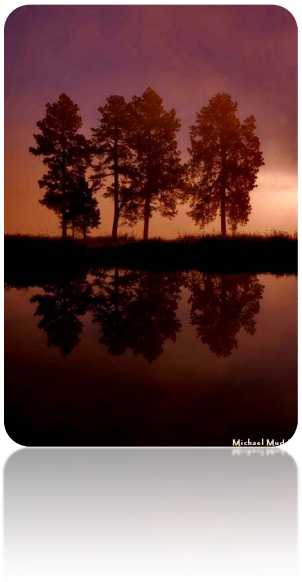
Valles Caldera National Preserve

Ecological Departure Summary



The attached information was presented, reviewed and revised by over 60 individuals representing agencies, organizations, pueblos, or simply themselves. This effort took place during a three day workshop in February 2010 that culminated in a collaborative strategy to restore over 210,000 acres in the Southwest Jemez Mountains Landscape (SWJML). This strategy has been submitted as a proposal for funding under the Collaborative Forest Landscape Restoration Program (CFLRP). For more information visit: http://www.fs.fed.us/r3/sfe/jemez_mtn_rest/index.html .

"Never doubt that a handful of committed people can change the world.
Indeed, it is the only thing that ever has." - *Margaret Mead*

What is "ecological departure"?!

Ecological departure is a measure of how out of whack an ecosystem is. This assessment is based on several assumptions.

#1 – Today's ecosystems persisted for 1,000s of years; evolving and adapting to disturbance, particularly FIRE, but including climate, insects, diseases, drought, and floods.

#2 – Human impacts since European settlement, especially the EXCLUSION OF FIRE, have disrupted the natural pattern of forest succession directing our forests on alternative paths of growth and development that may be less adapted to disturbances – especially FIRE.

#3 -Other actions including logging, grazing and road building in combination with the exclusion of fire have affected the structure, composition, and function of the interwoven web of natural systems including forests, woodlands, grasslands, wet lands, wet meadows, riparian areas, creeks, and rivers.

This measure of ecological departure compares a *reference condition* to the *existing condition.* The difference or *departure* is an indicator of just how ***out of whack*** our forests, woodlands, grasslands, and waters are (or aren't) today.

The ***reference condition*** is a model that represents what our systems would look like left to their own devices. The reference condition is thought to be sustainable and resilient in the event of natural disturbance and events. We have used nationally developed and accepted peer reviewed models as the reference condition for the structure and species composition of our forests, woodlands, and grasslands. We have used state and nationally agreed upon standards and measures as the reference condition for our water quality and stream condition.

The ***existing condition*** is derived from current measures based directly on field sampled data or estimated from remotely sensed data, calibrated and verified by field sampling. All data and information has been synthesized by interdisciplinary teams including foresters, fire managers, wildlife biologists, fisheries biologists, hydrologists, and soils scientists.

We have looked at this information forwards and backwards, inside out and upside down. Over the past year we have argued over and questioned everything and most importantly learned -and learned some more- about this landscape.

It has been challenging to present the information in a manner that can be quickly digested by a variety of individuals while retaining the richness of the information and the importance of the complex web of the systems being considered.

The attached tables are provided as a simple reference characterizing **KEY ATTRIBUTES** of the structure (age, size, density), composition (species and diversity), and function (habitats, processes and cycles) of the major ecosystems in this landscape.

For the purpose of strategic planning we have focused on **INDICATORS** or individual measures that can: 1) indicate the overall condition of the **KEY ATTRIBUTE** and, 2) have the potential to be measurably restored by management actions.

Each indicator is given a **CURRENT RATING** of **GOOD, FAIR**, or **POOR.**

- GOOD indicates that the current condition is within 33 percent of the reference condition.
- FAIR indicates a departure of 33 – 66 percent and
- POOR indicates that the current condition is departed by 66 – 100 percent.

Current **TRENDS** in condition are also noted as **UP** (improving), **DOWN** (worsening), or **FLAT** (no current trend).

Probable **CAUSES** and **EFFECTS** are provided. It should be noted that when the cause is logging or grazing it is the effect of this action over the past century (more or less) and does not necessarily indicate a direct effect from a current activity. The effect may be current or reflect a trend or risk i.e., loss of habitat, increased risk of uncharacteristic wildfire, etc.

