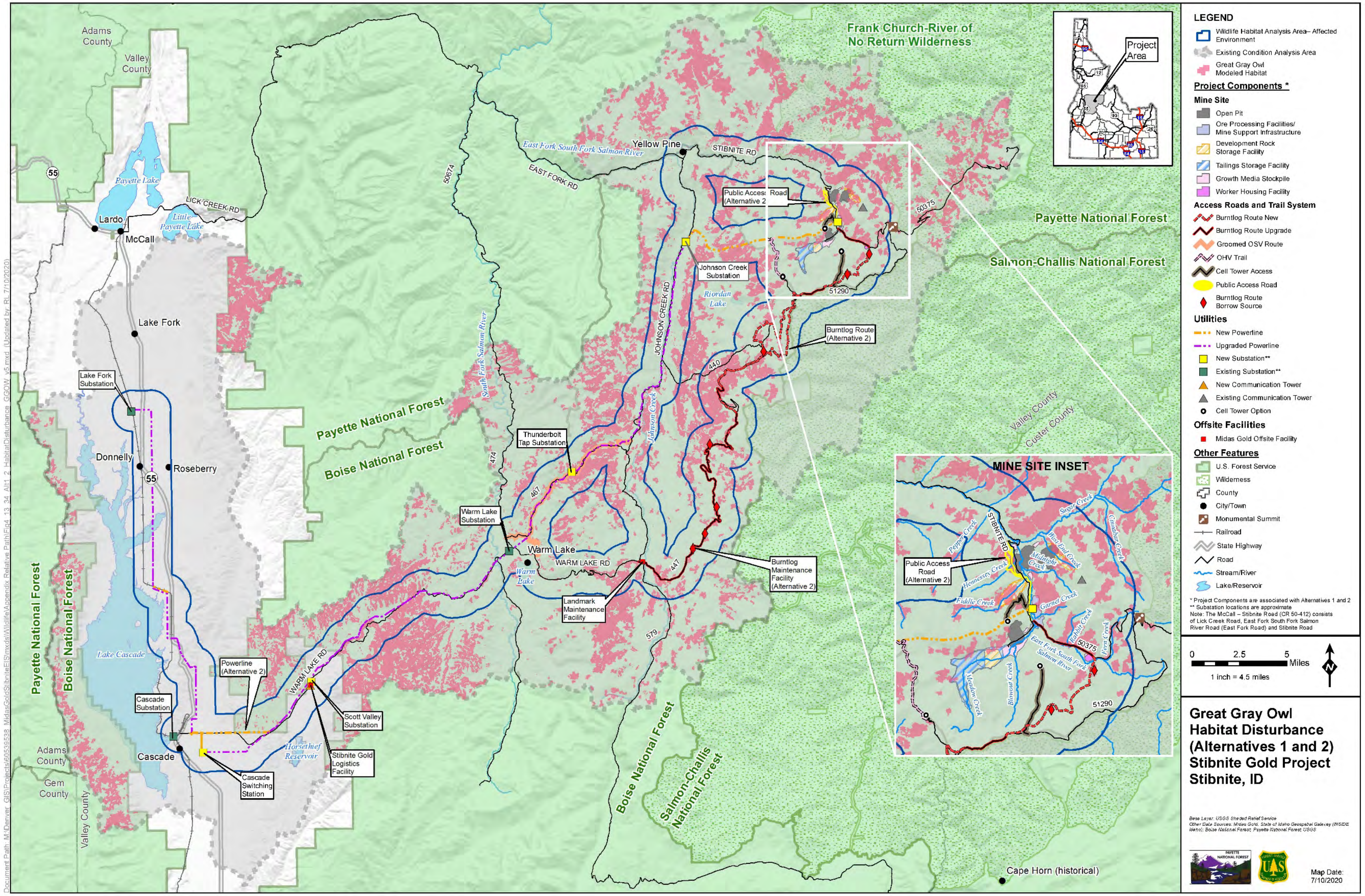

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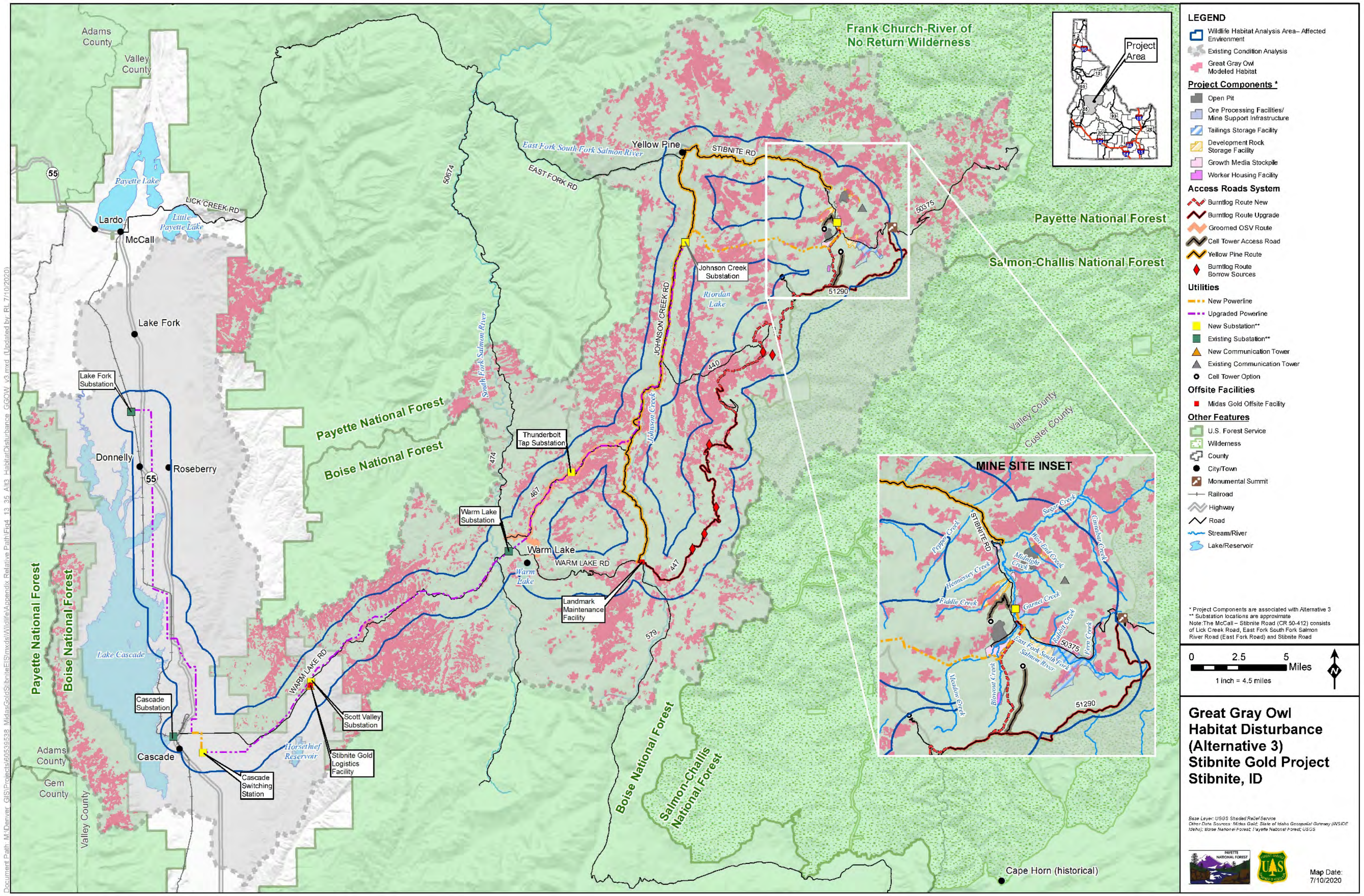

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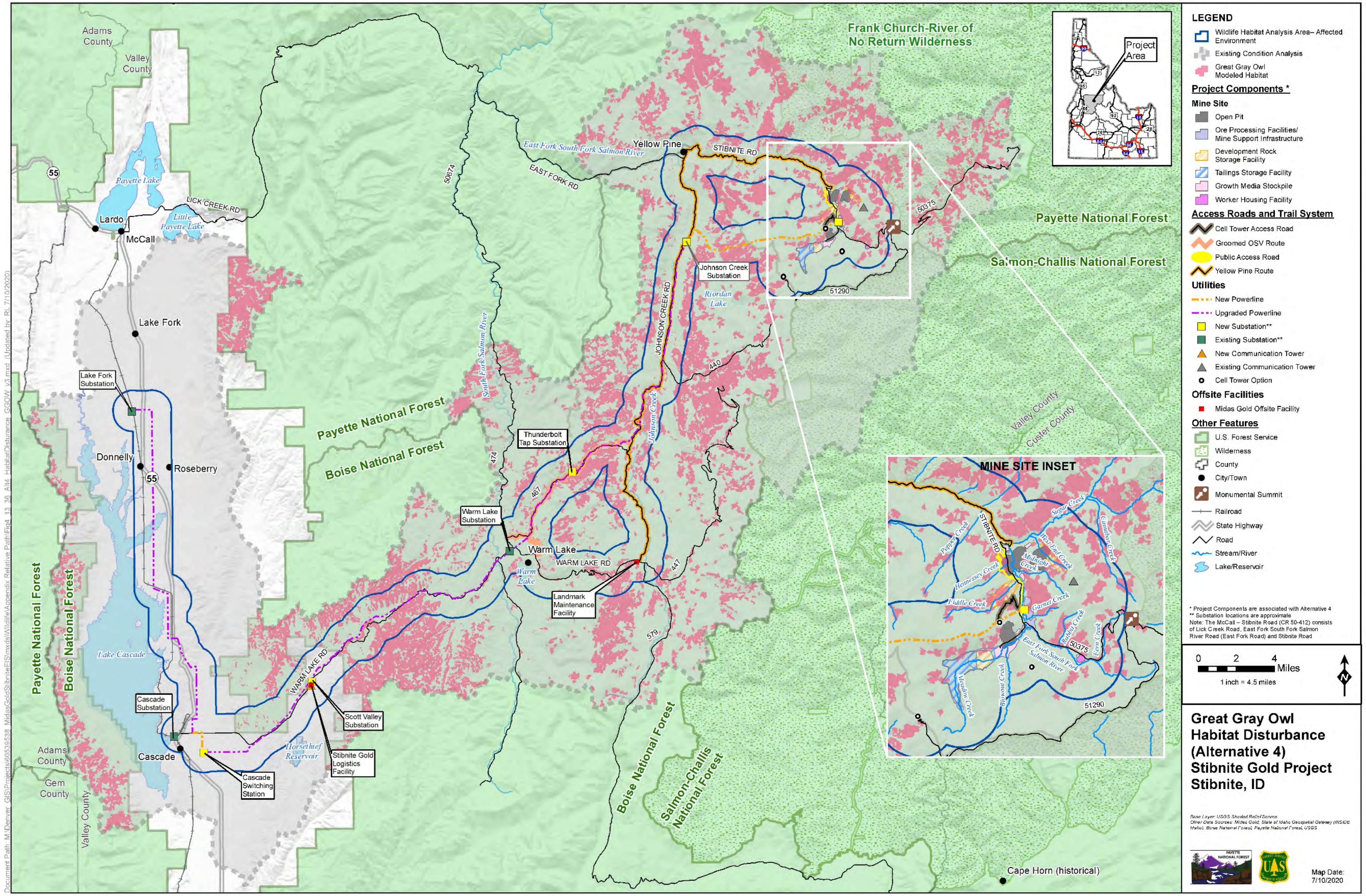

