

**APPENDIX Q – DIVERSITY AND VIABILITY – A
PLAN REVISION APPROACH**

INTRODUCTION

Management of ecological resources on San Juan Public Lands (SJPL) includes providing for a diversity of plant and animal communities and maintaining viable populations of all native and desired non-native wildlife, fish, and plant species. This is accomplished in this Plan in a multiple use framework through the sustainable management of ecological systems to provide conservation reserves and opportunities for human activity and resource extraction, and through species-specific management.

ECOSYSTEM APPROACH

The management of ecosystems is a cornerstone of our planning approach. We focus on the principle that managing for natural diversity in the composition, structure, and function of the terrestrial ecosystems, riparian and wetland ecosystems, and aquatic ecosystems on SJPL will provide for sustainability. We also focus on the idea that sustaining these components of ecosystems will provide for the viability of the majority of species associated with them, including species with viability concerns and species we know little about such as bacteria, soil invertebrates, and microorganisms.

Management of ecosystems on SJPL includes restoration activities, identification and management of reserves and special areas, commodities management, habitat management, and adaptive management. It also includes the protection of abiotic features (soils, water, landforms) and ecosystem processes including disturbance (fire, insects, disease), succession, and hydrologic processes, all of which play an important role in providing ecosystem and species diversity and viability on SJPL. Disturbance and recovery from disturbance are important mechanisms for maintaining certain elements of genetic, species, and ecosystem diversity.

Needs and opportunities for management are identified through assessments and are communicated through program emphasis, desired conditions, objectives, and land use allocations in plan. Standards and guidelines play a role in providing protective measures to ecosystem elements.

An understanding of Historical Range of Variation (HRV) is used as an important foundation for our approach to managing terrestrial ecosystems. HRV describes the range of ecological conditions, including vegetation structure and patterns and the characteristics of natural disturbance regimes, that occurred on SJPL during the reference period. We define the reference period as the period of indigenous settlement from about 1500 to the late 1800s when broad-scale climatic conditions were variable but similar to those of today, and European-American settlers had not yet introduced the sweeping ecological changes (including timber harvest, livestock grazing, fire suppression, water diversions, dams, and roads) that have altered many Rocky Mountain landscapes. HRV information allows us to understand the important disturbances occurring within ecosystems of the SJPL, the consequences of disturbances, and the probable outcome of potential management actions. This knowledge is important for planning restoration actions and for understanding the consequences of management intended to produce ecological conditions that may be unlike conditions experienced in the past. Our intent is not necessarily to manage SJPL with HRV as a target but rather to use HRV conditions as a context to help us formulate attainable and sustainable desired conditions that meet a variety of management goals.

The SJPL Aquatic, Riparian, and Wetland Assessment provides the foundation for the aquatic and riparian area and wetland ecosystems approaches for the Plan. It describes reference conditions and current conditions, identifies rare and important resources including wetland complexes, and identifies priority watersheds, riparian areas, and wetlands in need of restoration. It also evaluates the effects of anthropogenic influences on aquatic, riparian area, and wetland ecosystems, and describes ecological drivers, such as extent of glacial activity, stream gradient, climate, and geology, that provide a basis for how these ecosystems respond to disturbance.

A major ecosystem strategy of the Plan is the conservation reserve approach. We are providing for

diversity and viability by maintaining and protecting the many large unroaded lands on SJPL, and the intact ecosystems and linkages associated with them. These lands including wilderness areas, research natural areas, botanical areas, and roadless areas are relatively unaltered from human impacts and act as reserves to protect the ecosystems and the full range of biological diversity within them (Norton 1999). Reserves are large areas that are maintained in their natural state, within which natural disturbance processes are either allowed to proceed without interference or are mimicked through management (Scott et al. 1993, Noss and Cooperrider 1994). One management approach stresses that the maximum level of biodiversity will be conserved if the maximum diversity of habitats are represented in protected area networks (Scott et al. 1993, Noss and Peters 1995).

In addition to the reserve strategy, the SJPL ecosystem approach for the Plan includes proactive management actions that promote ecosystem and species diversity, viability, and sustainability including vegetation management through wildland fire use, management-ignited fire, timber harvest, and invasive species management. Although these activities have the potential for adverse effects to ecosystems and species on SJPL, they will be designed to prevent or minimize adverse effects and most will also be designed to maintain or improve ecological conditions. Wildland fire use and management-ignited fire will be used to introduce fire to ponderosa pine and warm-dry mixed conifer forests where it was a frequent disturbance agent during the reference period (HRV conditions), but has been absent from these ecosystems in many places for a long time. Timber harvest and fuels reduction projects will be used to reduce the density of trees and open up the forest canopy in ponderosa pine and warm-dry mixed conifer forests in order to create structural conditions more similar to those of the reference period (HRV conditions). Invasive species management will be used to prevent the introduction and spread of invasive species that compete with native species. These proactive management actions provide for the diversity and viability of ecosystems and species by creating more sustainable ecosystem conditions.

SPECIES APPROACH

The management of species is also fundamental to our planning approach since threats to some species and the factors limiting populations of other species are not always linked strongly to broader ecosystem conditions. For instance, cutthroat trout habitat may be threatened by hydrological conditions which can be managed through restoration of ecosystems, or cutthroat trout may be threatened by genetic introgression of non-native fish which is best handled through a species-specific approach.

Species management begins with the identification of special status species. This process assures that certain species are evaluated and managed because of their conservation status or their importance to the public. These species may include certain rare or endemic species, species at risk of decline, economically important species, and species not adequately protected by the management of their ecosystems. Federally listed species, candidate species, R2 Regional Forester's Sensitive Species, BLM Special Status Species, and SJPL Highlight Species are addressed through species management.

