Chapter 2. Forest-wide Plan Components and Management Approaches

Vegetation

Background and Description

Ecological Classification

The vegetation types for which desired conditions were developed were based on ecological response units (ERUs). ERUs represent an ecosystem stratification based on vegetation characteristics that would occur when natural disturbance regime and biological processes prevail and combine potential vegetation and historic fire regimes to form ecosystem classes useful for landscape assessment. Spatial representation of ERUs is derived from map unit delineation in the Terrestrial Ecosystem Unit Inventory (TEUI) database (USDA Forest Service 1986); one ERU polygon may encompass multiple map unit polygons. A TEUI map unit (usually less than 1,000 acres; typically about 200 acres) comprises one or more soil components, with each component having its own potential natural vegetation type (PNVT).

Scale

Desired conditions for forest and woodland vegetation types are presented at three spatial scales: landscape scale (1,000 to 10,000 plus acres), mid-scale (10 to 1,000 acres), and fine-scale (less than 10 acres). (Not enough science is available to provide descriptions at multiple scales for pinyon-juniper woodland, grassland, shrubland, and riparian vegetation types.) The landscape scale describes the “big picture” of desired conditions (Figure 2). Descriptions at the mid- and fine-scales provide additional detail necessary for guiding future projects and activities. The landscape scale is typically composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes. A landscape area is comprised of ten or more mid-scale units. The mid-scale is composed of assemblages of fine-scale units which have similar biophysical conditions. The fine-scale is an area in which the species composition, age, structure, and distribution of plants (single, grouped, or aggregates of groups) are described.

Range of Values

Ranges (minimum, maximum) of values presented in desired conditions were informed by current science for natural variation in the composition and structure within a vegetation type, and tempered by socioeconomic desires and management experience as well as a consideration of socioeconomic desires such as wood product outputs, recreation opportunities or wildlife habitat needs. Desired conditions vary within a vegetation type due to spatial variability in soils, elevation, and aspect, and to provide managerial flexibility to meet local project objectives. The ranges presented here often represent the upper and lower extremes for a given variable (e.g., the lowest and highest tree densities in a vegetation type). It is important to recognize that the goal is generally to manage toward average desired conditions for a given variable; however, it may be appropriate to have different desired conditions within a vegetation type, such as a lower density of vegetation inside the wildland-urban interface than outside of it so as to reduce fire risk to human life and property.

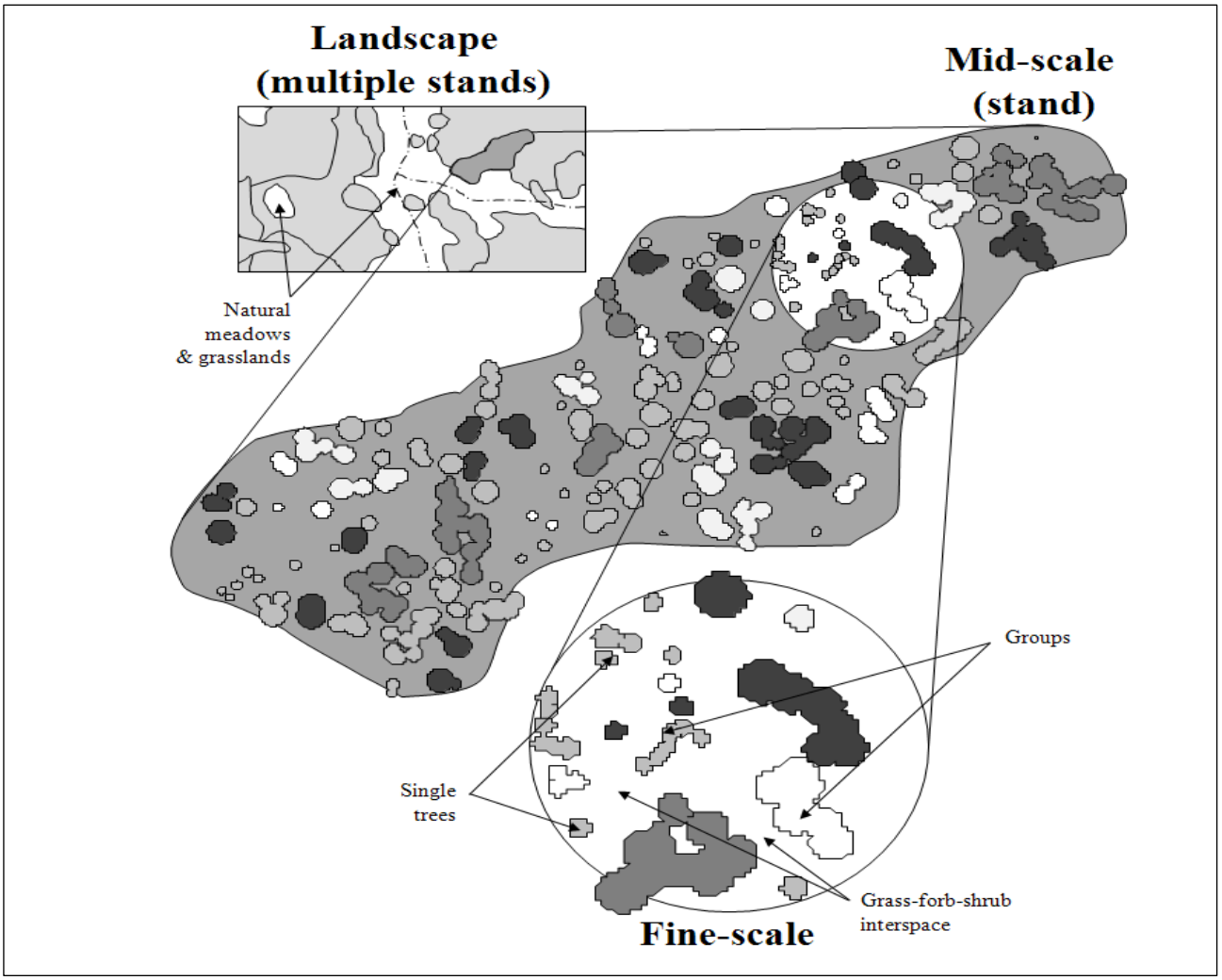

Figure 2. Desired conditions at three spatial scales

Note: The landscape scale illustrates multiple stands and natural meadows and grasslands. The mid- and fine-scales illustrate open grass-forb-shrub interspaces and uneven-aged stand conditions consisting of single and grouped trees of different vegetation structural stages, young to old, represented by different shades and sizes (Reynolds et al. 2013).

Plan Elements Common to All Vegetation Types

Fire Regime

Fire frequency and severity are referred to by their fire regime group (Table 1).

Table 1. Fire regime groups and descriptions

Group	Frequency (years)	Severity	Severity Description
I	0–35	Low/mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory
II	0–35	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation
III	35–200	Mixed/low	Generally mixed-severity; can also include low-severity fires
IV	35–200	Replacement	High-severity fires
V	>200	Replacement/any	Generally replacement severity; can include any severity type in this frequency range

Note: The above definitions use 25% and 75% as severity thresholds between the low, mixed, and replacement regimes.

Source: Adapted from Barrett et al. (2010)

Wildland-urban Interface

Desired Conditions

- Wildland fires in the wildland-urban interface sustain characteristic ecosystem function while preserving property and human health and safety. Wildland fires in the wildland-urban interface are low-intensity surface fires, because ladder fuels are nearly absent. Firefighters are able to safely and efficiently suppress wildfires in the wildland-urban interface.
- In forested vegetation communities, the area occupied by grass, forb, or shrub interspace is at or above the range given in the vegetation community desired conditions. Trees within groups may be more widely spaced with less interlocking of crown than what would be considered desirable otherwise. Interspaces between tree groups are of sufficient size to discourage isolated group torching from spreading as a crown fire to other groups. The tree basal area in the wildland-urban interface is on the lower end of the range given in the vegetation community desired conditions. Where the wildland-urban interface intersects vegetation types with a mixed- or high-severity fire regime, such as spruce-fir, characteristic ecosystem function is modified to promote low-intensity surface fires. In shrublands, fuel loading in the wildland-urban interface is on the lower end of the range given for the vegetation community desired conditions. There is adequate cover to meet the needs of a variety of wildlife species.
- Logs and snags, which often pose fire-control problems, are present in the wildland-urban interface, but at the lower end of the range given in the appropriate vegetation community desired conditions. The standing dead (snags) and downed wood (coarse woody material) load is 1 to 10 tons per acre, depending on vegetation type, with lower amounts in fire-adapted vegetation types, and higher amounts in infrequent fire types. This light fuel load applies even in vegetation types with higher reference fuel loads, such as mixed conifer with aspen or spruce-fir.

Higher fuel loading or tree densities may occur in areas where it provides for important fine-scale habitat structure, as long as it meets the overall intent of protecting values at risk.

Climate Change

Desired Conditions

- In areas of high vulnerability to climate change, based on 100-year climate projections (Triepke et al. 2014), tree basal area is restored or maintained at levels which mitigate water stress and increase resiliency to climate change (Allen et al. 2015; Sun et al. 2015; Vose et al. 2016), often this is the mid-range of potential basal area values.[1] In these areas, early- and mid-seral[2] species dominate over late-seral species, given the adaptations of many early- and mid-seral species for warmer and drier conditions. Early-seral species characteristic of lower-elevation life zones (e.g., Douglas-fir on a spruce-fir site) are maintained. Late-seral species (especially large specimens) are maintained primarily in locally cooler (north-facing aspects) and wetter (draws, seeps) areas to maintain diversity, wildlife habitat, and a local seed source. Natural plant associations (USDA Forest Service 1997a, 1997b) (including grass, forb, and shrub species) are maintained in all vegetation types.

Insects and Disease

- Insects and diseases are integral components of ecosystems. Often there are numerous positive impacts of insects and disease on the ecosystem including creation of small openings, increasing biodiversity, enhancing nutrient cycling, as food sources for animals, creation of wildlife habitat, and many other ecologically significant benefits. However, under severe disease infection levels or episodic outbreaks of insects, their effects are more evident, sometimes negative, and cause greater change. With the exception of white pine blister rust, the insects and diseases on the Cibola often considered pests are native organisms that have long been part of the ecosystem and have evolved with their plant hosts.

Desired Condition

- All vegetation types experience endemic infestation levels, patterns, and cycles of native insects and diseases.

Guideline

- Human controls should not be applied to native insect and disease life cycles in order to maintain wilderness character, except to protect resources on adjacent lands, to protect threatened and endangered species, or when human health and safety are a concern.