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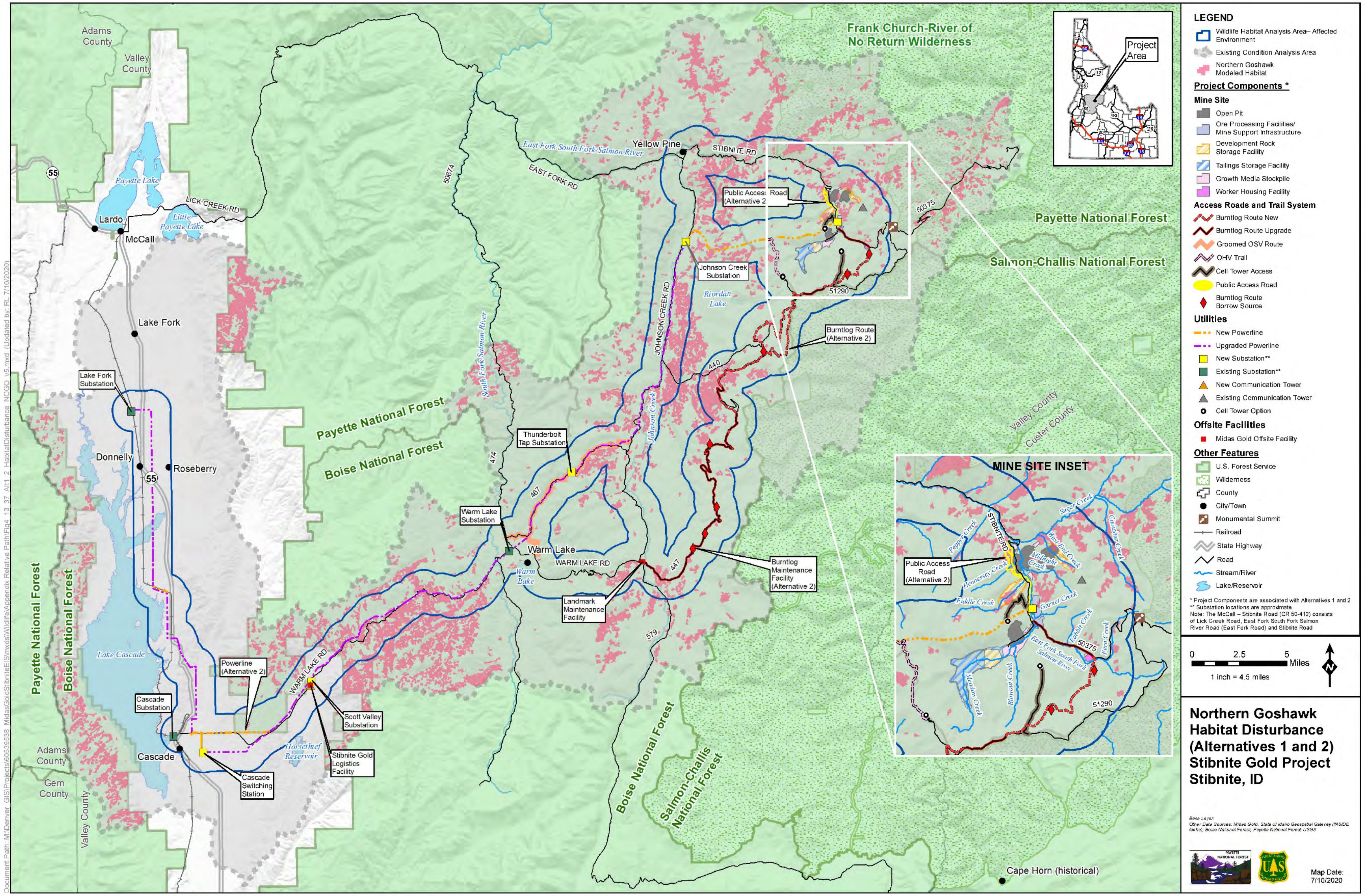

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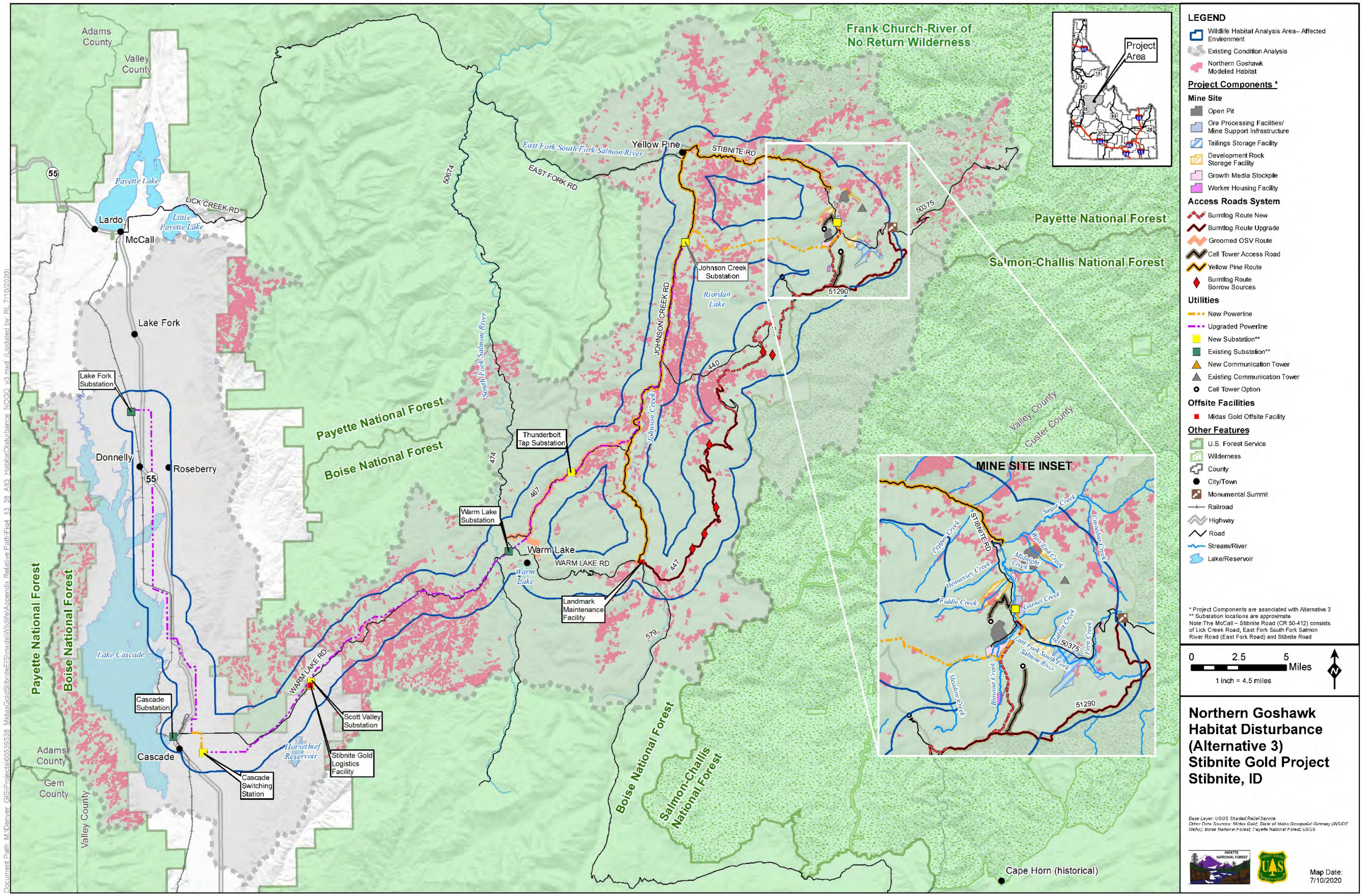

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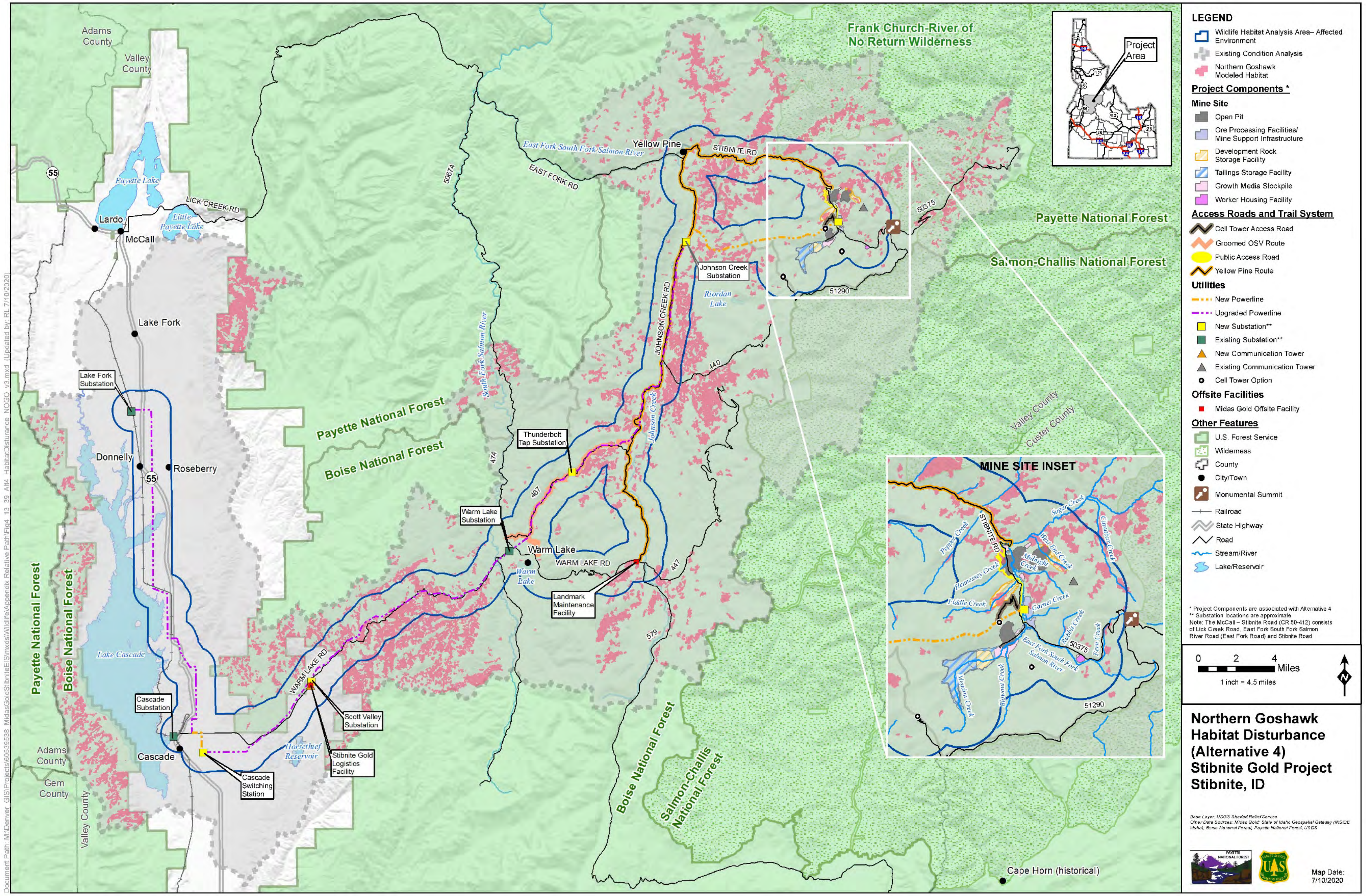