POTENTIAL OUTCOME indicates the condition rating achievable if restoration were to occur and does not refer to an ideal condition. For example, by thinning young trees forest structure could be moved from POOR to FAIR. However, a rating of GOOD would require continued management and time for the trees to grow and cannot be directly achieved by our actions. Therefore, the POTENTIAL OUTCOME is FAIR.

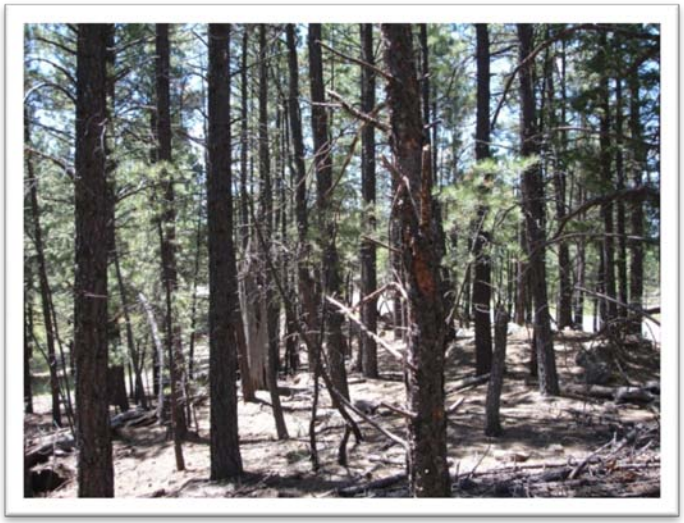
The **THREATS** rating relates to **EFFECTS.** Are the potential effects imminent? If they are currently happening, will they persist or increase?

The information summarized in these tables is available in Existing Condition Reports prepared by resource specialists and available for download at www.vallescaldera.gov, follow the links to Landscape Restoration and Management Plan on the homepage.

Ponderosa pine forests can generally be found at elevations from 6500 to 8000 feet in the mountains of New Mexico. On lower elevations and south slopes it may occur in pure stands of widely spaced trees over a grassy understory. At higher elevations and on north slopes, this forest type may include other species with blue spruce, Douglas-fir, white fir, or aspen accounting for up to 25 percent of the composition.

In the Jemez Mountains the ponderosa pine forests are adapted to frequent, low intensity fire (Fire Regime I). Fire scar studies in the area show an average fire frequency of less than 10 years. The higher elevations had a somewhat less frequent fire occurance, ranging from about 15-25 years depending on the site.

Ponderosa pine forests, so adapted to frequent fire, are the most ecologically departed forests relative to the reference condition. The exclusion of fire at the turn of the century allowed abundant reproduction to survive. These seedlings quickly grew to a size where they could survive low intensity fire. These systems have moved from open forests dominated by groups and clumps of large old trees (shown left) to dense forests, dominated by small diameter trees growing as thick as the hair on a dog's back (shown right). Besides the abundance of small trees there is an astounding lack of large trees and large snags. These are critical habitat features for many wildlife species. Historic grazing, logging and road building have also contributed to the current condition.



During the reference period crown fires were a rare event in ponderosa pine forests if they occurred at all. Currently these forests could support thousands of acres of crown fire under hot, dry, windy conditions. Ponderosa pine forests - the vegetation, soils, water, and wildlife; are not adapted to respond to crownfire. Following such an event, ponderosa pine forests can be sent onto an alternative pathway in growth and development that, based on the best estimates of scientists and ecologists, may require a century or more to transition back into a natural and sustainable trajectory.

Ponderosa Pine Forest							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Structure	Forest Succession	POOR	DOWN/FLAT	Fire exclusion, grazing, historic logging, wood cutting	Increased risk to wildfire, insects & disease,	FAIR	HIGH
Composition	Species Composition	FAIR	DOWN/FLAT	Fire exclusion, grazing, historic logging, wood cutting	Increased shade tolerant, fire intolerant species	GOOD	MEDIUM
Disturbance	FRCC Rating	POOR	FLAT	Fire exclusion, grazing, historic logging	Vulnerable to climate, wildfire, and insects	FLAT	HIGH
Habitat	Northern Goshawk habitat	POOR	DOWN/FLAT	Fire exclusion, wood cutting, historic logging	Loss of open habitat and late mature forest habitats	FAIR/GOOD	HIGH
Habitat	Abert's squirrel, JMS, cavity nesting species.	POOR	DOWN	Grazing, wood cutting, historic logging,	Loss of large down logs and snags, lack of recruitment, moist microclimates	FAIR	HIGH
Watershed	Forest structure	POOR	DOWN/FLAT	Fire exclusion, road density/condition historic logging,	Interception, sublimation of water. Loss of springs, vulnerable to drought	FAIR/GOOD	HIGH
Soil	Erosion	FAIR	FLAT	Historic logging, grazing, road building	Erosion, watershed function	FAIR/GOOD	MEDIUM