Management Approach

- Maintain and promote genetic diversity among white pines (Conklin et al. 2009) by retaining white pines in harvest and thinning projects to help provide a broad genetic base and promote natural selection. In stands already impacted by blister rust, rust-free white pines will be retained

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[1] Except in riparian vegetation types; large trees are retained in all vegetation types.

[2] “Seral” refers to the transitory stages that plant communities develop from bare ground to the climax stage.

when harvesting or thinning, since at least some of them are probably resistant. Planting rust-resistant trees may be the only option to maintain or restore white pines in some locations.

Plant Community Species Composition

Desired Condition

- All sites support the potential natural vegetation type (PNVT) for their respective soil type as listed in the Terrestrial Ecosystem Unit Inventory (TEUI) database.

Guideline

- Management activities promote the restoration and maintenance of the PNVT of the site as listed in the TEUI database.

Management Approach

- Management activities promote the desired conditions of the site. For example, where a woodland now occupies a historic grassland site (the TEUI map unit description indicates a soil classification of mollisol—a signature of grassland ecosystems), grassland desired conditions apply. In other words, the desired condition for vegetation type must be consistent with the site's soil type with an emphasis on native annual and perennial plant communities.

Significant Plant Communities and Individual Plants

Desired Conditions

- Plant communities that are regionally unique (such as the blue spruce community of Little Water Canyon located on the Zuni's a part of Mt. Taylor District) and individual plants that have particular social or botanical importance (such as "Big Trees" registered with American Forests) persist.

Management Approaches

- Areas surrounding individual plants that have particular social or botanical importance are periodically cleared of potentially damaging fuel sources.
- Plant communities that are regionally unique are managed to maintain their unique characteristics, such as Fourth of July Canyon in the Manzano Mountains.
- Plant communities that are regionally unique and individual plants that have particular social or botanical importance are accompanied by interpretive signs educating the public about the plant's significance.

General Management of All Vegetation Types

Standards

- Regulated timber harvest activities shall occur only on those lands classified as "suitable" for timber production. Restoration activities may occur on lands classified as either "suitable" or "unsuitable" for timber production.
- If individual harvest openings created by even-aged silvicultural practices are proposed that would exceed 40 acres, National Forest Management Act (NFMA) requirements regarding public notification and regional forester approval shall be followed and impacts on other

resources will be analyzed and mitigated where necessary. These requirements do not apply to the size of areas harvested in response to natural catastrophic conditions such as, but not limited to, fire, insect and disease attacks, or windstorms.

- On lands suitable for timber production, timber harvest and wildland fire intended to create openings for tree regeneration shall only be used when there is reasonable assurance of restocking within 5 years after final regeneration harvest (16 USC 1604). Restocking level is prescribed in a site-specific silviculture prescription for a project treatment unit and is determined to be adequate depending on the objectives and desired conditions for the Plan area. In some instances, such as when lands are harvested or prescribed burned to create or maintain openings for firebreaks and vistas, it is appropriate not to restock.
- Timber shall not be cut, sold, or removed in inventoried roadless areas, unless the responsible official determines that activities meet the circumstances provided in the Roadless Rule, section 294.13. Review authorities shall be followed.
- Cutting of trees and other vegetation shall not be permitted in in eligible wild and scenic rivers with wild classifications, except when needed in association with a primitive recreation experience, to protect users (including hazard tree removal or trail maintenance), or to protect identified outstandingly remarkable values.
- Temporary road construction shall mitigate any impacts to recreation resource values and facilitate rehabilitation of recreation resources impacted by projects.
- On lands suitable for timber production, even-aged stands shall generally have reached culmination of mean annual increment prior to regeneration harvest, unless the following conditions have been identified during project development: (1) when such harvesting would assist in reducing fire hazard within the wildland-urban interface, or (2) when harvesting of stands will trend landscapes toward vegetation desired conditions (for example, uneven-aged structure).
- Harvesting systems shall be selected based on their ability to meet desired conditions and not strictly on their ability to provide the greatest dollar return.
- Clearcutting shall be used only where it helps to achieve desired conditions (for example, spruce-fir vegetation type, heavily diseased stands, aspen regeneration) shall take into account desired conditions for other resources.
- In designated wilderness areas, human-caused disturbed areas that do not complement wilderness characteristics will be rehabilitated to a natural appearance, using species or other materials native to the area.

Guidelines

- Project design should manage for continuous representation of all age classes over time and create opportunities to develop underrepresented age classes.
- Where current forests are lacking proportional representation of late-seral states and species composition on a landscape scale, old-growth characteristics should be retained or developed within the scope of meeting other desired conditions (for example, reduce impacts from insects and disease, reduce the threat of uncharacteristic wildfire).
- To protect old-growth forest components, existing old-growth forest attributes should be protected from uncharacteristic natural disturbances. Methods of protecting existing old-growth forest components on the landscape may include thinning and prescribed fire.

- Healthy southwestern white pine should be retained to maintain a wide range of genetic variability to promote resistance against the nonnative white pine blister rust disease.
- On single species-dominated sites, uneven-aged management may be used where less than 20 percent of the host tree species—or less than 25 percent of the area—is infected by dwarf mistletoe. Thinning and prescribed fire may be used to keep dwarf mistletoe levels from increasing. Even-aged management or deferral should be considered when greater than 20 percent of the host species, or 25 percent of the area, is infected with dwarf mistletoe.
- On mixed species-dominated sites, even-aged management or deferral should be used instead of uneven-aged management where more than 50 percent of conifer trees (excluding white fir) are infected by dwarf mistletoe.
- Where a seed-tree or shelterwood treatment is applied for dwarf mistletoe control, it should be followed within 10 years of seedling establishment by a final removal treatment or other effective means to prevent further infection.
- Nonnative, invasive species should be treated within recommended wilderness areas in order to allow natural processes to dominate and to maintain wilderness characteristics.
- Nonnative, invasive species should be treated in order to allow natural processes to predominate in designated wilderness areas.
- Nonnative species should not be introduced into any wilderness area.
- Gathering of forest products for sale should not be permitted in recommended wilderness areas.
- Timber harvest should not be permitted in areas recommended for wilderness designation.
- In research natural areas, allow vegetation manipulation only when necessary to achieve or maintain the conditions for which the area is being studied.
- In eligible wild and scenic rivers classified as “recreational” or “scenic,” timber harvest should be allowed to maintain or restore the values for which the eligible river was identified.
- If forest health projects result in impacts to the scenic integrity objectives within the Continental Divide National Scenic Trail (CDNST) corridor, mitigation measures should be included, such as screening, feathering, and other scenery management techniques to meet the scenic integrity objectives within and adjacent to the trail corridor (at minimum, up to ½ mile on either side of the trail).
- Hauling or skidding, or locating landings or temporary roads within the CDNST corridor should not be permitted in order to preserve the nature, purposes, and integrity of the CDNST.
- Heavy equipment line construction within the CDNST corridor should not be allowed unless necessary for emergency protection of property and safety.
- Visual impacts from vegetation treatments, recreation uses, range developments, and other structures should blend with the overall scenic character along scenic byways.
- Where not in conflict with existing law, regulation, or policy, natural regeneration of disturbed areas should be allowed where feasible unless: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area and/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.

- Planning and design development for vegetation management projects should incorporate input from all resource areas in early planning stages to include opportunities and consideration for multi-resource management.
- Species of cultural significance should be considered when planning vegetation management projects.
- For vegetation management and forest health improvement projects:
  - Scenic integrity objectives may be temporarily lowered in the short term (3 to 5 years) if necessary to meet project objectives, but should meet scenic integrity objectives over the long term.
  - Vegetation management projects should avoid even spacing of retained trees, leave a diversity of tree species and sizes, avoid damage to vegetation that will remain, and naturalize disturbed areas.
  - Prescribed slash treatment in the immediate foreground (up to 300 feet) of concern level 1 and 2 travelways (area with the most public concern for scenery) should be completed as soon as conditions permit.
  - Healthy large trees should comprise the majority of the immediate foreground along concern level 1 and 2 travelways, unless doing so would not achieve project goals; some younger and mid-aged trees are retained to serve as replacement trees and as additional screening.
  - In the immediate foreground along concern level 1 and 2 travelways, stumps should be treated to reduce their visibility by methods such as cutting as low as possible (no more than 6 inches above ground on uphill side) and angling large stump faces away from viewing locations unless doing so would pose a safety hazard.
- Effects from prescribed fire should be considered during project planning and implementation. Blackened and scorched vegetation may be visible in project areas in the short term following treatments, but scenic integrity objectives should be met in the long term. Efforts should be made to minimize high-intensity fire in riparian areas with high scenic integrity such as along system trails and scenic vistas.
- Log decks should be removed and rehabilitated, and actions should be taken to naturalize skid trails as soon as conditions permit.
- Healthy, large trees should comprise the majority of trees in developed and dispersed recreation sites to provide shade and screening around hardened sites in order to preserve the recreation setting; some younger and mid-aged trees are retained to serve as replacement trees and as additional screening.
- Upon completion of management activities that occur in areas with high potential for cross-country motorized vehicle use, methods (for example, barriers and signing) that are consistent with the scenic integrity objectives should be used to control unauthorized motorized use.
- National Forest System trails should not be used for vegetation project activities such as skid trails, and impacts to system trails should be avoided; where impacts are unavoidable, rehabilitation should occur immediately upon completion of project.
- Management of cultural resources and historic properties will proactively be integrated into the planning, design, and implementation of vegetation projects.

Management Approaches

- Project design for vegetation management activities should prioritize treatment riparian areas that are important for wildlife, in the wildland-urban interface, along concern level 1 and 2 travelways and recreation sites (areas with the most public importance to scenery), and in historic openings.
- When salvaging timber where high-severity fire occurred, an adequate number of trees for snag recruitment and coarse woody material would be left to maintain long-term soil productivity and to meet wildlife needs.
- The predominant vegetation management strategies are for uneven-aged management systems. This is because the majority of the Cibola consists of frequent-fire vegetation types which have uneven-aged desired conditions (See Table 1. Fire Regime Groups and Descriptions). Even-aged prescriptions are appropriate where they would help achieve desired conditions such as to regenerate aspen or when insect or disease infestations are moderate to severe.
- Treatments for controlling dwarf mistletoe are typically aimed at maintaining infection levels that allow for development of a diversity of age classes across the landscape—not to eliminate this naturally occurring disturbance agent.
- Management activities that result in accumulations of green slash should be timed to minimize potential impacts from bark beetles; accumulating green slash (greater than 3 inches in diameter) before overwintering beetles emerge should be avoided (generally April to June).
- Coordinate with the New Mexico Department of Game and Fish on management of native species within designated wilderness areas to maintain wilderness character during project implementation.
- Develop appropriate measures to enhance and protect historic properties from damage by natural and man-made forces (fuel accumulation, wildfire, increased visitation, etc.). Such measures may include prescribed burning of adjacent areas, thinning within and adjacent to sites, creating visibility screens using vegetation, soil stabilization, encouraging culturally important plant species, etc. When appropriate and with particular mitigation measures in place, vegetation within archaeological site boundaries should be treated to similar specifications to the surrounding environment.