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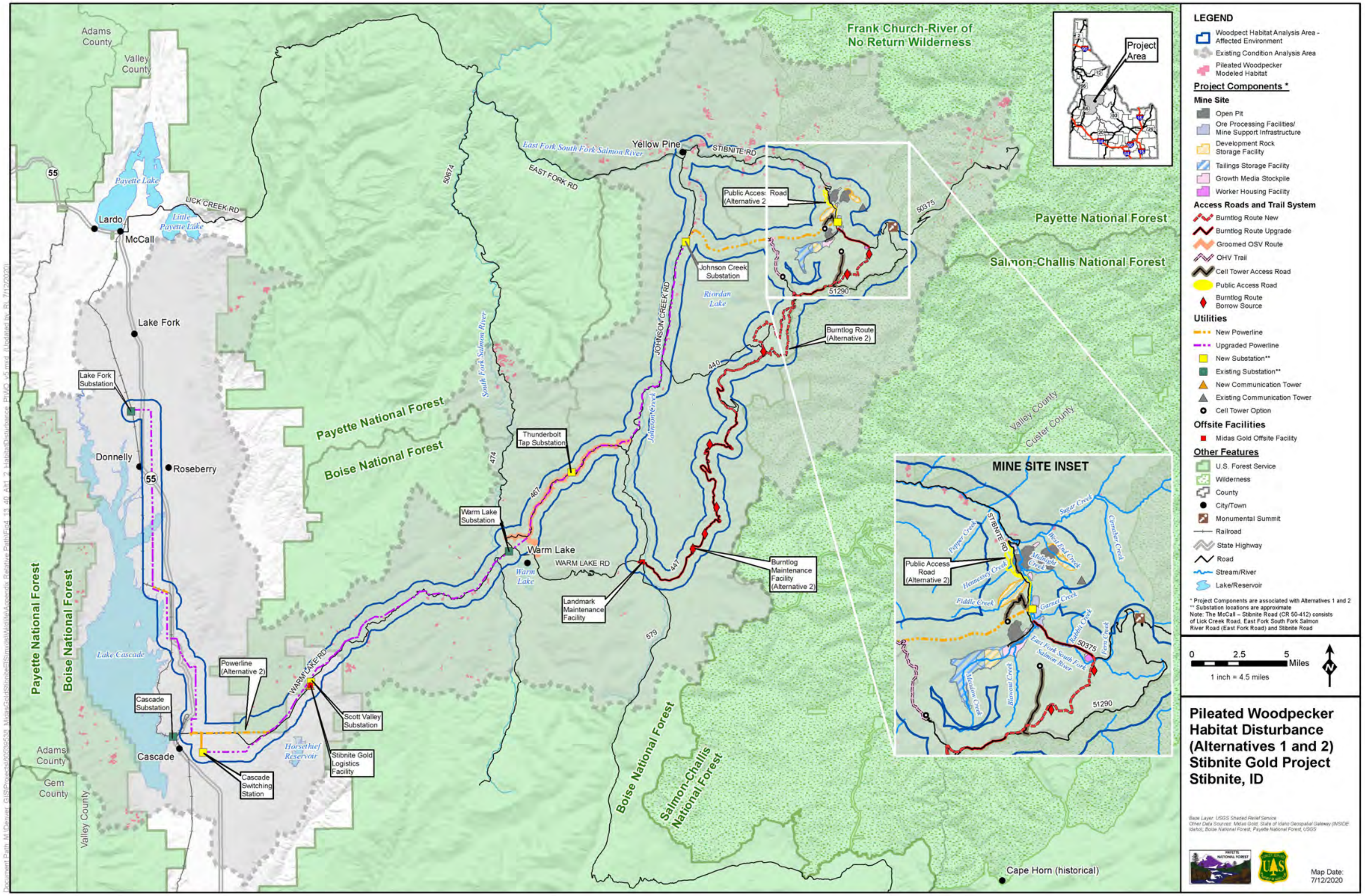

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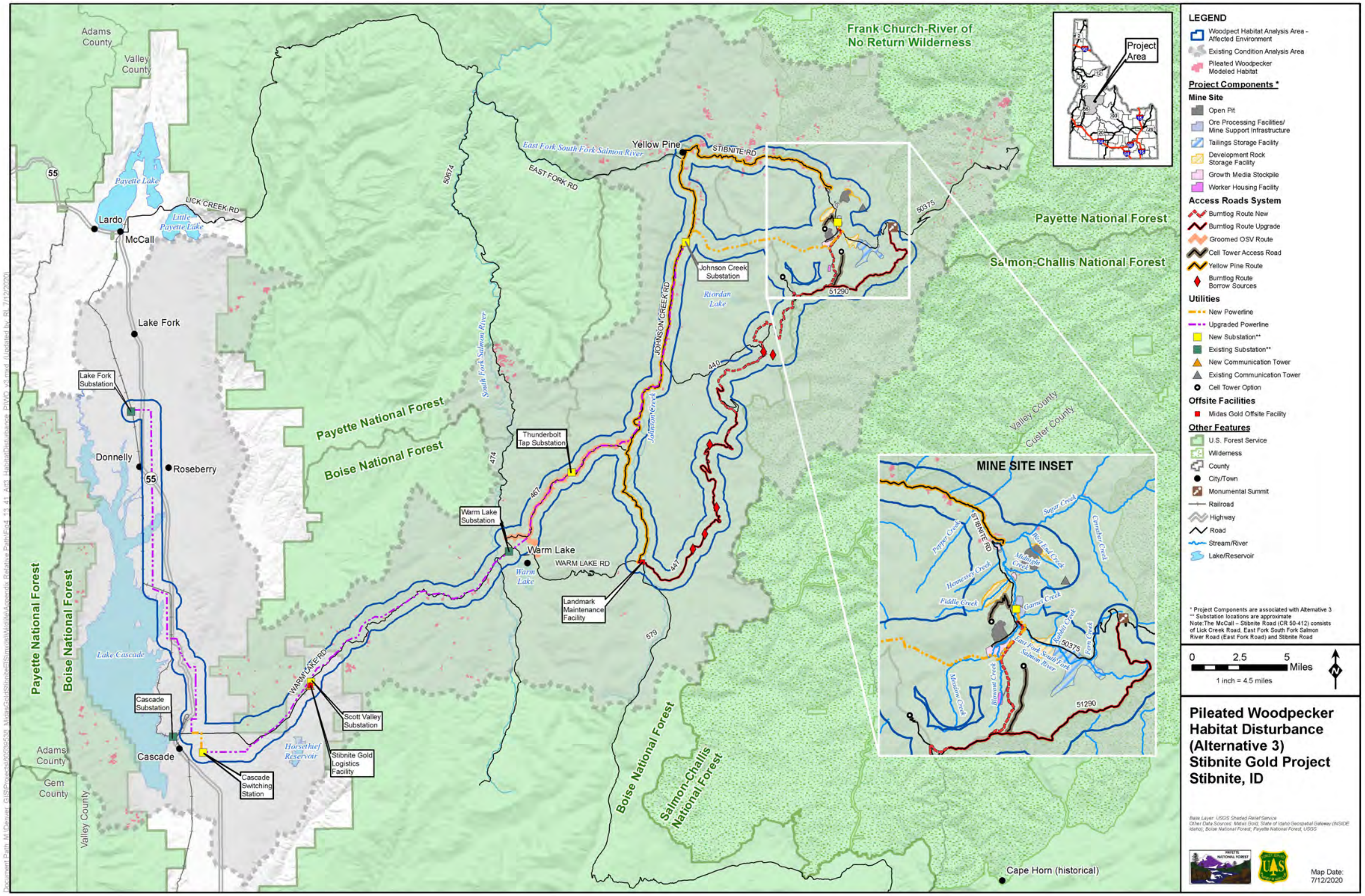

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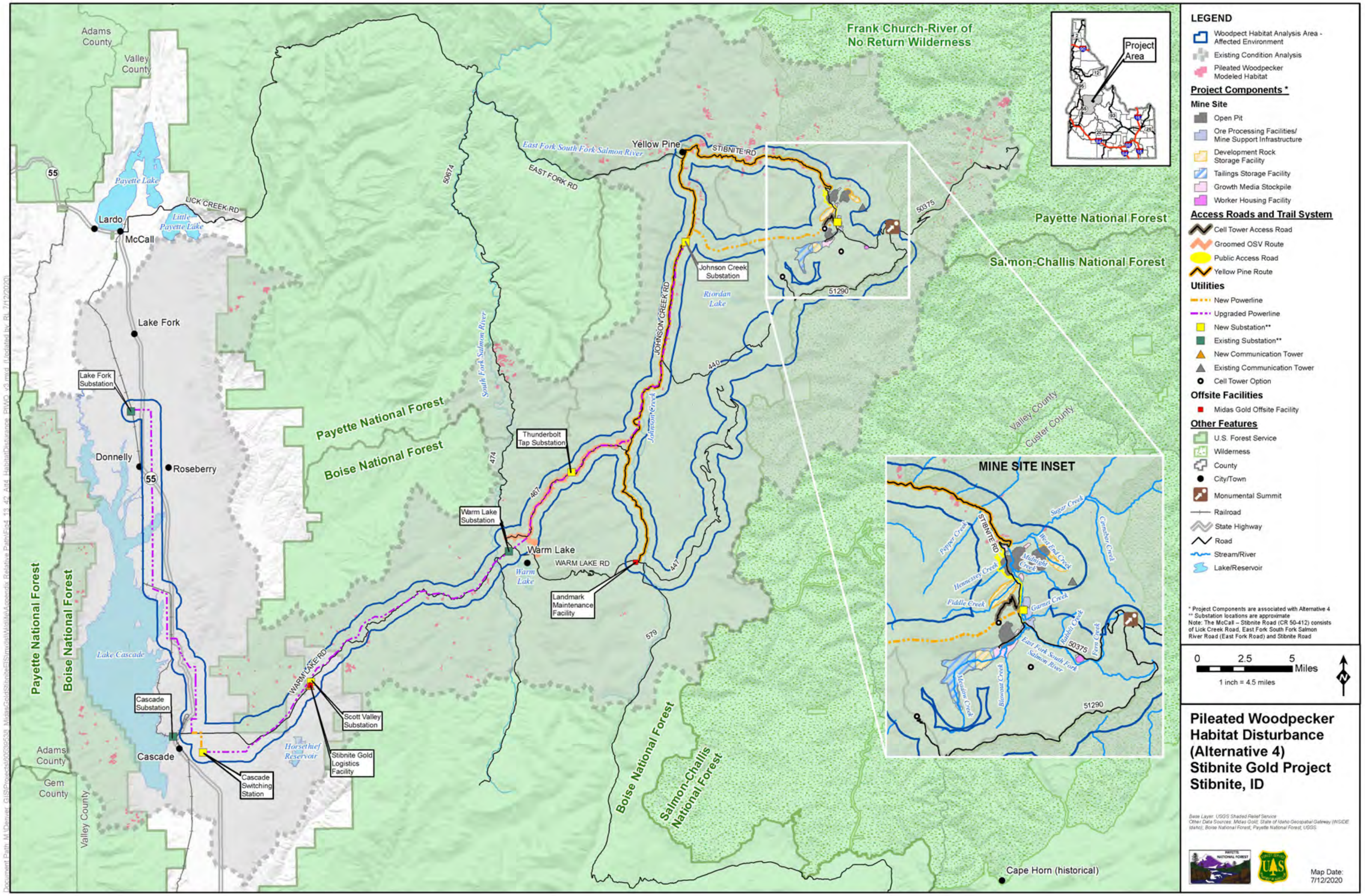