PLANNING PROCESS

Management of ecosystems and species on SJPL to provide for diversity and viability starts with the identification of desires, needs, and opportunities for management as identified through agency policy, ecological assessments, and public input. These are then communicated in the Plan through Plan components including background information, issues, land use allocations, desired conditions, and proactive measures such as program emphasis and objectives. Additional plan components including standards and guidelines, management indicator species, and monitoring play a role in providing protection measures to ensure ecosystem sustainability.

Plan components are linked together to provide an integrated planning process. Current ecological conditions on SJPL, as described in the background sections of the Plan, lead to Plan issues which lead to the development of desired conditions that facilitate the development of objectives, land use allocations, standards and guidelines, and program emphasis to achieve those desired conditions. Then management indicator species and monitoring are used to identify whether Plan components have been implemented properly and are achieving their intended purpose. If not, adaptive management is initiated.

Plan components and their relationship to diversity and viability are described below.

Background

The background section of the Plan describes the current condition of the resource. It sets the stage for the development of Plan issues and other Plan components.

The current conditions of the aquatic, riparian area and wetland, and terrestrial ecosystems on SJPL are described below. These conditions set the stage for the development of Plan issues and other Plan components that will provide for the diversity and viability of ecosystems and species on SJPL.

Aquatic ecosystems - A variety of land management activities occurring throughout the planning area over the last 100 years have impacted their aquatic ecosystems. Where they once occurred, or where they continue to occur, recreation, commercial, and management activities (including hard-rock mining, livestock grazing, timber harvesting, road construction, and a variety of water-development projects) have, in general, reduced the quantity and/or quality of aquatic habitats. As a result, their ability to support self-sustaining and functioning populations of fish and other aquatic biota has been reduced on a number of streams and rivers within the planning area. This is most evident in areas impacted by consumptive uses of water. The cumulative impacts of hundreds of existing water developments have resulted in adverse and on-going impacts to the composition, structure, and functioning of aquatic habitats. Where fish-population monitoring has been conducted downstream of water developments, significant decreases in population densities have been observed.

The introduction of non-native fish species, as well as the occurrence of potentially lethal pathogens, has resulted in the decline of some species. The stocking of non-native trout species over many years has come at a significant cost to the native Colorado River cutthroat trout. Native sucker species have also declined due to the loss of aquatic habitat, and as a result of hybridization with the introduced white sucker. The parasite *Myxobolus cerebralis* (which causes whirling disease in trout) is becoming more widespread throughout the planning area and is known to have increased mortality rates for infected populations.

More recently, fish population levels have been reduced by prolonged drought. This has reduced natural streamflow and resulted in increased demands for water for human consumptive uses. These increased demands have, in turn, resulted in numerous additional water-development proposals. With continued drought, and the increasing demand for consumptive water uses, aquatic habitats and fish populations are likely to experience additional declines.

Riparian area and wetland ecosystems - Due to human impacts, riparian areas and wetland ecosystems have changed dramatically during the last century-and-a-half in the southwestern United States (Blair et al. 1996; Dick-Peddie 1993). Human impacts to riparian areas and wetland ecosystems include urbanization, agriculture, logging, livestock grazing, mining, recreation, roads, dams, diversions, and the introduction of non-native species. These impacts have reduced native hydrophytic species (most notably cottonwood and willows), increased invasive species, changed dominant life forms (from trees or shrubs to herbs), reduced water flow, and lowered water tables.

Some fens within the planning area have been adversely impacted by management activities, including by roads that are in or adjacent to them, by roads that are impacting their hydrology, and by

damage caused by off-road vehicles. The non-native shrub tamarisk, which competes with native cottonwoods and willows, has invaded much of the Dolores River Canyon and its lower tributaries.

Terrestrial ecosystems - The current conditions found throughout the planning area differ from conditions that occurred during the reference period (HRV conditions). In many ponderosa pine forests, for example, the combination of unmanaged livestock grazing, timber harvesting, and fire exclusion during the last century have lengthened fire frequencies and have created unnatural forest structures (Romme et al. 2006). The current forest structures that display high stem densities of medium-sized trees and closed canopy covers are unlike the open-canopied, multi-sized structures of the ponderosa pine forests that dominated the reference period. Many of these forests have lost the large, old trees, as well as some of the native bunchgrasses that were once common. Consequences of the current structure in ponderosa pine forests include epidemic insect and disease outbreaks, increased risk of destructive wildfires (fires that are much hotter than they were during the reference period; fires that are increasingly difficult to control), a reduction in ponderosa pine regeneration, an increase in the abundance of white fir, and a reduction in biological diversity (Moir et al. 1997, Wu 1999).

Similar to ponderosa pine forests, many warm-dry mixed-conifer forests currently display forest structures that differ from HRV conditions. This is due to the combination of fire exclusion and selective timber harvesting. Structures that display high stem densities and closed canopy covers are unlike the less dense, open-canopied structures of the warm-dry mixed-conifer forests that dominated the reference period. The large, old ponderosa pine and Douglas-fir trees that once dominated many of these forests are gone. They have been replaced by smaller, younger trees, including white fir which has significantly increased during the long fire-free period of the Twentieth Century. Consequences of the current structure of these forests are similar to those described above for ponderosa pine forests. The establishment of new ponderosa pine and Douglas-fir trees has tapered off, or stopped altogether, in many warm-dry mixed-conifer forests due to the dense stand conditions (Wu 1999).