Forest Vegetation Types

Spruce-Fir Forest

General Description

The Spruce-fir Forest vegetation type is often dominated by Engelmann spruce; codominant and subdominant species vary by elevation. The understory commonly includes currants, maples, honeysuckle, common juniper, huckleberry, alpine clover, and sedges. This vegetation type can be subdivided into lower- and upper-elevation types, with differing fire regimes and subdominant and codominant species composition. The lower spruce-fir type typically occurs between 9,500 and 10,500 feet in elevation; the upper spruce-fir type typically occurs above 10,500 feet.

Lower-elevation spruce-fir resembles mixed conifer with aspen with a different composition of tree species, due to relatively warmer, drier conditions; and occupies the ecotone between mixed conifer with aspen and upper-elevation spruce-fir. In the lower-elevation type, common low- and mid-seral tree species are aspen, Douglas-fir, white fir (absent on Mount Taylor), southwestern white pine, and

limber pine. Climax forest is dominated by Engelmann spruce, white fir, and occasionally blue spruce. Subdominant species may include subalpine fir[3], white fir, and bristlecone pine. In the upper-elevation type, dominant tree species are Engelmann spruce and subalpine fir; patches of aspen may be present. Disturbances in these types typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly fire) and small-scale frequent disturbances (fire, insect, disease, wind).

Landscape-Scale Desired Conditions (1,000 to 10,000 plus acres)

- The Spruce-fir Forest is a mosaic of structural and seral stages ranging from young to old trees. Patch sizes vary, but are mostly in the hundreds of acres, with rare disturbances in the thousands of acres. Tree canopies are generally more closed than in mixed conifer. Native grass, forbs, and shrubs comprise the understory. Seral-stage proportions are applied at the landscape scale (Table 2).
- Old growth generally occurs over large areas and includes old trees, standing dead trees (snags), downed wood (coarse woody material) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- The spruce-fir community is composed predominantly of vigorous trees; older, declining trees provide snags and coarse woody material. The abundance of snags, downed logs, and coarse woody material varies by seral stage.

Table 2. Desired seral-stage proportions for Spruce-fir Forest

Seral Stage	Proportion	Description
Early	21%	Grass-forb-seedling-sapling Douglas-fir, spruce fir; tree canopy is open.[1]
Mid	33%	Young forest with regeneration; tree canopy is closed.
Late	46%	Mature-old forest with regeneration; tree canopy is closed.

[1] Seedlings and saplings are trees <5 inches DBH (diameter at breast height), small trees are 5–9.9 inches DBH, medium trees are 10–19.9 inches DBH, and large trees are >20 inches DBH. The terms “open” and “closed” describe canopy cover—under 30% and over 30%, respectively. The terms “tolerant” and “intolerant” refer to species that are tolerant (for example, spruce and fir) or intolerant (for example, ponderosa pine) of shade, respectively; “mixed-tolerant” refers to species intermediate in shade tolerance (for example, Douglas-fir).

Note: Aspen may be present in all seral stages.

- Vegetative conditions (composition, structure, function) are broadly resilient to disturbances of varying frequency, extent, and severity. The forest landscape is a functioning ecosystem that contains all of its components, processes, and conditions that result from endemic levels of disturbances (insects, diseases, fire, windfall) including snags, downed logs, and old trees. Organic ground cover and herbaceous vegetation protect the soil, facilitate water infiltration, and promote plant and animal diversity and ecosystem function. In the lower-elevation type, mixed-severity fire (fire regime group III) occurs infrequently (150 to 400 years); in the upper-elevation type, high-severity fire (fire regime groups IV and V) occurs very infrequently (greater than 400

[3] “Subalpine fir” refers to subalpine fir (*Abies lasiocarpa* var. *lasiocarpa*) or corkbark fir (*Abies lasiocarpa* var. *arizonica*), or both.

years). Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, age, structure, species composition, coarse woody material, and nutrient cycling.

- Dwarf mistletoe infestation size, degree of severity, and amount of mortality vary among infested stands. Witches' brooms may be scattered throughout the infestations providing structural diversity in the stand and improved foraging and nesting habitat for wildlife species such as small mammals (for example, tree squirrels) and raptors (for example, goshawks and spotted owls).

Mid-Scale Desired Conditions (10 to 1,000 acres)

- The size and number of tree groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. There may also be small disturbances resulting in groups and patches of tens of acres or less. Grass, forb, and shrub interspaces created by disturbance may involve single trees or comprise up to 100 percent of the mid-scale area following major disturbance. Aspen is occasionally present in large patches.
- Basal area varies from 20 to 250 plus square feet per acre depending on site productivity, disturbance history, and seral stage. Large snags (greater than or equal to 18 inches DBH[4]), range from 5 to 30 plus per acre, with the lower end of the range associated with early seral stages and the upper end associated with late-seral stages. Overall snag (greater than 8 inches DBH) density ranges from 13 to 30 per acre, averaging 20 per acre. Coarse woody material (dead and downed wood) ranges from 5 to 30 tons per acre for early seral stages, 30 to 40 tons per acre for mid-seral stages, and greater than 40 tons per acre for late-seral stages. An abundance of fungi (including mushrooms) is available for use by small mammals.
- Mixed-severity (fire regime group III) and high-severity (fire regime groups IV and V) fires and other disturbances maintain desired overall tree density, structure, species composition, coarse woody material, and nutrient cycling. Ground cover consists of shrubs, perennial grasses, and forbs with plant basal cover ranging from about 5 to 20 percent depending on site conditions.
- Forest conditions in some areas contain at least 10 percent higher basal area than the general forest (for example, goshawk post-fledging family areas and north-facing slopes). Nest areas have forest conditions that are multi-aged, but are dominated by large trees with relatively denser canopies than other areas in the spruce-fir type.

Fine-Scale Desired Conditions (less than 10 acres)

- Mid- to old-age trees grow tightly together with interlocking crown. Trees are generally of the same height and age in early stages of patch development, but may be multilayered later.
- Dwarf mistletoe infection severity and amount of mortality vary among infected trees. Witches' brooms may be present with these infestations, providing habitat for wildlife.

[4] DBH = diameter at breast height (4.5 feet).

Mixed Conifer with Aspen ("Wet Mixed Conifer") Forest

General Description

The Mixed Conifer with Aspen Forest generally occurs at elevations ranging from approximately 6,500 to 10,000 feet. Tree species composition varies depending on seral stage, elevation, and moisture availability. This type can be composed of early and mid-seral species such as aspen, Douglas-fir, New Mexico locust, southwestern white pine, and limber pine; and late-seral species such as maple, white fir, and blue spruce. Ponderosa pine may be present in minor proportions. The absence of Engelmann spruce and subalpine fir plant associations (USDA Forest Service 1997) distinguishes mixed conifer with aspen from the spruce-fir forest. Disturbances typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly fire), and small-scale frequent disturbances (fire, insect, disease, wind). The understory includes a wide variety of shrubs, grasses, and forbs; species composition varies with site conditions (soil type, aspect, elevation, and disturbance). Aspen communities have multi-height stems (except in early stages following fire) and adequate recruitment to perpetuate aspen communities, including site-appropriate, native, biodiverse understories.

Landscape-Scale Desired Conditions (1,000 to 10,000 plus acres)

- The mixed conifer with aspen forest is a mosaic of structural and seral stages ranging from young trees through old with species composition varying by seral stage. Patch sizes vary, but are frequently in the hundreds of acres, with rare disturbances in the thousands of acres. Seral-stage proportions are applied at the landscape scale (Table 3). Native grass, forbs, and shrubs comprise the understory.
- Old growth generally occurs over large areas and includes old trees, standing dead trees (snags), downed wood (coarse woody material) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- The spruce-fir community is composed predominantly of vigorous trees; older, declining trees provide snags and coarse woody material. The abundance of snags, downed logs, and coarse woody material varies by seral stage.
- Vegetative conditions (composition, structure, function) are broadly resilient to disturbances of varying frequency, extent, and severity. The forest landscape is a functioning ecosystem that contains all of its components, processes, and conditions that result from endemic levels of disturbances (insects, diseases, fire, and windfall) including snags, downed logs, and old trees. Organic ground cover and herbaceous vegetation protect the soil, facilitate water infiltration, and promote plant and animal diversity and ecosystem function. Mixed-severity fire (fire regime group III) is characteristic, especially at lower elevations of this type. High-severity fire (fire regime groups IV and V) is rare and typically limited to higher elevations of this type. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody material, and nutrient cycling.

Table 3. Desired seral-stage proportions for Mixed Conifer with Aspen Forest

Seral Stage	Proportion	Description
Early	7%	Grass/forb understory with aspen or oak ramets and suckers ranging in cover from 10–40% canopy cover.
Mid (deciduous)	21%	Dominated by aspen or oak species with more than 40% canopy cover. Conifers are often present in the understory.
Mid (small conifer)	18%	Dominated by a mix of conifer species. Tree canopy cover is 20–>60%; primarily seedlings, saplings, and small trees.
Mid (medium conifer)	14%	Dominated by a mix of conifer species. Tree canopy cover is 20–>60%; primarily medium-sized trees.
Late	40%	Dominated by mature, shade-tolerant conifer species. Tree canopy cover is 20–60% or more; primarily very large trees.

- Dwarf mistletoe infestation size, degree of severity, and amount of mortality vary among infested stands. Witches' brooms may be scattered throughout the infestations providing structural diversity in the stand and improved foraging and nesting habitat for wildlife species such as small mammals (for example, tree squirrels) and raptors (for example, goshawks and spotted owls).