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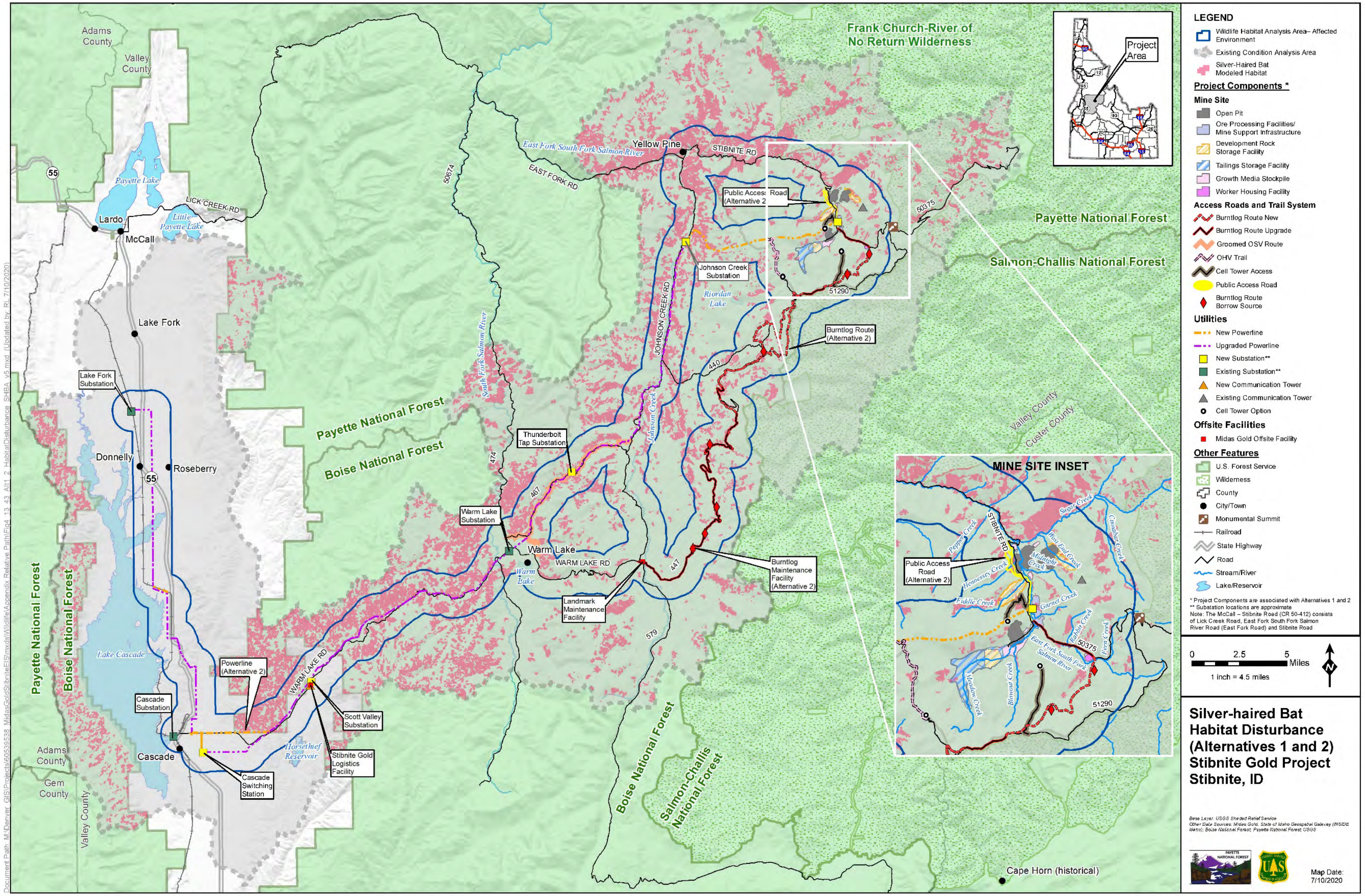

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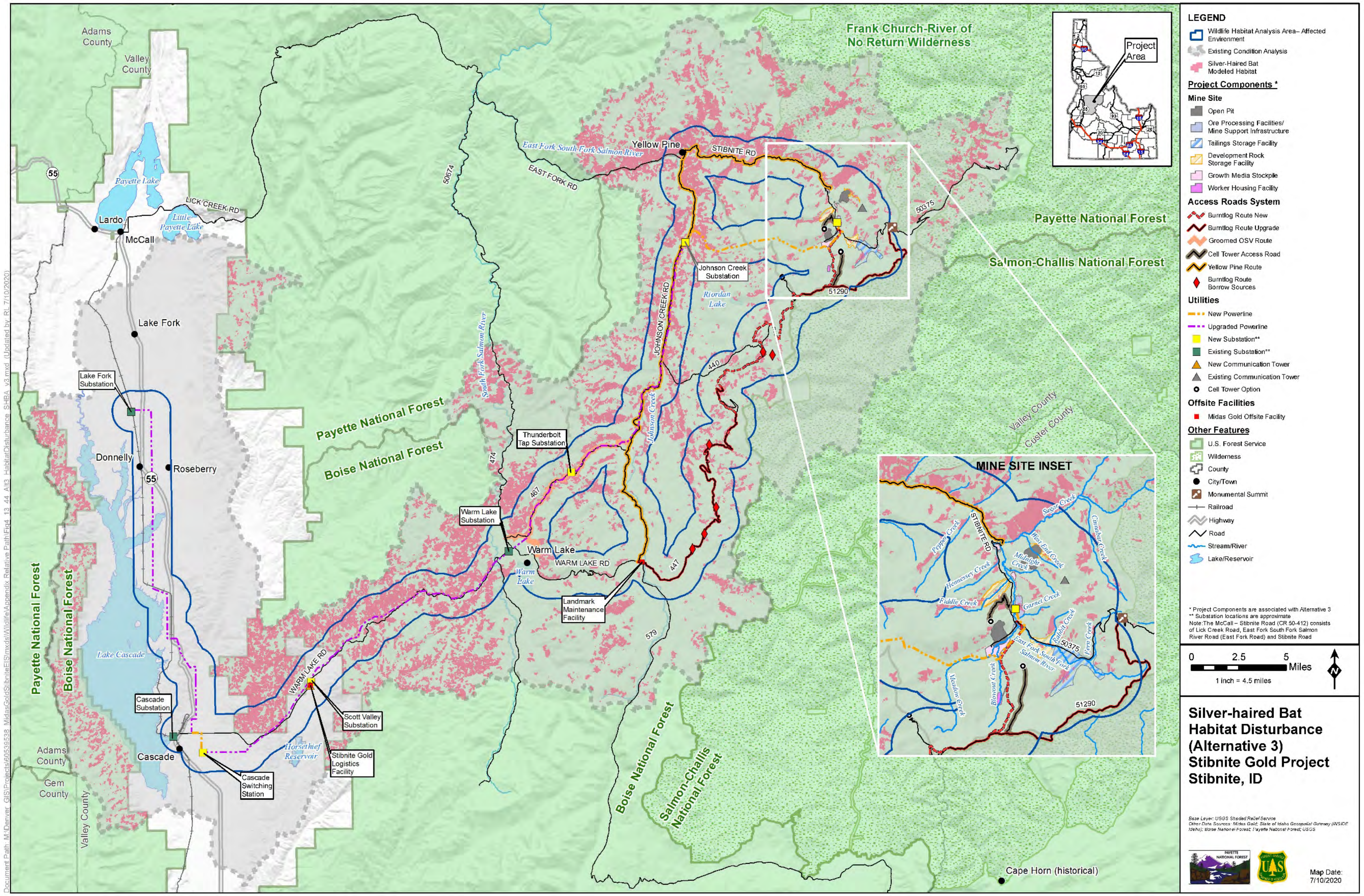

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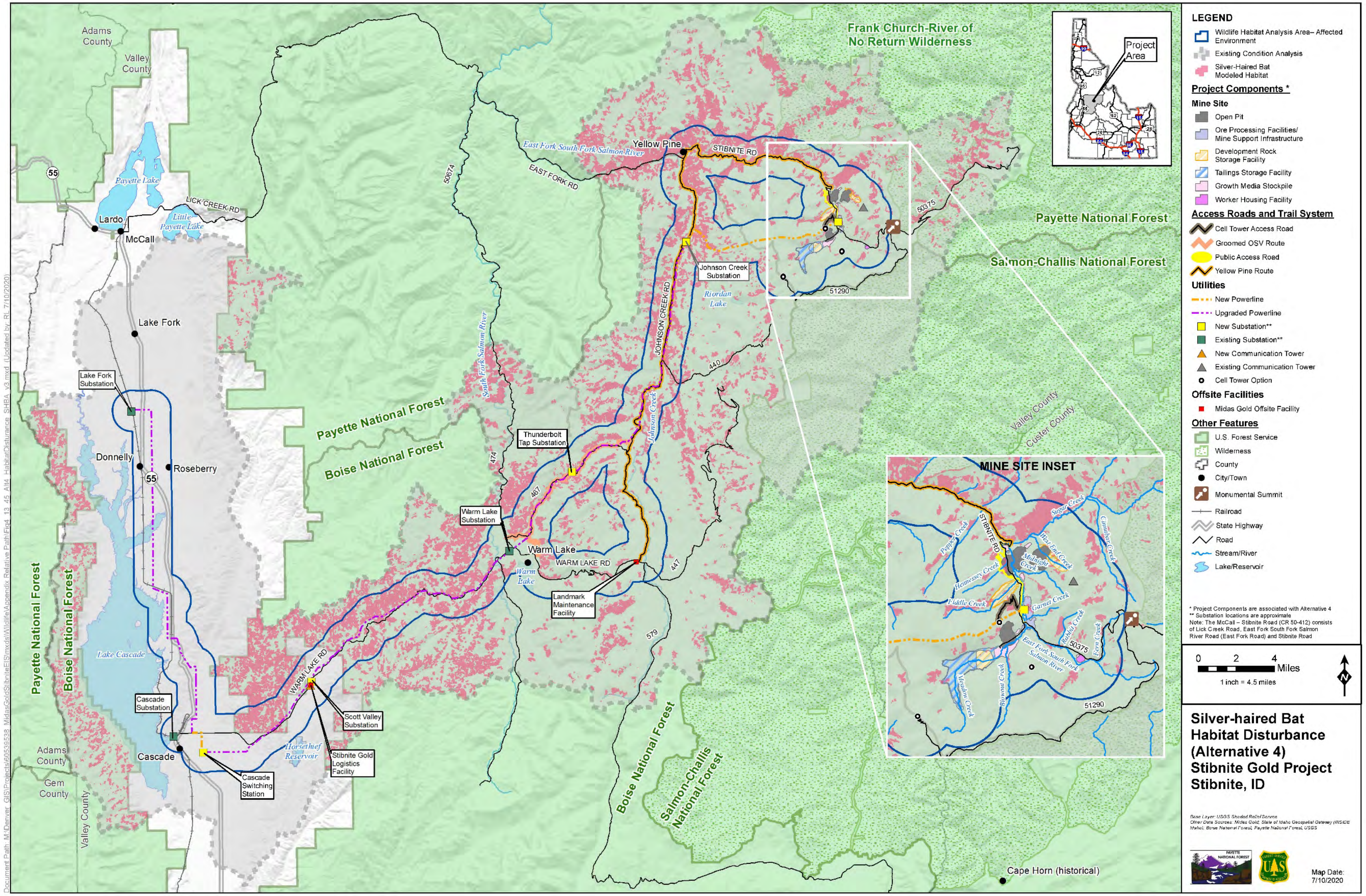