Many of the mountain grasslands found within the planning area have been significantly impacted by the unmanaged livestock grazing that occurred within the planning area from the late 1800s through to the mid-1900s (Romme et al. 2006). These grasslands currently display a composition and structure that is very different from the HRV conditions. Many native bunchgrasses (including Arizona fescue) are absent or rare having been replaced by non-native species and/or undesirable native species. Bare soil, compaction, and erosion have increased; litter has decreased. Structural conditions typically display an open canopy and reflect the short, sparse foliage of Kentucky bluegrass (which provides limited litter and organic matter for nutrient cycling and soil development, as well as limited protection to the soil surface from raindrop impacts, runoff, compaction, and erosion). This is unlike the HRV conditions, where there was typically a high density, relatively closed-canopy, and well-distributed arrangement of tall bunchgrasses (which provided an abundance of litter and organic matter for energy flow, nutrient cycling, and soil development, and protected the soil surface from raindrop impacts, runoff, compaction, and erosion).

Many of the semi-desert shrublands, semi-desert grasslands, sagebrush shrublands, and pinyon-juniper woodlands have also been significantly impacted by the unmanaged livestock grazing that occurred within the planning area from the late 1800s through to the mid-1900s. These areas currently display an herbaceous species composition that is very different from the HRV conditions. Native cool- and warm-season bunchgrasses are absent or rare on many sites having been replaced by non-native species and/or undesirable native species, including cheatgrass. Relative to HRV conditions, biological soil crusts in these vegetation types have also decreased.

Other current vegetation conditions within the planning area that differ from HRV conditions include a decrease in old-growth ponderosa pine and warm-dry mixed-conifer forests, a decrease in young- and mid-stages of spruce-fir and cool-moist mixed-conifer forests, a decrease in young aspen forests, a decrease in native bunchgrasses in many mountain grasslands, and an adverse increase in white fir in many mixed-conifer forests east of the Animas River.

Planning Issues

Planning issues identified from current social, economic, and ecological conditions are used to develop desired conditions, objectives, program emphasis, and monitoring items. Four broad planning issues were identified by the public and the ID team as follows.

- Balancing Management between the Ideas of Maintaining “Working Forest and Rangelands” and Retaining “Core Undeveloped Areas”
- Recreation and Travel Management
- Management of Special Areas and Unique Landscapes
- Oil and Gas Leasing and Development

Other ecological planning issues relative to diversity and viability as identified by the Plan ID Team through information in ecological assessments (AWRA, Terrestrial, HRV, and CLC) include:

- The current structural condition of many ponderosa pine forests and warm-dry mixed conifer forests differs from conditions that occurred during the reference period (HRV conditions) for these types.
- The current herbaceous composition of many mountain grasslands, semi-desert shrublands, semi-desert grasslands, sagebrush shrublands, and pinyon-juniper woodlands on SJPL differs from conditions that occurred during the reference period (HRV conditions) for these types.
- The current amount of old growth ponderosa pine and warm-dry mixed conifer forests is significantly less than what occurred during the reference period (HRV conditions) for these types.
- The current amount of the young and mid development stages of spruce-fir and cool-moist mixed conifer forests are significantly less than what occurred during the reference period (HRV conditions) for these types.
- The current amount of the young development stage of aspen forests is significantly less than what occurred during the reference period (HRV conditions) for this type.
- There is too much white fir in many mixed conifer forests east of the Animas River.
- Effects to water quantity due to water depletions associated with reservoirs, diversions, and oil and gas development.
- Effects to water quality due to soil erosion and sedimentation associated with ground-disturbing activities (fuels treatments, oil and gas development, timber harvest, livestock grazing, road construction, and recreation).
- Effects to native species and their habitat associated with changing the structure and function of ponderosa pine forests due to timber harvest activities and fuels treatments that remove ponderosa pine trees and Gambel oak.
- Effects to native species and their habitat in spruce-fir and cool-moist mixed conifer forests due to recreation and timber harvest activities.
- Effects to native species and their habitat associated with changing the composition, structure, and function of aspen forests due to clearcut timber harvest activities.
- Effects to native species and wildlife winter range (pinyon-juniper woodlands, sagebrush shrublands, mountain shrublands, and ponderosa pine forests) due to recreation activities, fuels treatments, oil and gas development, and timber harvest activities.

Desired Conditions

Desired conditions encompass the goals of land and resource management, and are statements of the social, economic, and ecological elements and values toward which management strives to

achieve. Desired conditions set the foundation for objectives, program emphasis, standards and guidelines, and monitoring that are described later in the Plan. In most cases desired conditions on SJPL are designed to be compatible. If desired conditions are conflicting or incompatible during Plan implementation, the ones that protect and sustain diversity and viability of species and ecosystems will be implemented.

The Plan contains many desired conditions relative to diversity and viability on SJPL as found in the soils, water, aquatic ecosystems, riparian area and wetland ecosystems, terrestrial ecosystems, terrestrial wildlife, MIS, invasive species, and species sections. Some are general and focused on the sustainability of ecosystems (such as vegetation types, fens), ecological processes (succession, fire frequency, insects & disease cycles, hydrologic function, and flooding), and groups of species (such as sensitive species, BLM Special Status Species, and SJPL highlight species). Others are specific and focused on the sustainability of individual species (such as the Uncompahgre fritillary butterfly - an endangered insect, *Ipomopsis polyantha* - a candidate plant species, and the bluehead sucker - a sensitive fish species) and ecosystem components such as snags, wood on the forest floor, and raptor nests. Some are focused on the abiotic components that are critical to sustaining diversity and viability on SJPL such as protecting soil productivity, ground cover, soil moisture, water quality, and water quantity. Major vegetation type narratives and the development stage Table 3 of the forest vegetation types provide many desired conditions relative to diversity and viability on SJPL.

Program Emphasis

The program emphasis section is developed in part from desired conditions and outlines where management for that program will be focused. It is a place where actions and activities that are important to achieving desired conditions can be described, including ones that aren't identified in the objectives section.

