The Southwestern Region of the Forest Service is currently preparing a manuscript for scientific publication titled:

A MANGEMENT FRAMEWORK FOR RESTORING RESILIENCY AND SUSTAINABLIITY OF FREQUENT-FIRE FORESTS IN THE SOUTHWEST

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This manuscript describes the desired conditions necessary to achieve restoration of frequent fire forests and their scientific basis. This manuscript is currently being reviewed internally within in the Southwestern Region of the Forest Service. Our current time line is to expand the manuscript review to external reviewers during May of 2012 and submit the manuscript to a scientific journal by June or July of 2012. In order to provide workshop participants with a preview of this manuscript we have included the Title, Abstract and Literature cited section in this workbook.

ABSTRACT— Many recent studies have shown that Southwestern forests have become increasingly susceptible to uncharacteristic severity of wildfires, insect and disease episodes, altered plant and animal demographies, and reduced biodiversity, ecosystem function, resilience, sustainability, and ecosystem services from these forests. Within the Southwest, these threats are most evident in frequent-fire ecosystems, primarily ponderosa pine and dry mixed-conifer forests. The composition and structure of vegetation in these forests have changed from historical conditions due to human activities, primarily community and resource developments and associated livestock grazing, logging, resulting in reduced frequency of low-severity fire. Changes include increased tree densities, reduced spatial and structural heterogeneity, loss of grass-forb-shrub communities, and associated losses of habitats, biodiversity, changed food webs and altered trophic interactions. We present a management framework for restoring the resiliency and sustainability of Southwestern frequent-fire forests; a framework based on the literature describing the natural ranges of variability and reference conditions of these forests in Arizona and New Mexico. Key ecosystem compositional and structural components of the framework are uneven-aged forest mosaics comprised of groups of trees, individual trees, open grass-forb-shrub interspaces between tree groups, snags, logs, woody debris, and the arrangement of these elements in space and time. The framework presents a vision for restoring the resiliency and sustainability of frequent-fire forests; the restoration of the compositions, structures, habitats, food webs, and the spatio-temporal feedbacks between pattern and process in these forests.

The framework recognizes and incorporates the natural spatial heterogeneity that occurs in these forests and presents management recommendations accommodating heterogeneity. The sources of spatial heterogeneity are different combinations in soils, elevation, slope , aspect, and

weather, and are manifested in differences in tree density, tree regeneration patterns (degree to which trees are grouped, numbers and arrangement of single trees, sizes of tree groups and openings), and numbers and dispersion of snags and logs. Such heterogeneity is evidenced in within- and among-stand reference conditions, which, when summed, comprise the natural range of variability of a forest type. The management recommendations encourage managers to recognize the spatial and temporal heterogeneity in these forests and to design treatments as informed by local site conditions (historical structures such as old trees, snags, logs, stumps) whenever possible, and to manage for a mix of vegetation structural stages within stands to sustain the desired compositions and structures over time.

Key words: Bio-diversity, ecologic function, food webs, frequent fire forests, grass-forb-shrub communities, habitats, landscapes, logs, management recommendations, mixed-conifer, Pinus ponderosa, ponderosa pine, resilience, restoration, snags, structure, sustainability, wildlife.

EXEUCTIVE SUMMARY

There is increasing recognition of the need to restore the resiliency and sustainability of forests in the Southwest United States. Many recent studies have shown that Southwestern forests have become increasingly susceptible to uncharacteristic severity of wildfires, insect and disease episodes, altered plant and animal demographies, and reduced biodiversity, ecosystem function, resilience, and sustainability of ecosystem services from these forests. Within the Southwest, these threats are most evident in frequent-fire forests, primarily ponderosa pine and dry mixed-conifer forests. The compositional and structural changes include increased tree densities, reduced spatial structural heterogeneity, loss of grass-forb-shrub communities, and associated losses of habitats, biodiversity, changed food webs and altered trophic interactions and have resulted from human activities; primarily community and resource developments and

associated livestock grazing, logging, resulting in a reduced frequency of low-severity fire. We present a management framework for restoring the resiliency and sustainability of Southwestern frequent-fire forests; a framework based on a synthesis of the science describing the natural ranges of variability and reference conditions of these forests in Arizona and New Mexico. Key ecosystem compositional and structural components of the framework are uneven-aged forest mosaics comprised of groups of trees, individual trees, open grass-forb-shrub interspaces between tree groups, snags, logs, woody debris, and the arrangement of these elements in space and time. The framework presents a vision for restoring the resiliency and sustainability of frequent-fire forests; the restoration of the compositions, structures, habitats, food webs, and the spatio-temporal feedbacks between pattern and process in these forests. Additional outcomes include the provision of ecosystem services such as wood products, clean air and water, and recreation.

The framework recognizes and incorporates the natural spatial heterogeneity that occurs in these forests and presents management recommendations accommodating the heterogeneity. The sources of spatial heterogeneity are differences in soils, elevation, slope , aspect, and weather, and manifests in differences in tree density, tree regeneration patterns (degree to which trees are grouped, numbers and arrangement of single trees, sizes of tree groups and openings), and numbers and dispersion of snags and logs. Such heterogeneity is evidenced in within- and among-stand reference conditions, which, when summed, comprise the natural range of variability of a forest type. The natural range of variability is a "best" estimate of a functioning and resilient system because it reflects the evolutionary ecology of these forests and is a powerful tool for establishing a science basis for restoring the compositions and structures of

forests and the ecological processes that operated in these forests before Euro-American influences on them.

The management recommendations in the framework encourage managers to recognize the spatial and temporal heterogeneity in these forests and to design treatments using local site conditions (historical structures such as old trees, snags, logs, stumps) as guides whenever possible. Also recommended is managing for an interspersed mosaic of different vegetation structural and successional stages that shifts over time (via ageing and succession) to provide plant and animal habitat adjacency and to sustain the desired compositions and structures at a fine scale (~10 acres). Because of the complex of species comprising the understory of Southwest frequent-fire forests, the framework focuses on the ecologies and life-histories of the dominant understory vegetation species. The framework, recognizing the importance of the types, frequencies, and severities of natural disturbances in shaping the composition and structure of frequent-fire forests, recommends using fire, perhaps the most influential of disturbances in these forests, as a tool in restoring the resiliency and sustainability of forests wherever feasible. However, when management objectives may be better met by silvicultural treatments, prescribed cutting methods such as group and single tree selection, perhaps in conjunction with fire, are recommended. In some cases, it may not be operationally feasible for management to exactly mimic natural processes and the structural reference conditions (tree sizes, ages, densities), especially within tree-groups. Nonetheless, the framework provides for close approximations of reference conditions and processes.

Here we describe our framework for the restoration of the resiliency and sustainability of frequent-fire forests and present the stand-level and landscape principles and concepts as well as the science supporting the desired restored conditions identified in the framework.