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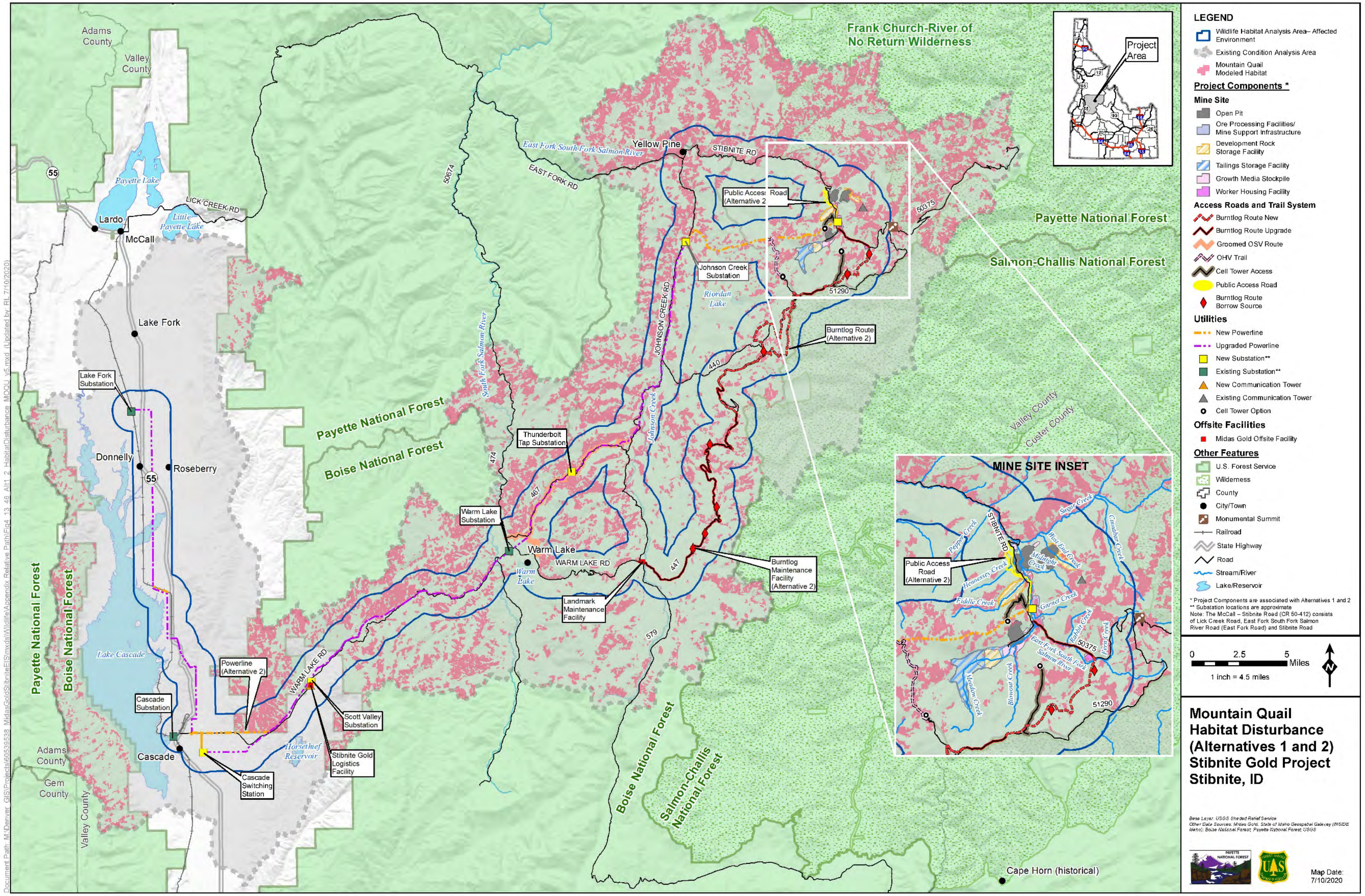

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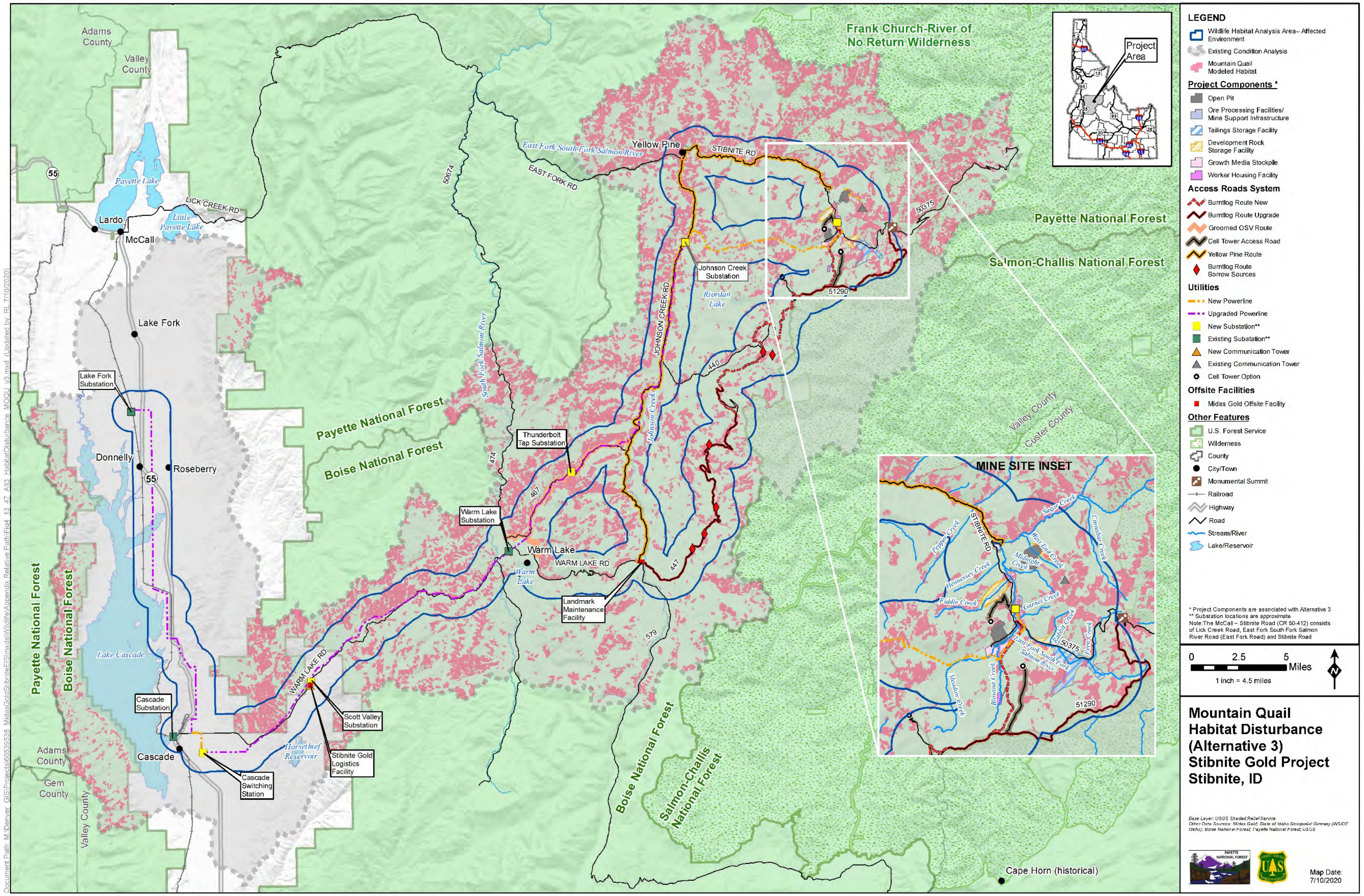

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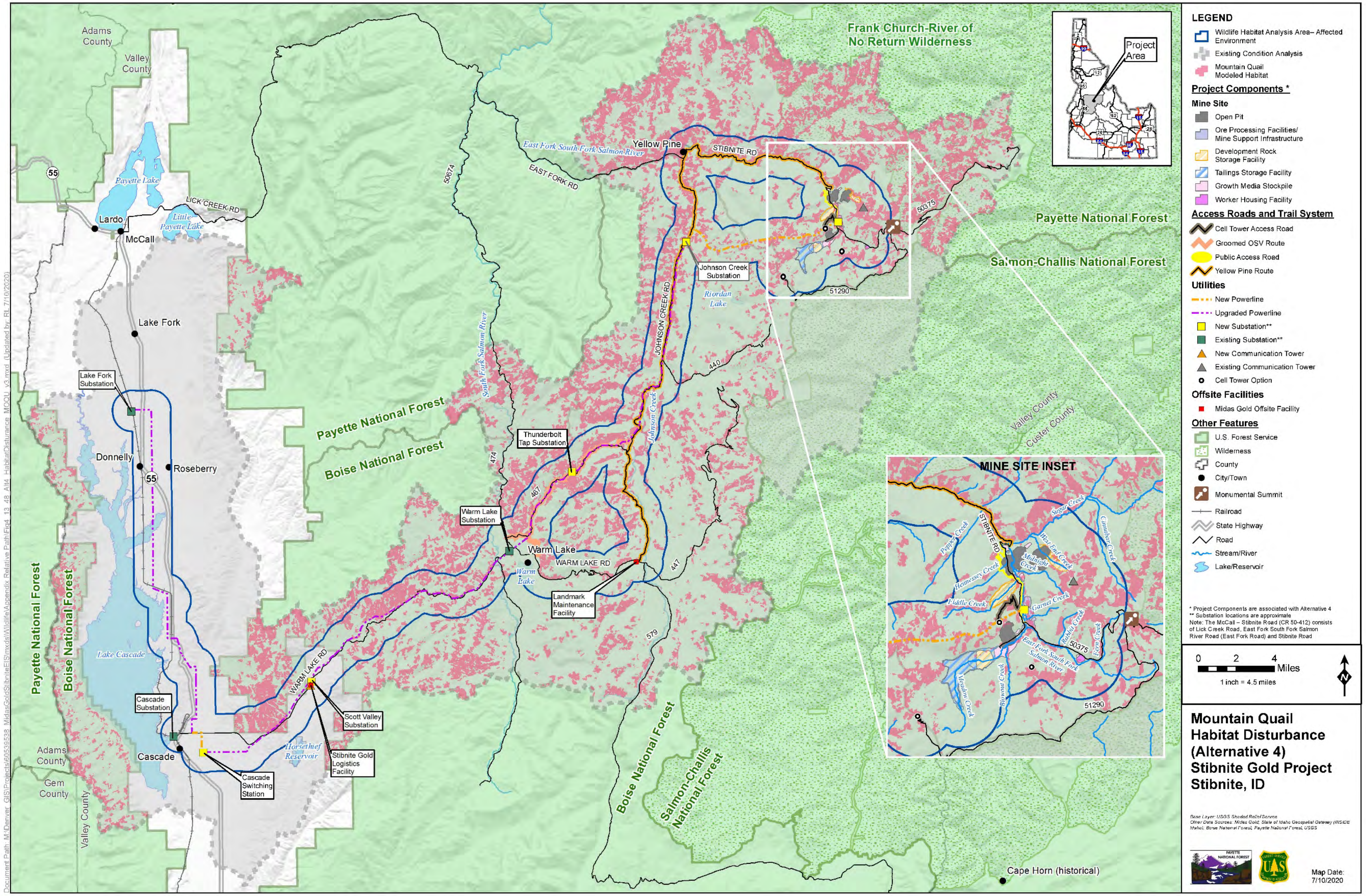