Mid-scale Desired Conditions (10 to 1,000 acres)

- The size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Groups and patches of tens of acres or less are relatively common. A mosaic of groups and patches of trees are present, primarily even-aged groups[5], and patches[6] that are variable in size, age, and species composition. Openness and prevalence of some species, such as aspen, is dependent on seral stage. Grass, forb, and shrub openings created by disturbance may compose 10 to 100 percent of the mid-scale area, depending on disturbance history. Aspen is occasionally present in large patches.
- Basal area varies from 20 to 180 plus square foot per acre, depending on site productivity, disturbance history, and seral stage. Large snags (greater than or equal to 18 inches DBH), range from 1 to 5 per acre, with the lower end of the range associated with early seral stages and the upper end associated with late-seral stages. Overall snag (greater than 8 inches DBH) density averages 20 per acre. Coarse woody material (dead and downed wood) ranges from 5 to 20 tons per acre for early seral stages, 20 to 40 tons per acre for mid-seral stages, and greater than or equal to 35 tons per acre for late-seral stages.

[5] Groups are clusters of two or more trees with interlocking or nearly interlocking crowns at maturity surrounded by grass-forb-shrub interspaces. Size of tree groups is typically variable depending on forest type and site conditions and can range from fractions of an acre (a two-tree group), such as in ponderosa pine or dry mixed-conifer forests, to many acres, as is common in wet mixed-conifer and spruce-fir forests. Trees within groups are typically non-uniformly spaced, some of which may be tightly clumped (adapted from Reynolds et al. (2014)).

[6] Patches are areas larger than tree groups in which the vegetation composition and structure are relatively homogeneous. Patches can be composed of randomly arranged trees or multiple tree groups, and they can be even-aged or uneven-aged. Patches comprise the mid-scale, ranging in size from 10 to 1,000 acres. Patches and stands are roughly synonymous (adapted from Reynolds et al. (2014)).

- Mixed-severity (fire regime group III) and high-severity (fire regime groups IV and V) fires and other disturbances maintain desired overall tree density, structure, species composition, coarse woody material, and nutrient cycling. Under moist conditions, smoldering low-intensity surface fires torch single trees and isolated groups; under drier conditions, passive to active crown fires kill up to 100 percent of the conifers in patches (usually less than 1,000 acres). Other smaller disturbances occur more frequently. Ground cover consists of shrubs, perennial grasses, and forbs with plant basal cover ranging from about 5 to 20 percent depending on site conditions.
- Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in the general forest (for example, goshawk post-fledging family areas, Mexican spotted owl nesting and roosting habitats, and north-facing slopes). Interspaces with native grass, forb, and shrub vegetation typically range from 10 to 50 percent of the area. Goshawk nest areas have forest conditions that are multi-aged, but are dominated by large trees with relatively denser canopies than other areas in the mixed conifer with aspen type.
- Aspen occurs as a shifting mosaic across its range with new aspen clones establishing over time. Understory vegetation consists of shrubby or herbaceous species, providing forage and cover for wildlife and habitat for invertebrates such as pollinators. Coarse woody material is scattered across the landscape and provides habitat for a variety of wildlife species (for example, small mammals, reptiles, amphibians, and birds) while contributing to efficient nutrient cycling.

Fine-Scale Desired Conditions (less than 10 acres)

- In mid-aged and older forests, trees are typically variably spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking, occasionally with some single trees spaced apart from clumps. Trees within groups can be of similar or variable species and ages. Disturbances create small openings of varying size.
- Organic ground cover and herbaceous vegetation provide protection for soil and moisture infiltration and contribute to plant diversity and ecosystem function. Due to presence of ladder fuels, fires usually burn either with low-intensity, smoldering combustion, or transition rapidly in the canopy as passive or active crown fire.
- Dwarf mistletoe witches' brooms may be present, providing habitat for wildlife.

Guidelines

- Aspen sprouting should be stimulated in areas that have or previously had aspen by clearcutting, conifer removal, or fire, has reasonable assurance of successful regeneration, and should take into account desired conditions for other resources.
- When managing for early seral states, conifers should be removed from aspen stands when needed to increase aspen longevity and increase diversity of aspen age classes.
- To preclude concentrated herbivore impacts, new surface water development should not be constructed near aspen stands (approximately a quarter of a mile) unless this is the only developable area for water in the planning area.
- Restoration of aspen clones should occur where aspen is overmature or decadent and has reasonable assurance of successful regeneration to maintain a sustainable presence of this species at the landscape level.

Management Approach

- Mixed Conifer with Aspen Forests are managed as Mexican spotted owl habitat as discussed under the most recent, approved recovery plan for the Mexican spotted owl. The Cibola National Forest works closely with the U.S. Fish and Wildlife Service to address the habitat needs of the Mexican spotted owl by minimizing disturbance and providing nest/roost habitat, which includes managing for areas of closed canopy and desired levels of key structural elements such as large old trees, snags, and downed woody material.

Mixed Conifer–Frequent Fire ("Dry Mixed Conifer") Forest

General Description

The Mixed Conifer–Frequent Fire Forest is transitional with increasing elevation between Ponderosa Pine Forest (below) and Mixed Conifer with Aspen Forest (above) and generally occurs at elevations ranging from approximately 6,000 to 9,500 feet. Mixed Conifer–Frequent Fire Forests are dominated by mainly shade-intolerant trees, such as ponderosa pine, southwestern white pine, limber pine, quaking aspen, and Gambel oak, with a lesser presence of shade-tolerant species such as white fir and blue spruce. Mixed-tolerance species, such as Douglas-fir are common. Aspen may occur as individual trees or small groups. The understory includes a wide variety of shrubs, grasses, and forbs; species composition varies with site conditions (soil type, aspect, elevation, and disturbance).

Landscape Scale Desired Conditions (1,000 to 10,000 plus acres)

- The Mixed Conifer–Frequent Fire Forest is a mosaic of forest conditions composed of structural stages ranging from young to old trees. Forest appearance is variable, but generally uneven-aged and open with occasional patches of even-aged structure. The forest arrangement is in small clumps and groups of trees interspersed within variably sized openings of grass/forb/shrub vegetation associations. Openness typically ranges from 10 percent on more productive sites to 50 percent on less productive sites. Size, shape, number of trees per group, and number of groups per area, vary across the landscape. Groups of aspen and oak in all structural stages are present. Higher tree densities exist in some locations such as north-facing slopes and canyon bottoms. Seral-stage proportions (Table 4) are applied at the landscape scale.
- Old growth occurs throughout the landscape, typically in small areas as individual old growth components or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody material), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- The Mixed Conifer–Frequent Fire Forest is composed predominantly of vigorous trees. Declining trees provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody material—all well distributed throughout the landscape. Overall snag (greater than 8 inches DBH) density averages nine per acre, including four large snags (greater than or equal to 18 inches DBH) per acre. In forested areas (as opposed to openings), coarse woody material (dead and downed wood) ranges from 8 to 16 tons per acre, including an average of three downed logs (greater than 12 inches diameter at mid-point, greater than 8 feet long) per acre.

Table 4. Desired seral-stage proportions for Mixed Conifer–Frequent Fire Forest

Seral Stage	Proportion	Description
Early[1]	9%	Trees absent or seedlings and saplings only.
Mid[1] (open)	3%	Dominated by small, shade-intolerant trees with open canopy structure.
Mid[1] (closed)	3%	Closed canopy state supporting small shade-tolerant and mixed-tolerance tree species.
Late (open)	60%	Dominated by medium to very large shade-intolerant trees with an open canopy structure.
Late (closed)	25%	Dominated by medium to very large shade-tolerant and mixed-tolerance trees with a closed canopy structure.

[1] Based on the necessary level of even-aged management (4% per decade) to sustain >25% mature closed forest condition (≥10" DBH) for Mexican spotted owl habitat.

- Vegetative conditions (composition, structure, function) are broadly resilient to disturbances of varying frequency, extent, and severity. The forest landscape is a functioning ecosystem that contains all of its components, processes, and conditions that result from endemic levels of disturbances (insects, diseases, fire, and windfall) including snags, downed logs, and old trees. Organic ground cover and herbaceous vegetation protect the soil, facilitate water infiltration, and promote plant and animal diversity and ecosystem function. Frequent low-severity fires (fire regime group I) are characteristic throughout this vegetation type (including goshawk home ranges). Natural and anthropogenic disturbances maintain desired overall tree density, structure, species composition, coarse woody material, and nutrient cycling.

Mid-Scale Desired Conditions (10 to 1,000 acres)

- The Mixed Conifer–Frequent Fire Forest is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area. Openness typically ranges from 10 percent on more productive sites to 50 percent on the less productive sites. Basal area within forested areas ranges from 30 to 100 square foot per acre.
- The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages. Small patches (usually less than 50 acres) of even-aged forest structure are occasionally present. Disturbances sustain the overall age and structural distribution. Where they naturally occur, groups or patches of aspen and all structural stages of oak are present.
- Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal vegetation cover ranging from about 5 to 20 percent depending on site conditions. Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
- Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in the general forest (for example, goshawk post-fledging family areas, Mexican spotted owl nesting/roosting habitats, and north-facing slopes). Interspaces with native grass, forb, and shrub vegetation typically range from 10 to 50 percent of the area. Goshawk nest areas have forest conditions that are multi-aged, but are dominated by large trees with relatively denser canopies than other areas in the Mixed Conifer–Frequent Fire Forest type.
- Snags 18 inches DBH or greater average three per acre. Downed logs (greater than 12 inches diameter at midpoint and greater than 8 feet long) average three per acre within the forested area of mid-scale units. Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre.

Fine-Scale Desired Conditions (less than 10 acres)

- Trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Crowns of trees within the mid- to old-age groups are interlocking or nearly interlocking. Interspaces surrounding tree groups are variably shaped and composed of a grass/forb/shrub mix. Some natural openings contain individual trees or snags. Trees within groups are of similar or variable ages and one or more species. Size of tree groups typically is less than 1 acre. Groups at the mid- to old-age stages contain 2 to about 50 trees per group.
- Dwarf mistletoe infections may be present on ponderosa pine and Douglas-fir, and rarely on other tree species, but the degree of infection severity and rate of mortality varies among infected trees. Witches' brooms may be present with these infestations, providing habitat for wildlife.

Guidelines

- Where Gambel oak or other native hardwoods are desirable to retain for diversity, treatments should improve vigor and growth and enhance tree-form structure of these species.
- Where consistent with project or activity objectives, canopy cover should be retained on the south and southwest sides of small, existing forest openings to enhance cooler and moister conditions. These small (generally 0.1 to 0.25 acre), shaded openings provide habitat conditions needed by small mammals, plants, and insects, and these openings should be maintained where they naturally occur.