Program emphasis relative to diversity and viability is found in the ecology, wildlife, and fish programs where sustainable ecosystem and species management throughout the planning area is emphasized. It includes acquiring and using the best available science relative to ecosystems (terrestrial, aquatic, and riparian area and wetland) and species within the planning area as found in the SJPL assessments (AWRA, Terrestrial, HRV, CLC, and R2 Species) and other relevant literature.

Program emphasis includes continuing ongoing Plan-scale inventories for old growth forests, rare plants, soils, vegetation types, and fens, and initiating new riparian area and wetland inventories. It includes producing new or modifying existing ecological assessments in order to have the best available information relative to ecosystems and species and the diversity and viability associated with them. It also includes developing vegetation classification systems, identifying plants and vegetation communities, conducting biological evaluations, monitoring, establishing Research Natural Areas and reference sites, using predictive models, and identifying research needs, all of which can provide for diversity and viability on SJPL.

Program emphasis includes ensuring that ecological data, issues, and opportunities relative to diversity and viability of ecosystems and species are adequately recognized and considered in all projects and management actions, through ID team participation and input into environmental documents including the development of biological evaluations, biological assessments, and project mitigation measures. It also includes participation in recovery plans for T&E species.

Objectives

Objectives are concise projections of measurable, time-specific intended outcomes. They are a means of progressing toward, maintaining, or achieving desired conditions. Not all desired conditions have a corresponding objective because some are general aspirational statements that do not have measurable, time-specific outcomes and others have low priorities. Criteria for prioritizing objectives included agency goals, budget constraints, ecological needs, social needs, threats to ecological conditions, time considerations, and safety.

Objectives in the Plan relative to diversity and viability on SJPL are found in the soils, water, aquatic ecosystems, riparian area and wetland ecosystems, terrestrial ecosystems, terrestrial wildlife, MIS, and species sections. Most objectives focus on the restoration of ecosystems such as restoring stream habitat, damaged fens, desirable native bunchgrasses to mountain grasslands, restoring the structure and function of ponderosa pine or warm-dry mixed conifer forests that have been without fire for decades, and restoring Gunnison sage grouse habitat by mechanical or prescribed fire treatments to remove pinyon and juniper trees from sagebrush shrublands. Ecological restoration can provide improved habitat for species that may not otherwise be using the degraded habitat, thus providing for the viability of those species.

Other objectives relative to sustaining diversity and viability on SJPL are found in active management sections of the Plan including the Fire and Fuels Management (wildland fire use), Invasive Species (eradicate noxious weeds), Recreation (designate motorized and mechanized vehicle routes), Timber (restoration harvests), and Livestock and Rangeland Management (satisfactory rangeland conditions) sections.

Land Use Allocations

Land use allocations on SJPL are assigned through the designation of Management Areas (MA). Each MA has a different mix of uses and activities that are compatible with its management emphasis and desired conditions. MAs provide a spectrum of management that range from little to no active management (as in MA 1 - Natural Processes Dominate) to heavily managed and highly altered lands (as in MA 8 - Highly Developed Areas). Lands are assigned a MA based on public input, past activities, desired conditions, the inherent capability of the land to provide the use or activity in a sustainable manner, and through suitability analysis that analyzed a lands capability for timber harvest, livestock management, motorized travel, water development, mineral and energy production, and biological diversity protection. SJPL ecological assessments (AWRA, HRV, and CLC) were used to help identify land suitability and MAs through identification of sensitive watersheds, lands with high biological diversity values, large unroaded areas, reserves, special areas, lands highly impacted from past management activities, and lands in need of restoration.

MAs 1, 2, and 3 are designed to sustain diversity and viability of ecosystems and species by limiting management activities and managing for relatively unaltered ecological conditions. Less active management activities means less potential for adverse effects to ecosystems and species.

MA1 lands (Natural Processes Dominate) include wilderness areas and roadless areas that are relatively unaltered from human impacts and act as reserves to protect the ecosystems and the full range of biological diversity within them (Norton 1999). Reserves are large areas that are maintained in their natural state, within which natural disturbance processes are either allowed to proceed without interference or are mimicked through management (Scott et al. 1993, Noss and Cooperrider 1994).

MA2 lands (Special Areas and Unique Landscapes) contain special areas many of which limit management activities and manage for relatively unaltered ecological conditions including 9 research natural areas; the Chattanooga and Burro Bridge iron fens Special Botanical Areas which protect fens and the rare mosses, lichen, and liverworts within them; the O'neal Hill Special Botanical Area which protects the largest known population of the globally rare sensitive plant species, *Lesquerella pruinoso*; and the Big Gypsum Valley ACEC which protects Gypsum rim-lichen (*Lecanora gypsicola*) and Nodule cracked lichen (*Acarospora nodulosa* var. *nodulosa*), both critically imperiled species (G1S1), and *Cryptantha gypsophila*, a sensitive plant species.

MA3 lands (Natural Landscapes, with Limited Management) are designed mostly for restoration purposes needed because of natural disturbance events or past management actions. Ecological restoration can provide improved habitat for species that may not otherwise be using the degraded habitat, thus providing for the viability of those species. Management activities may also include;

prescribed burns; wildland fire use; salvage logging following fire, insect epidemics, or wind events; hazardous fuels reduction; and invasive species reduction.

Standards and Guidelines

Standards and guidelines are design criteria used in project design and implementation in order to protect resources and help ensure that Plan components, including desired conditions and objectives, are achieved. They are project-level operational controls that help ensure that projects are consistently implemented in ways that reduce environmental impacts.