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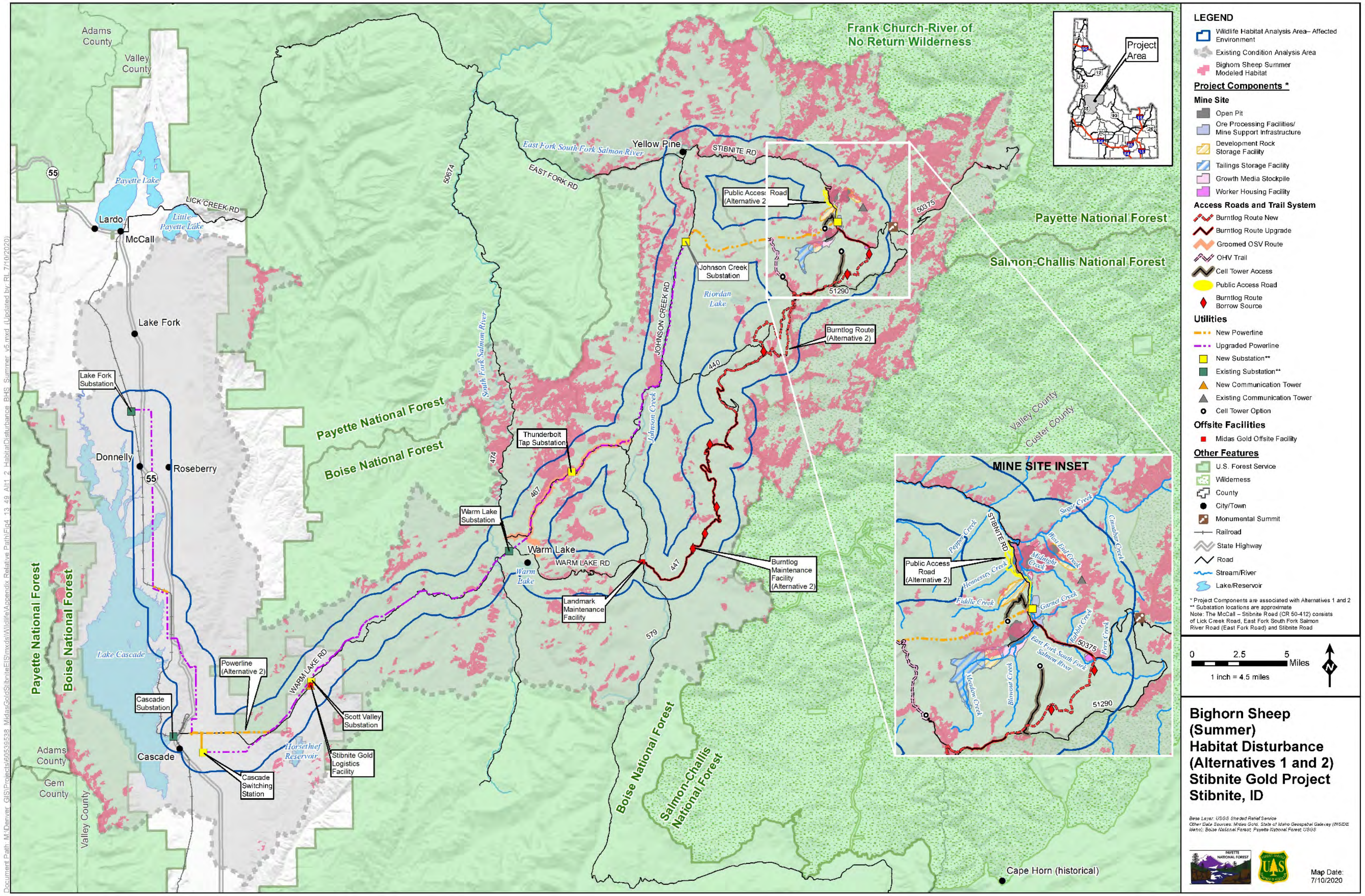

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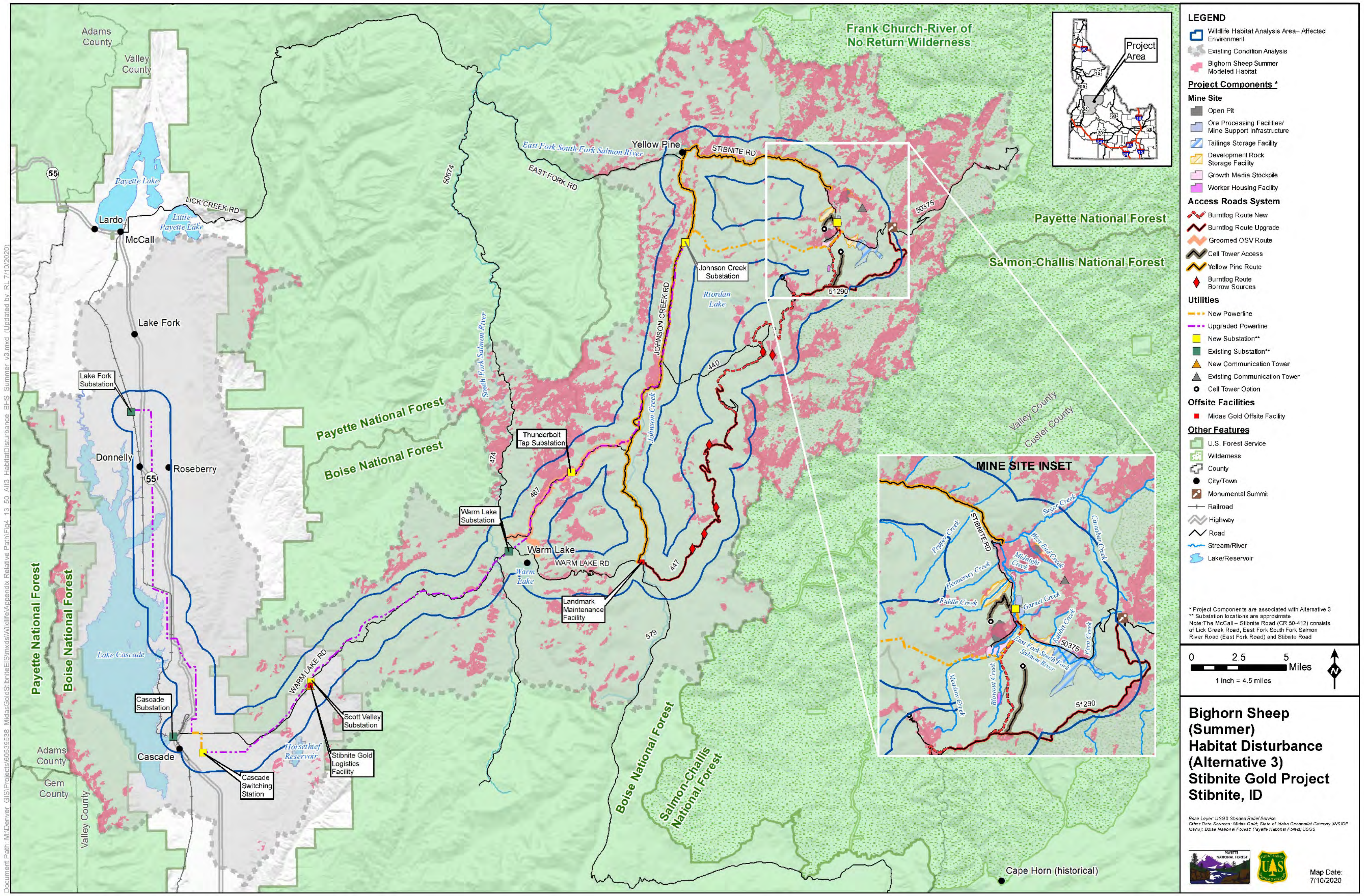

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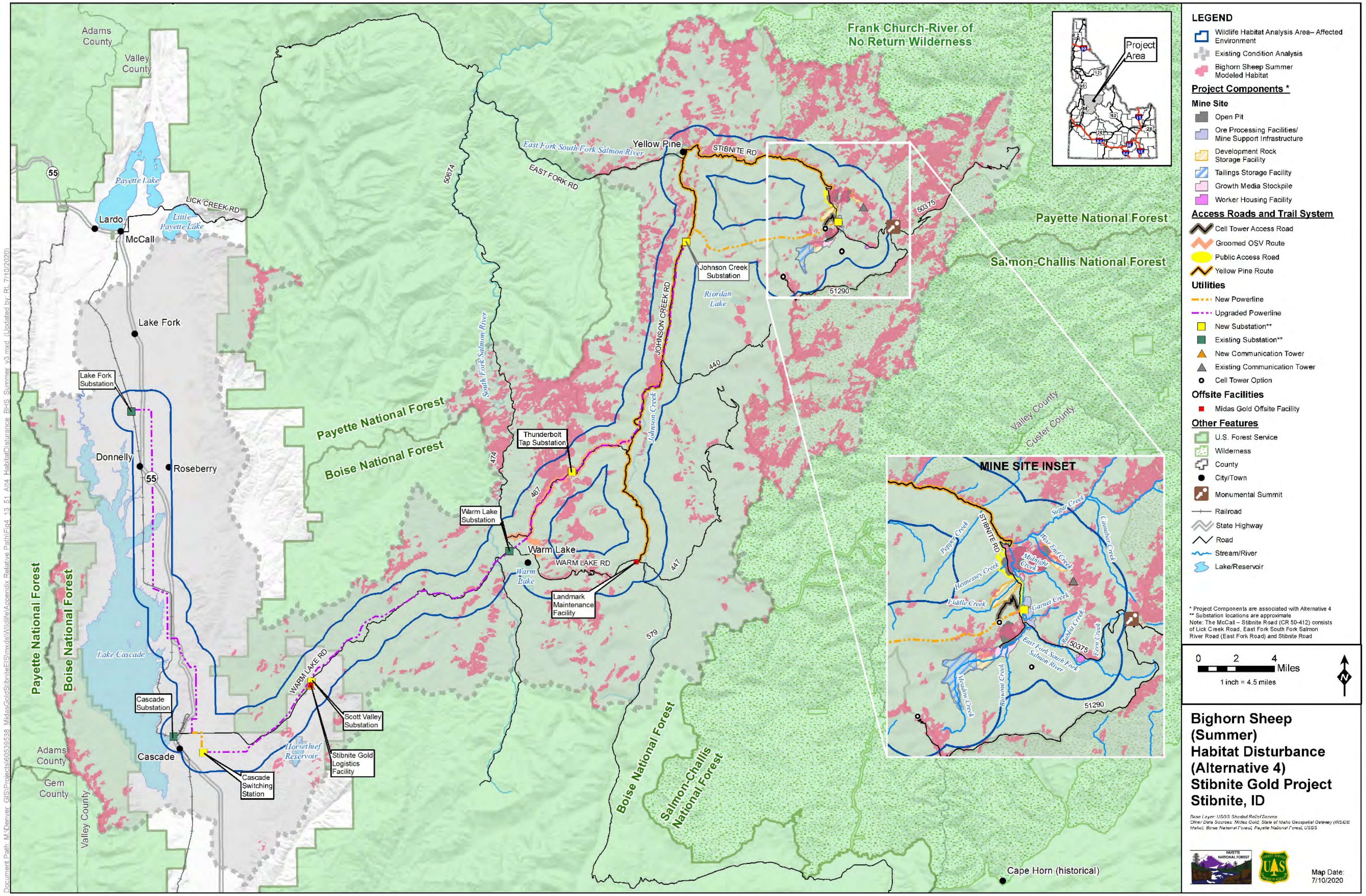