Management Approaches

- Mixed Conifer–Frequent Fire Forests are managed as Mexican spotted owl habitat as discussed under the most recent, approved recovery plan for the Mexican spotted owl. The Cibola National Forest works closely with the U.S. Fish and Wildlife Service to address the habitat needs of the Mexican spotted owl by minimizing disturbance and providing nest/roost habitat, which includes managing for areas of closed canopy and desired levels of key structural elements such as large old trees, snags, and downed woody material.
- In mixed conifer forests, many individual large Gambel oak trees and thickets have become overtopped by conifers. Treatments to promote oak regeneration and establishment are fairly effective, because oak sprouts prolifically after release treatments. Oaks may be cut or burned to stimulate new growth, maintain growth in large-diameter trees, or to stimulate mast production.
- Illegal wood cutting reduces both the amount and quality of oak habitat. Enforcement, education, and site-specific planning will be necessary to ensure quality oak habitat over the long term. Firewood collection opportunities are managed so site-specific planning and permitting may specify the amount and size of oak that can be collected in areas where live and dead woody oak habitat components are limited.
- In proposed treatment areas where there is little understory, slash treatments (for example, lop and scatter, mastication) should be used that improve herbaceous vegetation growth, soil and watershed condition, and increase soil productivity, consistent with scenic integrity objectives.

Ponderosa Pine Forest

General Description

The Ponderosa Pine Forest vegetation type includes two sub-types: Ponderosa Pine–Bunchgrass and Ponderosa Pine–Gambel Oak (desired conditions are the same for both). The Ponderosa Pine Forest generally occurs at elevations ranging from approximately 5,000 to 9,000 feet. This type is

dominated by ponderosa pine and commonly includes other species such as oak, juniper, and pinyon. More infrequently species such as aspen, Douglas-fir, white fir, and blue spruce may also be present, and may occur as individual trees. The understory includes a wide variety of shrubs, grasses, and forbs; species composition varies with site conditions (soil type, aspect, elevation, and disturbance).

Landscape Scale Desired Conditions (1,000 to 10,000 plus acres)

- The Ponderosa Pine Forest is composed of trees from structural stages ranging from young to old. Forest appearance is variable, but generally uneven-aged and open; occasional areas of even-aged structure are present. The forest arrangement is in individual trees, small clumps, and groups of trees interspersed within variably sized openings of grass/forbs/shrubs vegetation associations similar to historic patterns. Openness typically ranges from 10 percent in more productive sites to 70 percent in the less productive sites. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. Seral-stage proportions are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Table 5). In the Gambel oak sub-type, all sizes and ages of oak trees are present. Denser tree conditions exist in some locations such as north facing slopes and canyon bottoms.
- Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody material), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

The ponderosa pine forest is composed predominantly of vigorous trees, but declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody material (greater than 3 inch diameter), all well-distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater at DBH and average one to two snags per acre. In the Gambel oak subtype, large oak snags (greater than 10 inches) are a well-distributed component. Downed logs (greater than 12 inch diameter at mid-point, greater than 8 feet long) average three logs per acre within the forested area of the landscape. Coarse woody material, including downed logs, ranges from 5 to 10 tons per acre.

Table 5. Desired seral-stage proportions for Ponderosa Pine Forest

Seral Stage	Proportion	Description
Early	1%	Post-disturbance state consisting primarily of grass with less than 10% tree cover.
Mid*	3%	Conditions[1] indicative of occasional even-aged stand dynamics and the development of (1) northern goshawk nesting habitat where understory is dominated by grasses or (2) Mexican spotted owl habitat where understory is dominated by shrubs.
Late	96%	Predominance of uneven-aged dynamics and open forest. The plurality of stands on low-productivity sites likely to occur as early seral, post-disturbance state consisting primarily of grass with less than 10% tree cover; on high-productivity sites a mature- to old-growth forest consisting of open canopy stands from very large trees. Regeneration occurs within this state, with multi-aged stands from all size classes; however, the very large size class is the dominant cohort.

[1] Reflects percentage of early-mid seral forest necessary to sustain at least 3% mature closed forest condition as northern goshawk nesting habitat or Mexican spotted owl habitat.

- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (for example, insects, diseases, fire, and wind), including snags, downed logs, and old trees. Grasses, forbs, shrubs, and needle cast (fine fuels), and small trees maintain the natural fire regime. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. At the Plan unit scale, overall plant composition similarity to site potential is greater than 66 percent, but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions. Frequent, low severity fires (fire regime I) are characteristic in this type, including throughout goshawk home ranges. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody material, and nutrient cycling.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- The Ponderosa Pine Forest vegetation type is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. Openness typically ranges from 52 percent in more productive sites to 90 percent in less productive sites. In areas with high fine-scale aggregation of trees into groups, mid-scale openness ranges between 78 to 90 percent. Tree density within forested areas generally ranges from 22 to 89 square foot basal area per acre. Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal vegetation values ranging between about 5 and 20 percent.
- The mosaic of tree groups generally comprises an uneven-aged forest with all age classes present. Infrequently, patches of even-aged forest structure are present. Disturbances sustain the overall age and structural distribution.
- Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
- Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in the general forest (for example, goshawk post-fledging family areas, Mexican spotted owl nesting and roosting habitats, drainages, and steep north-facing slopes). Goshawk nest areas have forest conditions that are multi-aged, but are dominated by large trees with relatively denser canopies than other areas in the ponderosa pine type.

Fine-Scale Desired Conditions (less than 10 acres)

- Trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Crowns of trees within the mid- to old-age groups are interlocking or nearly interlocking. Interspaces surrounding tree groups are variably shaped and comprised of a grass/forb/shrub mix. Some natural openings contain individual trees. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Size of tree groups typically is less than 1 acre, but averages 0.5 acres. Groups at the mid- to old-age stages consist of 2 to approximately 40 trees per group.
- Where historically occurring, oak trees and thickets are present and provide forage, cover, and habitat for species that depend on them such as small mammals, foliage nesting birds, deer, and elk. Oak mast (acorns) provides food for wildlife species. Large tree-form oaks, snags, and partial snags with hollow boles or limbs are present.

- Isolated infestations of dwarf mistletoe may occur, but the degree of severity and mortality varies among the infected trees. Witches' brooms may form on infected trees, providing habitat and food for wildlife and invertebrate species.

Guidelines

- Where Gambel oak or other native hardwoods are desirable to retain for diversity, treatments should improve vigor and growth and enhance tree-form structure of these species.
- Where consistent with project or activity objectives, canopy cover should be retained on the south and southwest sides of small, existing forest openings to enhance cooler and moister conditions. These small (generally 0.1 to 0.25 acre), shaded openings provide habitat conditions needed by small mammals, plants, and insects, and these openings should be maintained where they naturally occur.

Management Approaches

- Ponderosa pine forests are managed as Mexican spotted owl habitat as discussed under the most recent, approved recovery plan for the Mexican spotted owl. The Cibola National Forest works closely with the U.S. Fish and Wildlife Service to address the habitat needs of the Mexican spotted owl by minimizing disturbance and providing nest/roost habitat, which includes managing for areas of closed canopy and desired levels of key structural elements such as large old trees, snags, and downed woody material.
- In pine-oak forests, many individual large Gambel oak trees and thickets have become overtopped with pine trees. Treatments to promote oak regeneration and establishment are fairly effective, because oak sprouts prolifically after release treatments. Oaks may be cut or burned to stimulate new growth, maintain growth in large-diameter trees, or to stimulate mast production.
- Enforcement, education, and site-specific planning to address illegal wood cutting will be necessary to ensure quality oak habitat over the long term. Illegal wood cutting reduces both the amount and quality of oak habitat. Firewood collection opportunities are managed so site-specific planning and permitting may specify the amount and size of oak that can be collected in areas where live and dead woody oak habitat components are limited.
- In proposed treatment areas where there is little understory, slash treatments (for example, lop and scatter, and mastication) should be used that improve herbaceous vegetation growth, soil and watershed condition, and soil productivity, consistent with scenic integrity objectives.

Woodland Vegetation Types

Pinyon-Juniper Woodland

General Description

- Pinyon-Juniper Woodland is collectively composed of the Juniper Grass, Pinyon-Juniper Grass, Pinyon-Juniper Sagebrush, Pinyon-Juniper Evergreen Shrub, and Pinyon-Juniper Woodland (persistent) vegetation types. These generally occur at elevations between approximately 4,500 and 7,500 feet. They are dominated by one or more species of pinyon pine and/or juniper and can occur with a grass/forb dominated understory (Pinyon-Juniper Grassland), a shrub-dominated understory (Pinyon-Juniper Sagebrush/Evergreen Shrub), or a discontinuous understory of some grasses and/or shrubs (Pinyon-Juniper Woodland). Two-needle pinyon and one-seed, Rocky Mountain, and alligator junipers are common, with a lesser abundance of oaks. Species

composition and stand structure vary by location primarily due to precipitation, elevation, temperature, and soil type.

- Pinyon-juniper communities provide important winter and spring range for wildlife. Mature pinyon-juniper stands are particularly important for several species of conservation concern, (for example, gray vireo and juniper titmouse) many of which rely on the habitat features provided only by mature stands. Such features include large-diameter trunks for nest cavities and greater cone (juniper "berry") and seed production. Mast (acorn) production is important forage for wildlife, as are young leaves important as browse.
- Plant litter (leaves, needles, etc.) and understory plant cover contribute to soil stabilization, prevent erosion, promote nutrient cycling, improve water retention, and provide cover and forage for small mammals and conditions necessary for pinyon seed germination. Tree density impacts the understory of grasses, forbs, and shrubs'.

Landscape Scale Desired Conditions (1,000 to 10,000 plus acres)

- Pinyon-Juniper Grass and Juniper Grass are generally uneven aged and open in appearance. Trees occur as individuals, but occasionally in smaller groups, and range from young to old. Scattered shrubs and a dense herbaceous understory including native grasses, forbs, and annuals are present to support frequent surface fires. Snags are scattered across the landscape. Old growth occurs throughout the landscape, generally in small areas as individual old-growth components, or as clumps of old growth. Old-growth components include old trees, dead trees (snags), downed wood (coarse woody material), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (for example, insects, diseases, and fire) and climate variability. Fires are typically frequent and low-severity (fire regime I).
- Seral-stage proportions are applied at the landscape scale (Table 6). Snags with diameters 8 inches and above at the base average five snags per acre, while snags 18 inches and above average one snag per acre. Coarse woody material increases with succession and averages 1 to 3 tons per acre.

Table 6. Desired seral-stage proportions for Pinyon-Juniper Grass Woodland and Juniper Grass Woodland

Seral Stage	Proportion	Description
Early	5%	Post-disturbance state supporting primarily herbaceous species with tree and shrub cover each below 10% canopy cover.
Mid (open)	25%	Comprised of seedlings, saplings, and small trees with a predominantly open canopy.
Mid (closed)	10%	Closed tree canopy from small trees.
Late (open)	50%	Open tree canopy dominated by medium to very large trees.
Late (closed)	10%	Closed tree canopy consisting of medium to very large trees.

- Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal vegetation values averaging between about 10 and 30 percent. Shrubs average less than 30 percent canopy cover. Overall plant composition similarity to site potential is greater

than 66 percent, but can vary considerably at the fine- and mid-scales owing to a diversity of seral conditions. Patch sizes of woodlands range from individual trees and clumps that are less than 0.1 acre, to tree groups of approximately an acre.

Pinyon-Juniper Sagebrush Woodland

Landscape-Scale Desired Conditions (1,000 to 10,000 plus acres)

- Pinyon-Juniper Sagebrush Woodland is a mix of trees and shrubs that occurs as a series of vegetation states that move from herbaceous-dominated to shrub-dominated to tree-dominated over time. Trees occur as individuals or in smaller groups ranging from young to old. Pinyon trees are occasionally absent, but one or more juniper species is always present. Typically groups are even-aged in structure. The understory is dominated by moderate to high density shrubs depending on successional stage. The shrub component consists of one or a mix of big sagebrush, evergreen shrub, oak, and other shrub species, which are well-distributed. Shrubs typically are in a closed canopy state during later successional stages. Native perennial grasses and annual and perennial forbs are present as understory components. Snags and old trees with dead limbs/tops are scattered across the landscape. Coarse woody material is present. The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (such as insects, diseases, and fire) and climate variability. Fires are typically infrequent mixed-severity, with rare stand-replacement fires.
- Seral-stage proportions are applied at the landscape scale (Table 7). Snags with diameters 8 inches and above at the base average 6 snags per acre, while snags 18 inches and above average 1 snag per acre. Coarse woody material averages about 4 tons per acre.

Table 7. Desired seral-stage proportions for Pinyon-Juniper Sagebrush Woodland

Seral Stage	Proportion	Description
Early	10%	Post-disturbance state.
Mid (open)	25%	Comprised of seedlings, saplings, and small trees with a predominantly open canopy.
Mid (closed)	20%	Closed tree canopy from small trees.
Late (open)	35%	Open tree canopy dominated by medium to very large trees.
Late (closed)	10%	Closed tree canopy consisting of medium to very large trees.

- Ground cover consists primarily of shrubs, perennial grasses, and forbs capable of carrying surface fire only infrequently, with basal vegetation values averaging between about 10 and 35 percent depending on site conditions. Shrubs average greater than 30 percent canopy cover. Overall plant composition similarity to site potential is greater than 66 percent, but can vary considerably at the fine- and mid-scales owing to a diversity of seral conditions. The patch size of woodlands ranges from 1 to 10s of acres.

Pinyon-Juniper Evergreen Shrub Woodland

Landscape Scale Desired Conditions (1,000 to 10,000 plus acres)

- Pinyon-Juniper Evergreen Shrub Woodland is a mix of trees and shrubs that occurs as a series of vegetation states that move from herbaceous-dominated to shrub-dominated to tree-dominated over time. Trees occur as individuals or in smaller groups ranging from young to old. Pinyon trees are occasionally absent, but one or more juniper species is always present. Typically groups are even-aged in structure with all ages represented across the landscape for an overall uneven-aged grouped appearance. The understory is dominated by low to moderate density shrubs depending on successional stage. The shrub component consists of one or a mix of evergreen oak, mountain mahogany, sumac and other shrub species, which are well-distributed. Native perennial grasses and annual and perennial forbs are present in the interspaces. Snags and old trees with dead limbs/tops are scattered across the landscape. Large dead wood is present. Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody material) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances (such as insects, diseases, and fire), and climate variability. Fires are typically mixed-severity with a moderate frequency (fire regime III). Some evergreen shrub types exhibit occasional high severity fires (fire regime IV).
- Seral-stage proportions are applied at the landscape scale (Table 8). Snags with diameters 8 inches and above at the base average three snags per acre, while snags 18 inches and above average one snag per acre. Coarse woody material averages 2 to 4 tons per acre.
- Shrubs average greater than 30 percent canopy cover. Overall plant composition similarity to site potential is greater than 66 percent, but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions. Ground cover consists of shrubs, perennial grasses, and forbs with basal vegetation values ranging between about 5 and 15 percent. The patch size of woodlands ranges from 1 to 10s of acres.

Table 8. Desired seral-stage proportions for the Pinyon-Juniper Evergreen Shrub Woodland

Seral Stage	Proportion	Description
Early	5%	Post-disturbance state supporting primarily herbaceous species with tree and shrub cover each below 10% canopy cover.
Mid	55%	Comprised of seedlings, saplings, and small trees with a predominantly open canopy.
Late	40%	Open tree canopy dominated by medium to very large trees. Total cover between trees and shrubs often exceeds 30%.

Pinyon-Juniper Woodland (Persistent)

Landscape Scale Desired Conditions (1,000 to 10,000 plus acres)

- Pinyon-Juniper Woodland (persistent) is characterized by even-aged patches of pinyons and junipers that at the landscape level form multi-aged woodlands. Very old trees (greater than 300 years old) are present. Tree density and canopy cover are high, shrubs are sparse to moderate,

and herbaceous cover is low and discontinuous. Snags and older trees with dead limbs and/or tops are scattered across the landscape. Old growth features are often concentrated in mid- and fine-scale units as patches of old growth. Old growth includes old trees, dead trees (snags), downed wood (coarse woody material) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (such as insects, diseases, and fire), and climate variability. Insects and disease occur at endemic levels. Fire as a disturbance is less frequent and variable due to differences in ground cover. The fires that do occur are mixed to high severity (fire regime III, IV, and V). Seral-stage proportions are applied at the landscape scale.

- Where pinyon-juniper obligate species occur (such as the gray vireo and juniper titmouse) project design should retain an average of six snags (diameters greater than 8 inches at base) per acre and one snag (greater than 18 inches diameter at base) per acre and an average of 4 tons per acre of coarse woody material (as well as partially dead or dying trees) even when this is in conflict with other activities such as fuelwood gathering.
- Snags with diameters 8 inches and above at the base average five snags per acre, while snags 18 inches and above average one snag per acre. Coarse woody material increases with succession and averages 2 to 5 tons per acre. Overall plant composition similarity to site potential is greater than 66 percent, but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions. Ground cover consists of shrubs, perennial grasses, and forbs with basal vegetation values ranging between about 5 and 15 percent. Some sites are capable of carrying surface fire. The patch size of woodlands ranges from 10s to 100s of acres.

Guideline

- Where pinyon-juniper obligate species occur (such as the gray vireo and juniper titmouse) project design should retain an average of six snags (diameters greater than 8 inches at base) per acre and one snag (greater than 18 inches diameter at base) per acre and an average of 4 tons per acre of coarse woody material (as well as partially dead or dying trees) even when this is in conflict with other activities such as fuelwood gathering.

Table 9. Desired seral-stage proportions for Pinyon-Juniper Woodland (persistent)

Seral Stage	Proportion	Description
Early	10%	Post-disturbance state supporting primarily herbaceous species with tree and shrub cover each below 10% canopy cover.
Mid (open)	5%	Comprised of seedlings, saplings, and small trees with a predominantly open canopy.
Mid (closed)	15%	Closed tree canopy from small trees.
Late (open)	10%	Open tree canopy dominated by medium to very large trees.
Late (closed)	60%	Closed tree canopy consisting of medium to very large trees.

Management Approaches

- Strategies for re-establishing the desired conditions include leaving juniper snags, downed logs, and other woody components that collect drifting seeds, provide shade, cooler temperatures, moisture retention, and protection from ungulate herbivory. These microclimates serve as

nurseries for grasses, forbs, and trees, contribute to resilience in times of drought, and provide habitat for small mammals and other wildlife.

- Move all vegetation types towards desired conditions by monitoring, recovering and mitigating severe or uncharacteristic disease outbreaks and insect infestations to ensure watershed health
- In proposed treatment areas where there is little understory, slash treatments (such as lop and scatter and mastication) should be used that improve herbaceous vegetation growth, soil and watershed condition, and soil productivity.
- Fuelwood collection opportunities are managed so site-specific planning and permits may specify the location and the amount and size of wood that can be collected in areas where live and dead woody habitat components are limited. Post-fuelwood collection rehabilitation restores soil stability and watershed function.

Madrean Woodland

General Description

Madrean Woodland comprises Madrean Pinyon–Oak Woodland and Madrean Encinal Woodland. Madrean Encinal Woodland (not found on the Cibola) often occurs below Madrean Pinyon–Oak at the interface with Semi-Desert Grassland.

The Madrean Woodlands generally occur at elevations between 4,900 and 7,500 feet and can occur with a grass/forb-dominated understory or a shrub-dominated understory. Madrean Encinal Woodland is characterized by the dominance of oak trees, while Madrean Pinyon–Oak is dominated by both oaks and pinyon. Juniper can be co-dominant in either type. The two Madrean types can intergrade with one another and with pinyon-juniper woodlands. Common oak species include Emory oak and gray oak depending on the location. Juniper species include alligator juniper and one-seed juniper. The understory includes a wide variety of shrubs, grasses, and forbs; species composition varies with site conditions (soil type, aspect, elevation, and disturbance).

The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from natural disturbances (such as insects, diseases, fire, and wind), including old growth. Grasses, forbs, shrubs, and needle cast (fine fuels), and small trees help to maintain the natural fire regime. Litter cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Frequent, primarily low-severity fires (fire regime I/III) burn on the forest floor and do not typically spread between trees as crown fire. Mixed-severity fires occur less frequently and over smaller spatial extents than low severity fires. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody material, and nutrient cycling.

Landscape Scale Desired Conditions (10,000 plus acres)

- Seral-stage proportions are applied at the landscape scale (Table 10). The Madrean types are relatively homogenous in structure, generally uneven-aged and open, with occasional patches of even-aged structure. Declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody material, all well-distributed throughout the landscape. Snags 8 inches or greater at DBH average four snags per acre; snags 18 inches or greater average one snag per acre. Large oak snags (greater than 10 inches) are a well-distributed component. Coarse woody material increases with forest succession and averages 2 to 3 tons per

acre. The amount of shrub cover depends on the Terrestrial Ecosystem Unit Inventory (TEUI) unit (USDA Forest Service 1986). Overall plant composition similarity to site potential is greater than 66 percent, but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions.