Standards and guidelines play an important role in providing protective measures to ecosystems and species. The Plan contains many standards and guidelines relative to diversity and viability on SJPL as found in the soils, water, aquatic ecosystems, riparian area and wetland ecosystems, terrestrial ecosystems, terrestrial wildlife, MIS, species, and livestock and rangeland management sections. Many are focused on the sustainability of ecosystems (such as old growth ponderosa pine and warm-dry mixed conifer forests, aquatic habitat for Colorado River cutthroat trout, fens) and groups of species (such as birds, mammals, invertebrates, BLM Sensitive plant species, and SJPL highlight species). Some are focused on ecological processes (hydrologic function). Many are focused on the sustainability of individual species (such as Colorado River cutthroat trout - a sensitive species, *Pediocactus knowltonii* - an endangered species), *Ipomopsis polyantha* - a candidate species). Some focus on preventing undesirable ecological components from inhabiting ecosystems (invasive plant species, sediment). Some focus on livestock management and others focus on abiotic components that are critical to sustaining diversity and viability on SJPL (such as soil erosion and landslide prevention, ground cover protection, water quality, and water quantity).

Standards and guidelines found in the WCPH are also important for sustaining the diversity and viability of ecosystems and species on SJPL.

Monitoring

Monitoring and evaluation are activities designed to determine how well desired conditions and objectives are being met, as well as how closely management standards and guidelines have been applied. Monitoring generally includes the collection of data and information, either by observation or by measurement. Evaluation entails the analysis of the data and information collected during monitoring. Evaluation results form the basis for adaptive management within the planning area.

The monitoring section of the Plan identifies many items related to sustaining the diversity and viability of ecosystems and species on SJPL. Many of these items are associated with ecosystem restoration (watersheds, stream habitat, riparian area vegetation, rangeland soils and vegetation). Others are associated with ecosystems (young spruce-fir, cool-moist mixed conifer, and aspen forests; ponderosa pine forest structures, old growth ponderosa pine forests), and others are associated with species (Colorado River cutthroat trout, *Festuca arizonica*, willows, sensitive plants, MIS population trends).

The monitoring section will use Management Indicator Species (MIS) to assess the effects of management activities on their populations and on the habitats (ecosystems) with which they are associated. Changes in MIS populations or their habitats could indicate that current management is adversely affecting the diversity or viability of the species within them.

Management Indicator Species

Management Indicator Species (MIS) are species which are monitored at the Forest Plan scale in order to assess the effects of management activities on their populations and on the habitats with which they are associated. Changes in MIS populations or their habitats could indicate that current management is adversely affecting the composition structure, or function of those habitats, resulting in Plan direction not being met and the need for adaptive management. MIS provide a mechanism to

focus management actions on addressing management concerns and monitoring management effects. MIS are addressed in the Plan through the development of desired conditions, objectives, program emphasis, standards and guidelines, and monitoring sections.

MIS on SJPL were chosen to address the last six ecological issues above. MIS will help to provide for diversity and viability on SJPL by monitoring ecosystem (habitat) conditions in aquatic ecosystems, ponderosa pine, spruce-fir, and cool-moist mixed conifer forests, and winter range habitats (pinyon-juniper woodlands, sagebrush shrublands, mountain shrublands, and ponderosa pine forests). Adverse effects to these ecosystems, identified through monitoring items in the monitoring section of the Plan, could be adversely affecting the viability of these ecosystems and the MIS and other species associated with them. In that case, adaptive management will be incorporated to change management actions so that they are compatible with desired conditions in the Plan and aren't contributing to adverse effects to ecosystem or species viability.

Adaptive Management

Adaptive management is used to make sure management actions are sustainable and not having adverse ecological effects. Adaptive management acknowledges that our understanding of complex ecological systems is limited and we may make mistakes, but the seriousness of those mistakes can be reduced by placing forest management into a consciously experimental framework, by carefully observing the ecosystem's response to management actions, and by modifying our actions appropriately as we learn more about the ecosystems.

EXAMPLES

The following examples demonstrates how Plan components link together and provide for the viability of the Colorado River Cutthroat Trout, *Lesquerella pruinosa*, and lynx. The approach centers on sustaining the ecosystems that the species relies on, and providing for the needs of the species that may not be adequately protected by the ecosystem approach.

Species 1: Colorado River Cutthroat Trout (FS and BLM sensitive, and MIS)

Background

A variety of land management activities occurring throughout the planning area over the last 100 years have impacted aquatic ecosystems. Where they once occurred, or where they continue to occur, recreation, commercial, and management activities (including hard-rock mining, livestock grazing, timber harvesting, road construction, and a variety of water-development projects) have, in general, reduced the quantity and/or quality of aquatic habitats. As a result, their ability to support self-sustaining and functioning populations of fish and other aquatic biota has been reduced on a number of streams and rivers within the planning area. This is most evident in areas impacted by consumptive uses of water. The cumulative impacts of hundreds of existing water developments have resulted in adverse and on-going impacts to the composition, structure, and functioning of aquatic habitats. Where fish-population monitoring has been conducted downstream of water developments, significant decreases in population densities have been observed.

The introduction of non-native fish species, as well as the occurrence of potentially lethal pathogens, has resulted in the decline of some species. The stocking of non-native trout species over many years has come at a significant cost to the native Colorado River cutthroat trout. Native sucker species have also declined due to the loss of aquatic habitat, and as a result of hybridization with the introduced white sucker. The parasite *Myxobolus cerebralis* (which causes whirling disease in trout) is becoming more widespread throughout the planning area and is known to have increased mortality rates for infected populations.

More recently, fish population levels have been reduced by prolonged drought. This has reduced natural streamflow and resulted in increased demands for water for human consumptive uses. These increased demands have, in turn, resulted in numerous additional water-development proposals. With continued drought, and the increasing demand for consumptive water uses, aquatic habitats and fish populations are likely to experience additional declines.