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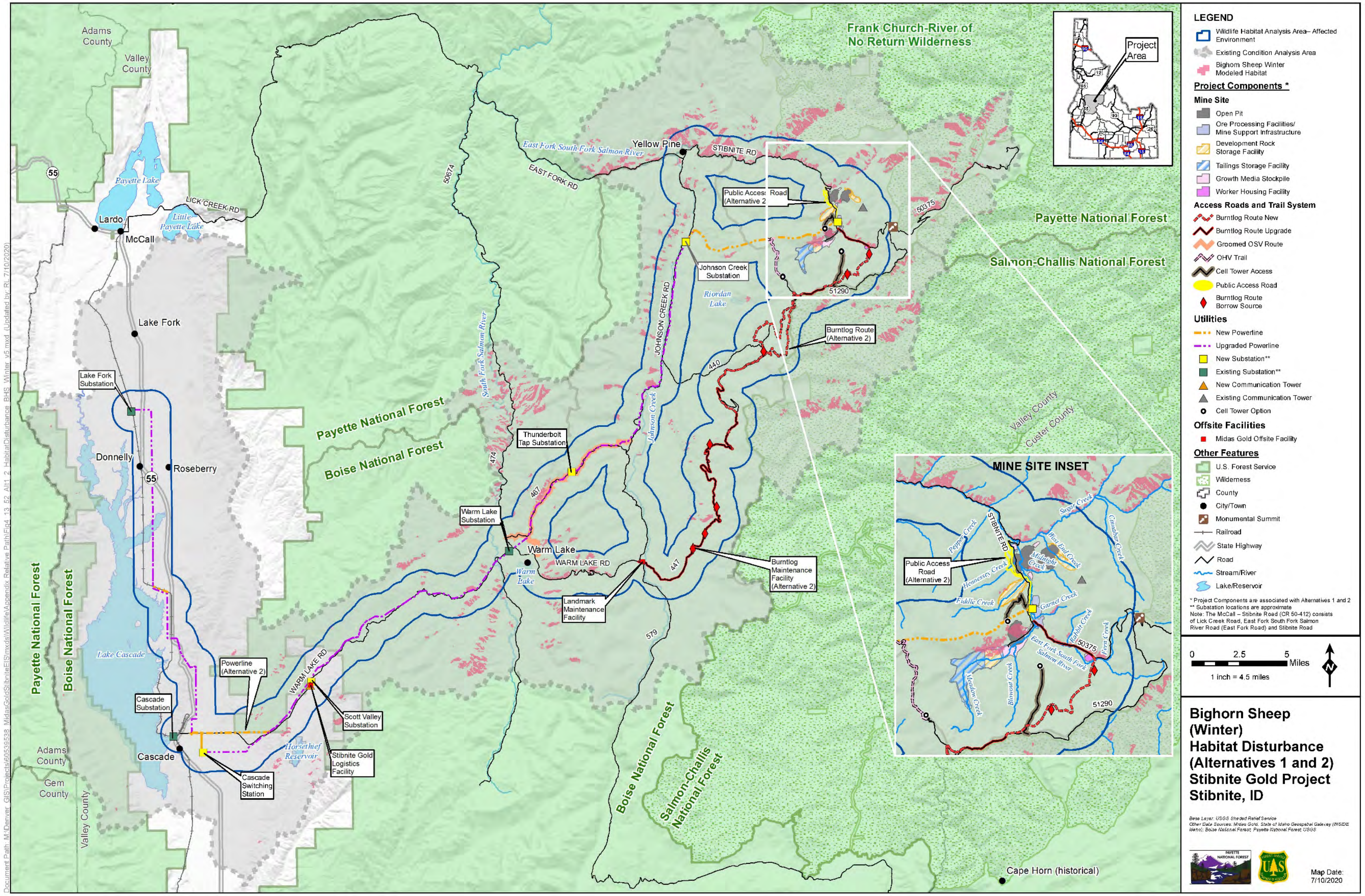

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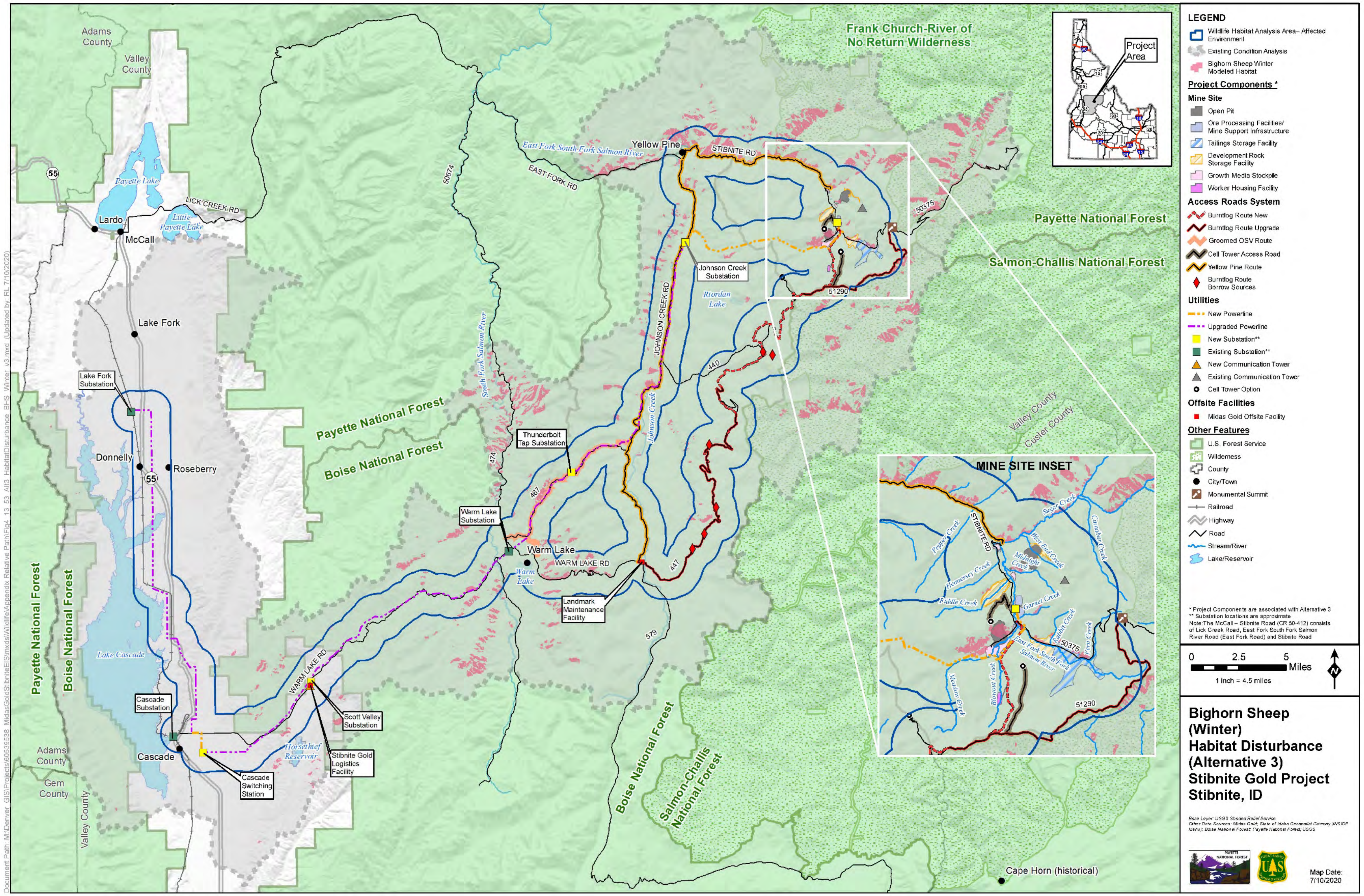

Figure Source: AECOM 2020

Figure 4.13-53 Bighorn Sheep (Winter) Habitat Disturbance (Alternative 3)

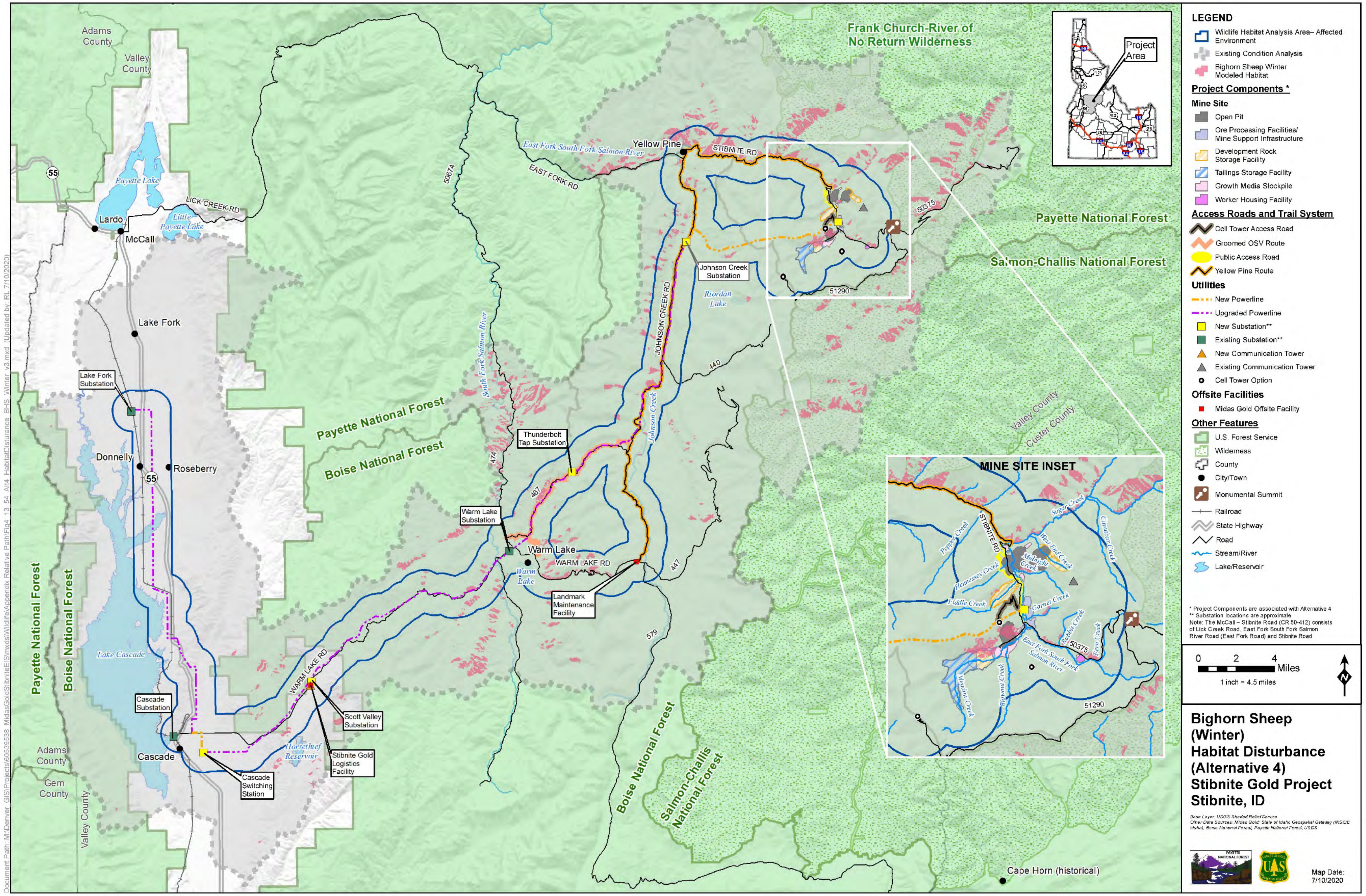

Figure Source: AECOM 2020

Figure 4.13-54 Bighorn Sheep (Winter) Habitat Disturbance (Alternative 4)

