1. PURPOSE OF AND NEED FOR ACTION

1.01 Increase Landscape Resilience to Natural Disturbances (drought, insects, disease, wildfire) by Restoring Resilient Forest Conditions as Guided by the Natural Range of Variation

Past management actions, including fire suppression and historic logging practices, over the last one and a half centuries have extensively altered current forest conditions and ecosystem processes in the Sierra Nevada. Some of the key changes in yellow pine and mixed conifer forests include loss of old, large-diameter, fire-resistant trees and associated large, downed logs; shift in tree species composition towards shade-tolerant species; denser forests with multiple canopy layers and ladder fuels that facilitate crown fire; and more densely forested landscapes with continuous high fuel levels. These trends have led to forest stands, watersheds, and landscapes that are highly susceptible to threats such as large, high-severity wildfires, widespread drought- and insect-induced tree mortality, as well as climate change (Safford and Stevens, 2017).

Modeled estimates for the Sierra Nevada indicate temperatures will increase by 5.4 to 10.8 degrees Fahrenheit (3 to 6 degrees Celsius) during the twenty-first century. Climate change projections indicate many of the low- and mid-elevation forests in the Sierra Nevada are vulnerable to conversion to woodlands, shrublands, and grasslands (USDA 2019). Projected increases in temperature and decreases in snowpack for the Sierra Nevada (Safford et al. 2012) are likely to continue the increasing trend in the size of stand-replacing fires and proportion of landscape impacted by high-severity fires (Stephens et al. 2013), as well as triggering insect species population increases and subsequent tree mortality (Millar and Stephenson 2015).

Natural Range of Variation (NRV) assessments provide baseline information on the composition, structure, and function of forested ecosystems that can be compared to current conditions to develop an idea of trend over time and an idea of the level of departure from their natural state (Safford and Stevens 2017). Restoring forest composition, structure, and processes based on NRV conditions has been linked to greater resilience to wildfire, climate change, and other stressors and is a central and guiding principle of the Conservation Strategy for the California Spotted Owl in the Sierra Nevada (USDA 2019). The concept of restoring the landscape into closer alignment with historic reference conditions is rooted in the assumption that the structural composition of forests occurring in pre-settlement times, were, and would still be, more resilient to disturbances such as insects, disease, drought, and climate change, and less susceptible to large-scale, high-severity wildfires. Pre-settlement reference conditions represent forests where ecological processes and adaptive capacity can continue to evolve together. Aligning the landscape with NRV is the first step towards an eventual resilient future range of variation (USDA Forest Service 2019).

The current forest structure in the SERAL project area is considerably departed from the reference conditions described in Safford and Stevens (2017) and Meyer and North (2019) (Figure 2). In both the Yellow Pine/Dry Mixed Conifer (e.g., pine-dominant mixed conifer) and Fir/Moist Mixed Conifer (e.g., fir-dominant mixed conifer) forest types, current departure is pronounced in both mid- and late-developmental stages, with the current landscape containing much more closed canopy and much less open canopy in both developmental stages. These general vegetation types represent more than two thirds of the project area (Table 1, Map 1).

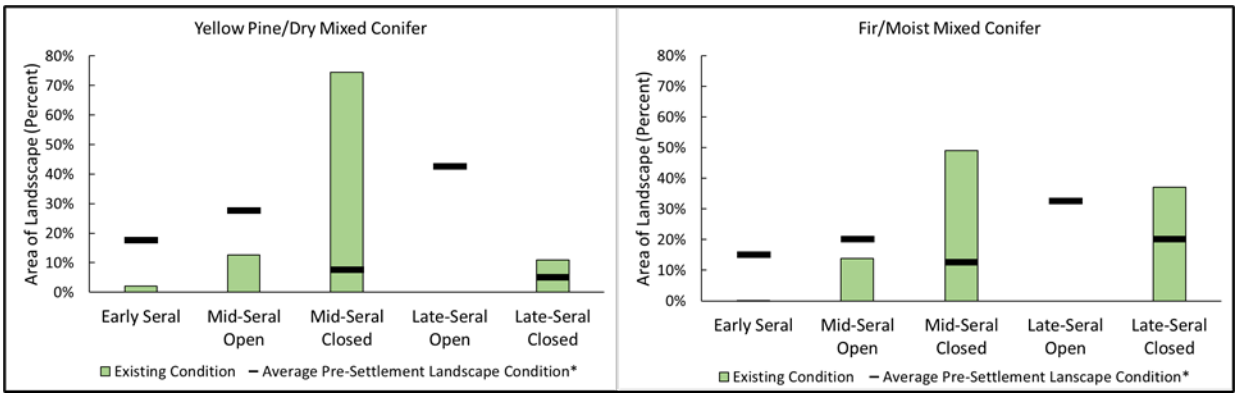

Figure 2. Current landscape structure of Yellow Pine/Dry Mixed Conifer and Fir/Moist Mixed Conifer forest types compared to historic conditions.

Table 1: General vegetation types in the project area[3].

General Vegetation Type	Total Acres / Percent of Total (NFS and non-NFS lands)	NFS Land Acres / Percent of Total NFS Lands (NFS lands only)
Yellow Pine / Dry Mixed Conifer	73,030 / 61%	58,143 / 61%
Oak Woodland	21,421 / 18%	17,737 / 19%
Shrub	15,321 / 13%	11,736 / 12%
Fir / Moist Mixed Conifer	6,753 / 6%	6,113 / 6%
Herbaceous	1,104 / <1%	489 / <1%
Non-Vegetated	1,166 / <1%	562 / <1%
TOTAL[4]	118,795 / 100%	94,779 / 100%

A comparative assessment between the current forest structure and the reference conditions broadly informed the proportion of the project area in need of restoration as well as the type of restoration needed (Appendix A, Table A.2 and Table A.3). The restoration needs to increase resiliency include (1) increase within- and between-stand heterogeneity; (2) reduce stand densities; (3) increase the large tree component on the landscape; (4) increase the relative abundance of fire-tolerant and shade-intolerant tree species; (5) reduce surface and ladder fuels; (6) increase management by fire, both prescribed and managed wildfire; and (7) actively restore habitat after disturbances that do not align with NRV (USDA 2019). Each of these desired conditions are further addressed in items A though G below.

A. *Increase Forest Heterogeneity (within- and between stands)*

Based on the NRV assessment of conifer forest types in the SERAL project area, there is a need to increase the amount of open canopy habitat and reduce the proportion of closed canopy conditions in mid- and late-seral stages (Figure 2) to get a patchy distribution of diverse stand types across the landscape. To best mimic NRV conditions and achieve within-stand and multi-stand diversity, applied silviculture and prescribed fire treatments need to create a pattern of individual trees, clumps of trees, and openings containing various sizes of clumped trees and openings. The understory of mid- and late-seral areas should be managed for a patchy distribution of shrubs, forbs, tree regeneration patches, and bare ground to increase diversity, and reduce fuel continuity.

[3] F3 derived (Huang et. al 2018); "Forest Type".
[4] F3 derived data are raster-based products and acres are approximate and explain why the total project area and NFS land acres do not equal 118,808 and 94,823 acres respectively.