Planning Issues

- Effects to water quantity (and to the aquatic species, such as Colorado River cutthroat trout, that are affected by water quantity) due to water depletions associated with reservoirs, diversions, and oil and gas development.
- Effects to water quality (and to the aquatic species, such as Colorado River cutthroat trout, that are affected by water quality) due to soil erosion and sedimentation associated with ground-disturbing activities (fuels treatments, oil and gas development, timber harvest, livestock grazing, road construction, and recreation).

Desired Conditions

- Long-term aquatic ecosystem sustainability is maintained.
- Aquatic habitat quantity and quality are maintained or enhanced to provide for long-term sustainability and viability of all native and desired non-native vertebrate species.
- Connectivity between water bodies provides for all life history functions of aquatic species. Aquatic systems are connected in a manner that avoids fragmentation of aquatic habitats and provides for the movement of aquatic species, sufficient to ensure that fish populations are not isolated.
- All native and/or desired non-native fisheries thrive in the vast majority of systems historically capable of supporting such fisheries.
- Populations of aquatic species across the planning area are sustainable, adequately mobile, genetically diverse, and functionally diverse.
- Federally listed species, Candidate species, R2 Regional Forester's Sensitive Species, BLM Special Status Species, and SJPL highlight species maintain self-sustaining, viable populations and new habitat to expand into.

Program Emphasis

The aquatics program strives to provide ecological conditions in the vast majority of stream, river, and lake systems sufficient to support a diversity of native and desired non-native fish species and/or other aquatic biota over the long term. Proactive management of aquatic habitats and populations is critical to reversing downward population trends. In order to best maintain and protect native and desired non-native fish species, USFS Management Indicator Species (MIS), and USFS and BLM Sensitive Fish Species, the design of land management activities in the planning area would accomplish objectives and meet desired conditions for fisheries. BMPs would be used, and mitigation measures would be implemented, in order to minimize any adverse impacts of management activities on populations and habitats of fish and other aquatic species.

Plan implementation and consistent monitoring of outcomes for fisheries and aquatic habitat would provide the impetus toward achieving desired conditions. Periodic inventories and surveys of streams, stream segments, and lakes are needed in order to determine the natural range and frequency of aquatic habitat conditions, the specific habitat quality, the species population levels, and stream/lake health. Habitat improvement projects should be prioritized where specific assessments have identified habitat-related constraints to fish populations. Monitoring will provide an evaluation designed to help identify needs for possible LMP amendments or other changes in management practices. Scientific efforts to track changing conditions in key areas and for specific species is an important step in

accomplishing objectives and achieving desired conditions for the fisheries program. In general, water developments and other special uses should contain terms and conditions necessary in order to achieve LMP objectives and desired conditions.

LMP implementation involves close coordination with the CDOW and the USFWS. Although cooperation with the CDOW and the USFWS is critical, partnerships with other State and Federal agencies, as well as with interested individuals and organizations, are also an important means to achieve desired conditions and accomplish multiple objectives (and could yield much needed funding for fish habitat management activities).

Objectives

- Over the life of the Plan, establish 5 new additional populations of Colorado River Cutthroat Trout in cooperation with Colorado Division of Wildlife.
- Annually, enhance or restore 5 to 15 miles of stream habitat in order to maintain or restore structure, composition, and function of physical habitat for USFS MIS or USFS and BLM Sensitive Species.
- Over the implementation-life of the Plan, connect 10 to 15 miles of fragmented stream habitat in order to provide for aquatic species migration and for the establishment of aquatic metapopulations, especially for Colorado cutthroat trout (USFS MIS, and USFS and BLM Sensitive Species), and for other BLM and USFS Sensitive Species.

Land Use Allocations

The Plan provides for the viability of this species through the designation of a Research Natural Area and management area 1 lands in the Hermosa watershed where populations of Colorado River Cutthroat Trout currently exist and where new populations of Colorado River Cutthroat Trout will be introduced. These land allocations are designed to preserve aquatic habitat for aquatic species and for the populations of species within them.

Standards and Guidelines

- Management activities throughout the Unit should be consistent with the objectives of the Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the States of Colorado, Utah, and Wyoming. For formally designated conservation populations of Colorado River cutthroat trout, 100% of existing habitat must be maintained.
- Streamflow in each reach should be sufficient to maintain, for each life stage of each target species, a minimum of 50% of the Weighted Usable Area that would occur under natural flow conditions.
- Habitat quality, including large woody debris, residual pool depths, composition of habitat units (eg. pools, riffles), and overall habitat complexity, should be maintained or improved commensurate with reference stream conditions and in a manner that maintains viable, self-sustaining fish populations.
- Conservation pools should be provided in water storage facilities where there are trout Management Indicator Species.
- Streamflow in riffle habitats should be at levels that maintain minimum water depth, wetted perimeter, and mean velocity values consistent with those identified for each stream size category identified below.

Bankfull Width (ft)	Mean Depth (ft)	Wetted Perimeter (%)	Mean Velocity (ft/sec)
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1 to 20	≥ 0.2	50	1.0
21 to 40	0.2 to 0.4	50	1.0
41 to 60	0.4 to 0.6	50 to 60	1.0
> 60	> 0.6	> 60	1.0

Standards and guidelines found in the WCPH are also important for sustaining the diversity and viability of aquatic and riparian area ecosystems and species on SJPL.

Monitoring

The Plan provides for the viability of this species through the Plan’s monitoring section which includes the following monitoring questions:

- Have new populations of Colorado River Cutthroat trout been established by the Colorado Division of Wildlife on potential streams?
- Are streams providing for aquatic species migration and establishment of aquatic meta-populations?
- What are the habitat and population trends for MIS on lands within the planning area?

Management Indicator Species

The Plan provides for the viability of the Colorado River Cutthroat trout and its habitat by designating it as a Management Indicator Species. In so doing, plan components are identified for it including monitoring items to track its population and habitat trends.