Table 10. Desired seral-stage proportions for Madrean Pinyon–Oak Woodland

Seral Stage	Proportion	Description
Early	4%	Post-disturbance state dominated by grasses.
Mid (seedlings)	5%	Dominated by resprouting seedlings with both open and closed stands.
Mid (open)	13%	Open tree canopy cover from small trees. Grasses dominate the understory. Conditions indicative of even-aged stand dynamics and the development of Mexican spotted owl habitat.
Mid (closed)	3%	Closed tree canopy cover from small trees. Grasses dominate the understory.
Late (open)	60%	Open tree canopy cover from medium to very large trees. Grasses dominate the understory.
Late (closed)	15%	Mature forest state with closed tree canopy cover from medium to very large trees. Grasses dominate the understory. Conditions indicative of Mexican spotted owl habitat and mature closed-forest conditions.

Mid-Scale Desired Conditions (100 to 1000 acres)

- The majority of woodland is in open condition with tree cover averaging between 10 and 40 percent depending on site productivity and past disturbance, with tree cover in canyons and drainage bottoms nearer the upper end of this range. A lesser amount is in closed canopy condition characteristic of the reference condition. Patch sizes range from less than 1 acre to 10s of acres. Tree groups vary in size and number depending on climate, soil type, and past disturbance. The more biologically productive sites contain more trees per group and more groups per acre. Shrubs occur in low to moderate densities which do not inhibit tree regeneration. The size, shape, and number of trees per group, and number of groups per mid-scale unit, are variable. All structural stages of oak are present with old trees occurring as dominant individuals, and small groups occurring typically within openings. Denser overall tree conditions exist in some locations such as north facing slopes and canyon bottoms. Ground cover consists of perennial grasses and forbs capable of carrying surface fire, with basal vegetation values between about 2 and 20 percent depending on site conditions.

Fine-Scale Desired Conditions (less than 10 acres)

- At the fine scale, forest arrangement is in individual trees, small clumps, and groups of trees interspersed within variably sized openings of grass/forbs/shrub vegetation associations similar to historic patterns. Trees typically occur in small groups in which they are variably spaced with some tight clumps. Crowns of trees within the mid- to old-age groups are interlocking or nearly interlocking. Interspaces between tree groups are variably shaped and comprised of a grass/forb/shrub mix. Some natural openings contain individual trees, including large open-grown oaks. Trees within groups are of similar or variable ages and may contain species other than oak, juniper, and pinyon pine. The size of tree groups is typically 1 acre or less. Groups at the mid- to old-age stages consist of 2 to approximately 40 trees.

Guideline

- Clusters of trees, and shrubs, and snags should be maintained in treatment areas to benefit species that require these structures for breeding, feeding, shelter, and other needs.

Management Approaches

- Madrean Pinyon-Oak woodlands are managed as Mexican spotted owl habitat as discussed under the most recent, approved recovery plan for the Mexican spotted owl. The Cibola National Forest works closely with the U.S. Fish and Wildlife Service to address the habitat needs of the Mexican spotted owl by minimizing disturbance and providing nest/roost habitat, which includes managing for areas of closed canopy and desired levels of key structural elements such as large old trees, snags, and downed woody material.
- Strategies for re-establishing the desired conditions include leaving snags, downed logs, and other woody components that collect drifting seeds, provide shade, cooler temperatures, moisture retention, and protection from ungulate herbivory. These microclimates serve as nurseries for grasses, forbs, and trees, contribute to resilience in times of drought, and provide habitat for small mammals and other wildlife.
- In proposed treatment areas where there is little understory, slash treatments (such as lop and scatter and mastication) should be used that improve herbaceous vegetation growth, soil and watershed condition, and soil productivity.
- Fuelwood collection opportunities are managed so site-specific planning and permits may specify the location and the amount and size of wood that can be collected in areas where live and dead woody habitat components are limited. Post-fuelwood collection rehabilitation restores soil stability and watershed function.

Shrubland Vegetation Types

Mountain Mahogany Mixed Shrubland

Mountain Mahogany Mixed Shrubland vegetation type occurs in the foothills, canyon slopes, and lower mountain slopes of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. It is often associated with exposed sites, rocky substrates, dry conditions, and recurrent fire that limits tree growth. Scattered trees or inclusions of grassland patches or steppe may be present, but a variety of shrubs including mountain mahogany and skunkbush sumac typically dominate. Historically, tree canopy cover was less than 10 percent. Seral-stage proportions are applied at the landscape scale (Table 11).

Table 11. Desired seral-stage proportions for Mountain Mahogany Mixed Shrubland

Seral Stage	Proportion	Description
Early	5%	Recently disturbed state with shrub cover <10%.
Mid	65%	Dominated by shrubs with tree cover <10%.
Late	30%	Dominated by trees with >10% cover.

The Mountain Mahogany Mixed Shrubland vegetation type is characterized by fire regime group IV, with an average fire-return interval of 35 to 200 years from stand-replacing fire.

Gambel Oak Shrubland

Gambel Oak Shrubland[7] vegetation type is dominated by long-lived Gambel oak clones that form largely monotypic overstories. It occurs between 6,500 and 9,500 feet on all aspects, and at higher elevations it occurs more predominantly on southern exposures. Gambel oak occurs as the dominant species ranging from dense thickets to clumps associated with other shrub species such as serviceberry or big sagebrush. Older, more developed Gambel oak can have a well-developed understory comprised of snowberry, elk sedge, Letterman's needlegrass, Sandberg bluegrass, yarrow, lupine, and goldenrod. Ponderosa pine, juniper, and pinyon may encroach older plant communities. The primary disturbance mechanism is mixed-severity to stand-replacement fire resulting in top-kill and rare mortality. Gambel oak responds to fire with vigorous sprouting from the base. Larger forms may survive low-intensity surface fire. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 12).

The Gambel Oak Shrubland vegetation type is characterized by fire regime group IV, with an average fire-return interval of 35 to 200 years from stand-replacing fire (See Table 1. Fire Regime Groups and Descriptions).

Table 12. Desired seral-stage proportions for Gambel Oak Shrubland

Seral Stage	Proportion	Description
Early	80%	Herbaceous species dominate with shrub cover <10%.
Late	20%	Shrub cover >10%.

Where historically occurring, Gambel oak thickets with various diameter stems and low growing, shrubby oak are present. These thickets provide forage, cover, and habitat for species such as small mammals, foliage nesting birds, deer, and elk. Gambel oak mast (acorns) provides food for wildlife species.

Sagebrush Shrubland

This vegetation type is dominated by big sagebrush. Sagebrush shrubland primarily occurs adjacent to Great Basin grassland and Pinyon-Juniper Woodland vegetation types. While big sagebrush is the dominant species, other shrubs such as broom snakeweed and shadscale are common, as are grassland species such as blue grama, junegrass, and western wheatgrass. Historically, this vegetation type had less than 10 percent tree canopy cover. Sagebrush shrubland sites are usually found on deep, well-drained valley bottom soils between 4,800 and 5,800 feet elevation with precipitation ranging between 10 to 18 inches per year. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 13).

Sagebrush provides variable habitat that can include a mix of shrublands and grasslands. This diversity supports an abundance of birds, animals, and native plants, some of which are specially adapted to the system. Overall, wildlife species diversity may be lower in sagebrush systems than in habitat types with greater vertical complexity, but the species that occur in sagebrush systems often

[7] Adapted from the description of Rocky Mountain Gambel Oak-Mixed Montane Shrubland (LANDFIRE 2010).

occur nowhere else. Sagebrush shrublands provide important habitat for several migratory bird species. Populations of many bird species that depend on these ecosystems are in decline, and many have special conservation status. Enough shrub cover exists to meet the needs of a variety of sagebrush obligate wildlife species.

Table 13. Desired seral-stage proportions for Sagebrush Shrubland

Seral Stage	Proportion	Description
Early	80%	Herbaceous species dominate with shrub cover <10%.
Late	20%	Shrub cover >10%.

The Sagebrush Shrubland vegetation type is characterized by fire regime group III, with an average fire-return interval of 35 to 200 years from mixed severity fire.

Intermountain Salt Scrub

The Intermountain Salt Scrub vegetation type is found in cold climate gradients and the Great Plains, and is not often found on Forest Service lands of the Southwest. Soils associated with this vegetation type are typically sodic, saline, or saline-sodic. The vegetation is characterized by a typically open to moderately dense shrubland composed of four-wing saltbush, yellow rabbitbrush, jointfir (Mormon tea), greasewood, and winterfat. Associated grasses include Indian ricegrass, bottlebrush squirreltail, Sandberg bluegrass, galleta, alkali sacaton, and sand dropseed. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 14).

Table 14. Desired seral stage proportions for Intermountain Salt Scrub

Seral Stage	Proportion	Description
Early	25%	Herbaceous species dominate with only widely scattered shrubs.
Mid	45%	Open canopy shrub cover and discontinuous grasses.
Late	30%	Dominated by shrubs and lacking an herbaceous component.

The Intermountain Salt Scrub vegetation type is characterized by fire regime group III, with an average fire-return interval of 35 to 200 plus years from mixed severity fire.

Chihuahuan Salt Desert Scrub

This vegetation type occurs in the high sun/mild climate gradient and includes extensive open-canopied shrublands of typically saline basins (saline, sodic, or saline-sodic soils) in the Chihuahuan Desert. Stands often occur on alluvial flats and around playas. Substrates are generally fine-textured, saline soils. Vegetation is typically composed of saltbush, honey mesquite, ocotillo, prickly pear, dropseed, tobosagrass, saltgrass, and other halophytic plants. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 15).

Table 15. Desired seral-stage proportions for Chihuahuan Salt Desert Scrub

Seral Stage	Proportion	Description
Early	25%	Sparsely vegetated and dominated by herbaceous species.
Mid	35%	Open canopy shrub cover and discontinuous grasses.
Late	40%	Closed canopy and dominated by shrubs.

The Chihuahuan Salt Desert Scrub vegetation type is characterized by fire regime group III, with an average fire-return interval of 100 to 200 years from mixed severity fire.

Chihuahuan Desert Scrub

The Chihuahuan Desert Scrub vegetation type ranges from the edges of basin floors, up alluvial fan piedmonts, to foothills of desert mountains and mesas. The major dominant is creosotebush often mixed with honey mesquite, catclaw acacia, whitethorn acacia, and ocotillo. Sub-shrubs are also abundant and often codominants. These include agave, prickly pear, and Wright's beebrush. Herbaceous cover can by sparse or grassy with fluffgrass and bush muhly as key indicators. Black grama, tobosagrass, and burrograss may also occur.[8] Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 16).

Table 16. Desired seral-stage proportions for Chihuahuan Desert Scrub

Seral Stage	Proportion	Description
Early	5%	Sparsely vegetated and dominated by herbaceous species.
Mid	20%	Open canopy shrub cover and discontinuous grasses.
Late	75%	Closed canopy and dominated by trees and shrubs.