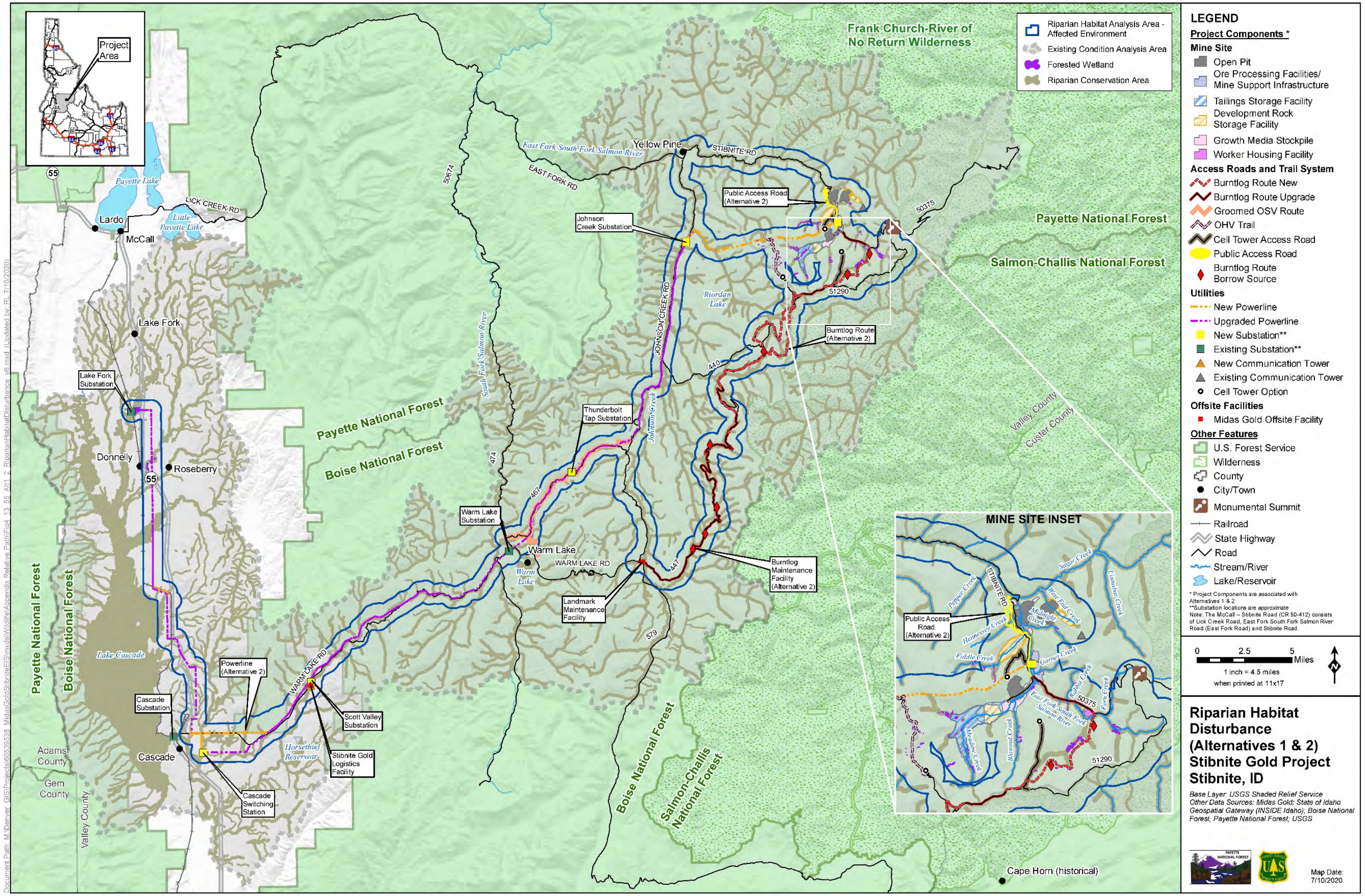

Figure Source: AECOM 2020

Figure 4.13-55 Riparian Habitat Disturbance (Alternatives 1 & 2)

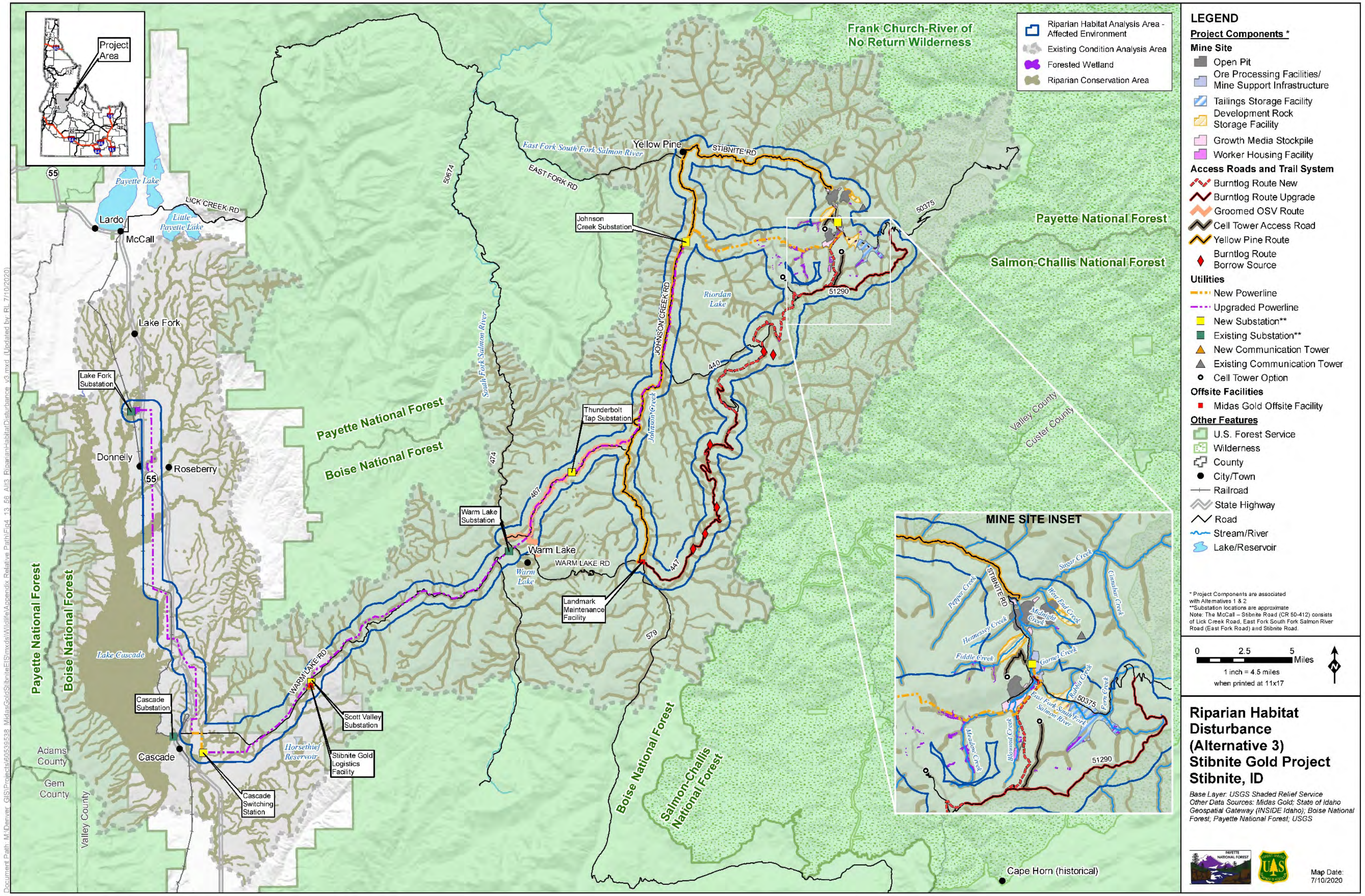

Figure Source: AECOM 2020

Figure 4.13-56 Riparian Habitat Disturbance (Alternative 3)

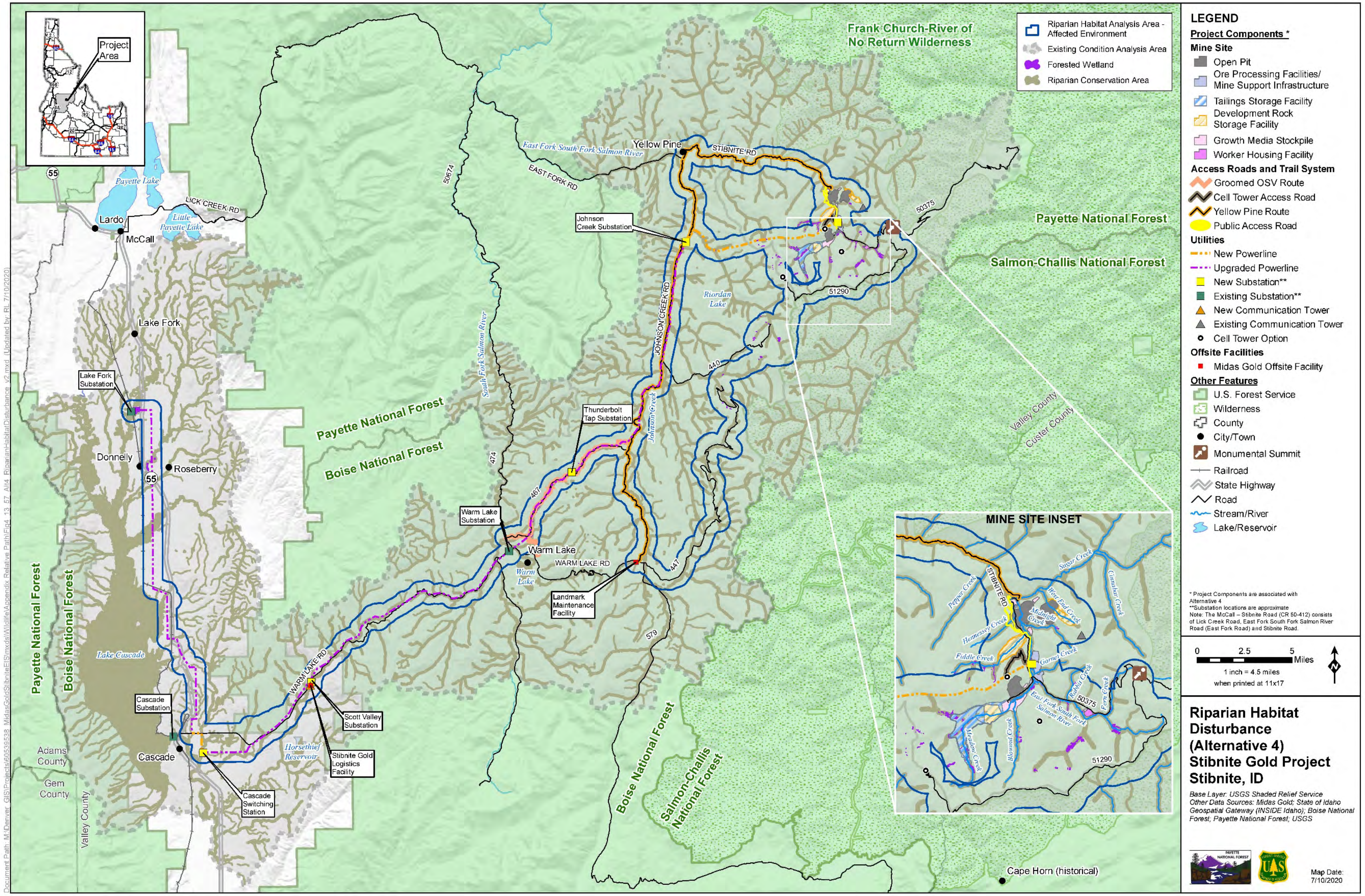

Figure Source: AECOM 2020

Figure 4.13-57 Riparian Habitat Disturbance (Alternative 4)

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