Adaptive Management

Changes in the populations or habitats of this MIS could indicate that current management is adversely affecting its viability or the viability of its habitat, in which case adaptive management would be implemented to change management direction in order to sustain the viability of the species and its habitat.

Species 2: *Lesquerella pruinos* (FS and BLM sensitive)

Background

Terrestrial ecosystems - The current conditions found throughout the planning area differ from conditions that occurred during the reference period (HRV conditions). Many of the mountain grasslands found within the planning area have been significantly impacted by the unmanaged livestock grazing that occurred within the planning area from the late 1800s through to the mid-1900s (Romme et al. 2006). These grasslands currently display a composition and structure that is very different from the HRV conditions. Many native bunchgrasses (including Arizona fescue) are absent or rare having been replaced by non-native species and/or undesirable native species. Bare soil, compaction, and erosion have increased; litter has decreased. Structural conditions typically display an open canopy and reflect the short, sparse foliage of Kentucky bluegrass (which provides limited litter and organic matter for nutrient cycling and soil development, as well as limited protection to the soil surface from raindrop impacts, runoff, compaction, and erosion). This is unlike the HRV conditions, where there was typically a high density, relatively closed-canopy, and well-distributed arrangement of tall bunchgrasses (which provided an abundance of litter and organic matter for energy flow, nutrient cycling, and soil development, and protected the soil surface from raindrop impacts, runoff, compaction, and erosion).

Planning Issues

- The current herbaceous composition of many mountain grasslands on SJPL differs from conditions that occurred during the reference period (HRV conditions) for this type.

Desired Conditions

- The major vegetation types of the SJPL are sustainable, resistant to change, resilient, and dominated by desirable native plant species.
- Federally listed species, Candidate species, R2 Regional Forester's Sensitive Species, BLM Special Status Species, and SJPL highlight species maintain self-sustaining, viable populations and new habitat to expand into.
- The highly erosive and easily compacted shale soils of the SJPL that provide the habitat for *Lesquerella pruinosa*, *Ipomopsis polyantha*, *Astragalus missouriensis* var. *humistratus*, *Physaria pulvinata*, and *Townsendia glabella* maintain the soil productivity necessary to support and sustain these rare plant species.

Program Emphasis

The SJPL Plan provides for the viability of this species through protection of the composition, structure, and function of the terrestrial ecosystems (mountain grasslands and mountain shrublands) that this species is associated with, using knowledge of HRV conditions.

Program emphasis includes acquiring and using the best available science relative to *L. pruinosa* and its mountain grassland and mountain shrubland ecosystems as found in the SJPL assessments (Terrestrial, HRV, CLC, and R2 Species) and other relevant literature. It includes continuing ongoing Plan-scale inventories for rare plants. It includes producing new or modifying existing ecological assessments in order to have the best available information relative to ecosystems and species and the diversity and viability associated with them.

Program emphasis includes ensuring that ecological data, issues, and opportunities relative to *L. pruinosa* and its mountain grassland and mountain shrubland ecosystems are adequately recognized and considered in all projects and management actions, through ID team participation and input into environmental documents including the development of biological evaluations, biological assessments, and project mitigation measures.

Land Use Allocations

The SJPL Plan provides for the viability of this species through the designation of the O'neal Hill Botanical Area which was created to preserve the habitat for *Lesquerella pruinosa* and the populations of that species within it.

Standards and Guidelines

- Projects should be designed to avoid R2 Regional Foresters Sensitive Plant Species, BLM Sensitive Plant Species, and SJPL Highlight Plant Species and their current and potential habitat, and these species and their current and potential habitat should be avoided during project implementation unless the project is designed to improve their habitat.

Monitoring

The Plan provides for the viability of this species through the Plan's monitoring section which includes the following monitoring questions:

- Are R2 Regional Forester's Sensitive Plant Species and those BLM Special Status Plant Species not currently listed as endangered or threatened trending toward federal listing under the Endangered Species Act?

Adaptive Management

Changes in the populations or habitats of this species could indicate that current management is adversely affecting its viability or the viability of its habitat, in which case adaptive management would be implemented to change management direction in order to sustain the viability of the species and its habitat.

Species 3: Lynx (threatened species)

Background

The current conditions found throughout the planning area differ from conditions that occurred during the reference period (HRV conditions). Young- and mid-stages of spruce-fir and cool-moist mixed-conifer forests, and young aspen forests are uncommon relative to reference period conditions (HRV). These development stages provide important foraging habitat for lynx.

Planning Issues

- The current amount of the young and mid development stages of spruce-fir and cool-moist mixed conifer forests are significantly less than what occurred during the reference period (HRV conditions) for these types.
- The current amount of the young development stage of aspen forests is significantly less than what occurred during the reference period (HRV conditions) for this type.

Desired Conditions

- The major vegetation types of the SJPL are sustainable, resistant to change, resilient, and dominated by desirable native plant species.
- All development stages of all the major vegetation types of the SJPL are represented and distributed across SJPL.
- Snags, large and small wood on the forest floor, and litter are present in all forest vegetation types, and serve to maintain soil productivity, provide wildlife habitat, and protect the soil surface.
- The many, large unroaded lands that represent much of the ecological diversity on SJPL (including Wilderness Areas, Research Natural Areas, and some inventoried roadless areas) remain unroaded, contain relatively intact ecosystems where natural processes dominate, provide habitat and corridors for native biota, and are part of a reserve system that helps to preserve the native biological diversity on SJPL.
- Landscape linkage areas provide habitat for and facilitate the movement of wide-ranging species such as forest carnivores.
- Special biological diversity features of SJPL (old growth forests) are sustained.
- Wildlife populations across the planning area are viable, self-sustaining within healthy habitat conditions, adequately connected, and genetically diverse.
- Federally listed species maintain self-sustaining, viable populations and new habitat to expand into.