The Chihuahuan Desert Scrub vegetation type is characterized by fire regime group III, with an average fire-return interval of 200 plus years from mixed severity fire. The sparse nature of this vegetation type indicates that fires likely would have been limited in size to small areas of continuous fuels.

Sandsage

The Sandsage Shrubland occurs mainly on sand dunes and areas that were overblown with a thicker, sandier soil surface during disturbances. Characteristic plant species for the Sandsage vegetation type are sand sagebrush, blue grama, sideoats grama, big bluestem, little bluestem, needle and thread, and Indiangrass. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 17).

[8] Excerpted from Integrated Landscape Assessment Project (2012).

Table 17. Desired seral-stage proportions for Sandsage Shrubland

Seral Stage	Proportion	Description
Early	30%	Herbaceous species dominate with open shrub canopy.
Late	70%	Closed shrub cover.

The Sandsage vegetation type is characterized by fire regime group III, with an average fire return interval of 35 to 200 plus years from mixed-severity fire.

Grassland Vegetation Types

Montane/Subalpine Grassland

Also referred to as montane grasslands, this system occurs at elevations ranging from 8,000 to 11,000 feet, and often harbors several plant associations with varying dominant grasses and herbaceous species. Such dominant species may include Parry's oatgrass, Arizona fescue, Thurber's fescue, pine dropseed, sedges, rushes, shooting star, Rocky Mountain iris, Parry's bellflower, cinquefoil, and Woods' rose. Trees may occur along the periphery of the meadows, which may include Engelmann spruce, blue spruce, Douglas-fir, white fir (except on Mount Taylor), limber pine, and subalpine fir. Some shrubs may also be present. These meadows are seasonally wet, which is closely tied to snowmelt, though they typically do not experience flooding events. Tree and shrub canopy cover is less than 10 percent each. The fire return interval is 0 to 35 years from stand-replacing fire (fire regime group II). The Montane/Subalpine Grassland if often interspersed with the Herbaceous Riparian vegetation type. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 18).

Table 18. Desired seral-stage proportions for Montane/Subalpine Grassland

Seral Stage	Proportion	Description
Early	20%	Recently disturbed. Grass, shrub, tree canopy cover <10% each.
Late	80%	Mature grassland, grass is dominant lifeform. Shrub and tree canopy cover <10% each.

Colorado Plateau/Great Basin Grassland

The Colorado Plateau/Great Basin Grassland vegetation type is typically found along elevational and temperature gradients above Semi-Desert Grasslands and below Montane-Subalpine Grasslands. It occupies cooler and wetter sites than Semi-Desert Grasslands and is common above the Mogollon Rim. The Colorado Plateau/Great Basin Grassland vegetation type is typically associated with the Pinyon-Juniper Grass vegetation type along the grassland-woodland ecotone in cool climates. Vegetation coverage consists of mostly grasses and interspersed shrubs. Grass species may include Indian ricegrass, blue grama, Arizona fescue, needle and thread, mountain muhly, and junegrass. Shrub species may include big sagebrush, Apache plume, Stansbury cliffrose, saltbush, jointfir (Mormon tea), winterfat, and wax currant. Shrub cover may occasionally exceed 10 percent; tree cover is less than 10 percent. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 19).

Table 19. Desired seral-stage proportions for Colorado Plateau/Great Basin Grassland

Seral Stage	Proportion	Description
Early	25%	Perennial-mixed grasses; combined shrub and tree cover ≥10%, grass cover ≥10%.
Mid	5%	Perennial-mixed grasses; combined shrub and tree cover <10%, grass cover ≥10%. Includes post-fire plant communities previously late-seral.
Late	70%	Perennial grasses; combined shrub and tree cover <10%, grass cover ≥30%.

The Colorado Plateau/Great Basin Grassland vegetation type is characterized by fire regime group II, with an average fire-return interval of 0 to 35 years from stand-replacing fire. Mixed-severity fire has been reported in this vegetation type to have occurred with a mean return interval of 37 years primarily top-killing herbaceous species. Stand-replacing fire occurs less frequently (about every 75 years) and consumes both shrub and herbaceous life forms.

Semi-Desert Grassland

The Semi-Desert Grassland vegetation type occurs throughout southern New Mexico at elevations ranging from 3,000 to 4,500 feet. It is bounded by Sonoran or Chihuahuan desert at the lowest elevations and woodlands at the higher elevations. The boundary between Semi-Desert Grasslands and desert communities is sometimes hard to distinguish because desert shrub species can be common in this vegetation type.

Species composition and dominance varies across the broad range of soils and topography where it occurs. Dominant grassland associations/types are black grama grassland, blue grama grassland, curly mesquite grassland, tobosa grassland, giant sacaton grassland, and mixed native perennial grassland. Shrubs also occupy these grasslands and their abundance and species composition also vary. Shrub cover may occasionally exceed 10 percent; tree cover is less than 10 percent. Not enough science is available to provide descriptions at multiple scales for this vegetation type. Seral-stage proportions are applied at the landscape scale (Table 20).

Two subclasses of the Semi-Desert Grassland vegetation type occur on the Cibola; they are as follows.

Piedmont Grassland.[9] This grassland vegetation is typical of coalesced alluvial fan piedmonts along mountain fronts and characterized the dominance of black grama and bush muhly. Other grasses that are prevalent and may dominate or co-dominate are tobosagrass, New Mexico feathergrass, sideoats grama, hairy grama, and blue grama. While shrubs and sub-shrubs are clearly subordinate in these grasslands, they are always common and sometimes abundant, forming a shrub-steppe. The most diagnostic tall shrubs are jointfir (Mormon tea) and soaptree yucca along with the agave and broom snakeweed.

[9] Adapted from Integrated Landscape Assessment Project (2012).

Sandy Plains Grassland.[10] This grassland vegetation is typical of sandy plains (sandsheets) and dominated by black grama, sand dropseed, mesa dropseed, spike dropseed, and sand muhly. In addition to the dominant grasses, blue grama, bush muhly, sandhill muhly, and giant dropseed can be common associates. On gypsum substrates, gyp dropseed, and New Mexico bluestem dominate. While shrubs and sub-shrubs are clearly subordinate in these grasslands, they are always common and sometimes abundant, forming a shrub-steppe. Typical indicators include jointfir (Mormon tea) and soaptree yucca.

Table 20. Desired seral-stage proportions for Semi-Desert Grassland

Seral Stage	Proportion	Description
Early	5%	Perennial-mixed grasses; combined shrub and tree cover ≥10%, grass cover ≥10%.
Mid	25%	Perennial mixed grasses; combined shrub and tree cover <10%, grass cover ≥10%. Includes post-fire plant communities previously late-seral.
Late	70%	Perennial grasses; combined shrub and tree cover <10%, grass cover ≥30%.

The Semi-Desert Grassland vegetation type is characterized by fire regime group II, with an average fire-return interval of 0 to 35 years from stand-replacing fire. Recurring fire is important in this type to maintain open conditions, prevent shrub and tree invasion, and retain species diversity. Large-scale fire events occur every 2.5 to 10 years and typically occur in the early summer (The Nature Conservancy 2006). This coincides with pre-monsoon lightning activity in the region and contemporary fire behavior suggests that historic ignitions would likely have burned until they ran out of contiguous fuel or were rained out.

Riparian Vegetation Types

General Description

Riparian areas occur throughout all vegetation types. Vegetation supported within riparian areas varies with watershed size, geology, slope, elevation, and aspect. Natural disturbances (including flooding, scouring, and desiccation) result in changes that promote a diverse community structure necessary for recruitment of riparian species. In turn, a healthy plant community helps maintain a stable and functioning riparian physical environment (for more, see the “Watershed Resources” section). Riparian areas are especially important to wildlife, including many federally listed species and species of conservation concern on the Cibola, such as Mexican spotted owl, southwestern willow flycatcher, Lewis’ woodpecker, Chiricahua leopard frog, and Arizona myotis (see the “Aquatic Species and Habitats” section).

Based on future climate projections, vegetation in riparian areas will experience higher temperatures, an increase in extreme precipitation events, and changes to the hydrologic cycle. Further, it is likely

[10] Adapted from Integrated Landscape Assessment Project (2012).

that riparian areas dependent on spring flows will experience a decrease in available water. These changes can create corresponding shifts in plant composition, diversity, and abundance.

For riparian vegetation Plan components and management approaches, see the “Watershed Resources” section.

Watershed Resources

Watersheds

Background and Description

A watershed is a region or land area drained by a single stream, river, or drainage network. Watersheds encompass all of the ecosystem elements—water, geology, soils, vegetation, and animals. Watersheds also span the landscape at many different scales. Watershed boundaries cross ownership boundaries since they are based on topography. There is an established method for delineating watershed boundaries which is defined by a number code called the hydrologic unit code (HUC). Each two digits in the number system represent a drainage basin, with successive numbers referring to smaller watersheds nested within the larger one. On the Cibola, the Plan area is located within portions of 60 5th (10 digit) HUC watersheds. Nested within these larger watersheds, there are 205 individual 6th (12 digit) code HUCs sub-watersheds that intersect the Plan area.

The “USFS watershed condition framework” was developed to assess the condition of watersheds that intersect National Forest System lands. Watershed condition is the state of the physical and biological characteristics and processes within a watershed that affect the soil and hydrologic functions supporting aquatic ecosystems. Watersheds that are functioning properly have the terrestrial, riparian, and aquatic ecosystem that capture, store, and release water, sediment, wood, and nutrients within their range of natural variability for these processes. When watersheds function properly they are considered in satisfactory condition and healthy. There are 119 sub-watersheds within the Plan area that rated as functioning properly, 46 watersheds rated as functioning at risk, and 1 watershed rated as impaired. Forty-two watersheds were not rated because they had less than 10 percent of their area within the Plan area. The condition rating only applies to the National Forest System lands within each watershed.

Desired Conditions

- Watersheds are functioning properly, in satisfactory condition.
- Watersheds are not at risk due to the fuels composition and uncharacteristic disturbance.
- Watersheds mostly contain free-flowing streams and functioning wetlands and riparian areas.
- The hydrologic regime within a watershed is not impacted by the density and distribution of roads, trails, and impervious surfaces.
- Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their potential condition.
- More than 50 percent of each 12 digit sub-watershed is in a satisfactory fire condition class as described in the watershed condition framework.
- No more than 20 percent of the forested land in each 12 digit sub-watershed should be at imminent risk of high levels of mortality due to insects and disease.