- The ecosystems and habitats on which federally listed species depend are sustained.
- Federally listed species improve their abundance, distribution, and habitat across SJPL to a point where the provisions of the ESA are no longer necessary.
- Native and desired non-native species are able to disperse freely across SJPL and to adjacent lands, which allows for interchange between populations and the maintenance of genetic diversity.
- Canada lynx populations become self-sustaining, finding suitable habitat condition across the planning area supporting successful foraging, reproduction, and dispersal to other habitats within Southern Colorado and Northern New Mexico.

Program Emphasis

The SJPL Plan provides for the viability of this species through protection of the composition, structure, and function of the terrestrial ecosystems (spruce-fir forests, cool-moist mixed conifer forests, and aspen forests) and riparian area ecosystems that this species is associated with, using knowledge of HRV conditions.

Program emphasis includes acquiring and using the best available science relative to lynx and its spruce-fir forest, cool-moist mixed conifer forest, and aspen forest, and riparian area ecosystems as found in the SJPL assessments (Terrestrial, HRV, CLC, and R2 Species) and other relevant literature. It includes continuing ongoing Plan-scale inventories for old growth forests. It includes producing new or modifying existing ecological assessments in order to have the best available information relative to ecosystems and species and the diversity and viability associated with them.

Program emphasis includes ensuring that ecological data, issues, and opportunities relative to lynx and its spruce-fir forest, cool-moist mixed conifer forest, aspen forest, and riparian area ecosystems are adequately recognized and considered in all projects and management actions, through ID team participation and input into environmental documents including the development of biological evaluations, biological assessments, and project mitigation measures.

Land Use Allocations

The SJPL Plan provides for the viability of this species through the designation of Research Natural Areas and management area 1 lands which are designed to preserve the habitat for lynx and the populations of lynx within them.

Standards and Guidelines

- Land management activities and projects must avoid disturbing proposed, threatened or endangered species during breeding, young rearing, or at other times that are critical to survival. (Exceptions may occur when individuals are adapted to human activity, or when the activities are not considered a threat or unless otherwise provided for under Section 7 consultation.)
- Projects (including, but not limited to, wildlife viewing sites, fences, highways, bridge upgrades or replacements, communication towers, utility lines, and canals) should be designed and built to provide for wildlife movement and maintenance of effective habitat.
- Management activities in, and immediately adjacent to, important wildlife habitats for Federally listed and sensitive species (including falcon and eagle nesting cliffs, bat roosts and hibernacula, Canada lynx landscape linkage areas, and winter raptor concentration areas) must be designed and conducted in a manner protecting the value of those areas for wildlife population sustainability.

- Management activities in, and immediately adjacent to, important wildlife habitats (including big game concentration and severe winter range) should be designed and conducted in a manner protecting the value of those areas for wildlife objectives and habitat effectiveness

- The Lynx Conservation Assessment and Strategy must be adopted as a component of this Plan. All conservation measures and guidelines contained therein must be implemented. (LCAS 2000, revised 2006).

- Forest vegetation types must be managed to retain or achieve at least the minimum percentages of old growth by vegetation type as displayed under desired conditions in table 3 of the Plan. If forest types currently do not meet these desired conditions, stands that are close to the old growth development stage should be identified as old growth recruitment areas in order to meet these desired conditions in the future.

- Following timber harvest and fuels treatments snags and large wood on the forest floor must meet the minimum standards described in Table 41 unless the site did not contain these attributes before the activity, in which case units must be designed to retain snags, snag recruits, and large wood in order to meet these minimum standards in the future.

Monitoring

The Plan provides for the viability of this species through the Plan's monitoring section which includes the following monitoring questions:

Has there been an increase in the amount of young spruce-fir and young cool-moist mixed-conifer forests?

Has there been an increase in the amount of young aspen forests?

Adaptive Management

Changes in the populations or habitats of this species could indicate that current management is adversely affecting its viability or the viability of its habitat, in which case adaptive management would be implemented to change management direction in order to sustain the viability of the species and its habitat.

REFERENCES

Ecosystems and species and the diversity and viability associated with them were considered through review and analysis of the best available science including the documents listed below.

- Terrestrial Current Landscape Condition Assessment for the San Juan National Forest.
- Aquatic, Riparian, and Wetland Ecosystem Assessment, San Juan National Forest.
- R2 Species Conservation Assessments
- Landscape Condition Analysis for the South Central Highlands Section, Southwestern Colorado and Northwestern New Mexico (HRV)
- Historic Range of Variability in Landscape Structure and Wildlife Habitat. San Juan National Forest (RMLANDS)
- Southern Rocky Mountains Ecoregion: An Ecoregional Assessment and Conservation Blueprint. Prepared by The Nature Conservancy
- Colorado Plateau Ecoregion: An Ecoregional Assessment. Prepared by The Nature Conservancy

- San Juan Planning for Biodiversity Model Project: Phase 1 Report to BLM. Prepared by The Nature Conservancy
- Colorado Natural Heritage Program, 2006. Element Occurrence Records for San Juan National Forest: GIS files and Database Reports.
- A Classification of Riparian Area and Wetland Vegetation of the San Juan National Forest
- Vegetation of the San Juan National Forest. A Working White Paper
- A Classification of Forest Habitat Types of N. New Mexico and Southern Colorado.
- Terrestrial Wildlife Management Indicator Species Assessment. San Juan National Forest
- SJPL inventories and GIS covers (R2Veg, rare plants, soils, ecological units, riparian areas, potential natural vegetation)
- Summary and Discussion of the Deputy Under Secretary of Agriculture's General Policy Guidance on NFMA Viability and Diversity. Liggett et al.