Ponderosa Pine - Reference and Current Structure					
Class	A	B	C	D	E
Reference	10%	10%	25%	40%	15%
Current	0%	89%	10%	1%	0%

Learn about a pine tree from a pine tree, and about a bamboo stalk from a bamboo stalk.

-Basho, Matsuo

Mixed conifer forests are the dominant forest type in the VCNP. Two distinct types of mixed conifer are present, *dry-mesic* and *wet-mesic*. The warm-dry type is subject to frequent surface fire (Fire Regime I). It is dominated by the fire adapted Douglas-fir and Ponderosa pine which grow in an open, two-story canopy. The composition and structure of overstory varies based on the temperature and moisture relationships of the site. Ponderosa pine, Douglas-fir, white fir and aspen make up the warm/dry mixed conifer overstory; Gambel oak is often the dominant shrub. Southwestern white pine and Rocky Mountain juniper can also be present. Ponderosa pine regeneration typically occurs after fire while white fir regeneration happens continuously between fires. Douglas-fir regeneration can happen in between and after fires. It gains fire resistance more quickly than white fir and can be a canopy dominant with ponderosa pine.

The cool moist forest types are subject to less frequent fire and fires of mixed severity (Fire Regime III). Ponderosa pine and Douglas-fir are often canopy dominants with a heavy white fir understory. The major tree species found in the cool/moist are Douglas-fir, ponderosa pine, blue spruce and aspen. Other tree species encountered are Rocky Mountain juniper and southwestern white pine. Near riparian areas, wetlands and drainages, blue spruce can be quite common.

The warm dry mixed conifer is often adjacent to ponderosa pine forests. The cool moist mixed conifer dominates the forested domes of the preserve. The drier type has been affected by fire exclusion and historic logging, which favored the removal of the fire adapted ponderosa pine and Douglas-fir and favored an increase in the fire intolerant but shade tolerant white fir. The wet sites historically produced huge Douglas-fir, prized for their clean straight lumber. These trees were targeted for removal during intensive historic logging especially, clear-cutting that occurred in the 1960's on the VCNP. The photo series below depicts Redondito Peak in the southwest quadrant of the VCNP in 1960 (left), 1972 (center) and 2000 (right).

Currently these forests are lacking in diverse habitats, especially for species that require old growth features (large and old trees, snags, and logs.) These forests are also at risk to crown fire occurring at a scale and intensity uncharacteristic for Fire Regimes I or III.

Moist Mesic Mixed Conifer Forests							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Structure	Forest Succession	POOR	DOWN/FLAT	Fire exclusion, grazing, historic logging, woodcutting	Wildfire, insects & disease,	FAIR	HIGH
Composition	Species Composition	FAIR	UP	Fire exclusion, grazing, historic logging	Increased shade tolerant, fire intolerant species	GOOD	MEDIUM
Disturbance	FRCC Rating	FAIR	DOWN/FLAT	Fire exclusion, grazing, historic logging	Vulnerable to climate, uncharacteristic wildfire	FAIR	HIGH
Habitat	Mexican spotted owl	POOR	DOWN/FLAT	Fire exclusion, historic logging	Loss of late closed forest habitats, and old growth structure (snags, logs)	FAIR/GOOD	HIGH
Habitat	Jemez Mountain Salamander	POOR	DOWN	Historic logging, woodcutting	Loss of large down logs and snags, lack of recruitment	FAIR	HIGH
Watershed	Forest structure	POOR	DOWN/FLAT	Fire exclusion, grazing, historic logging	Interception, sublimation of water. Loss of springs, vulnerable to drought	FAIR/GOOD	HIGH
Soil	Erosion	FAIR	FLAT	Historic logging, grazing road building	Erosion and watershed function	FAIR/GOOD	MEDIUM

Wet-Mesic Mixed Conifer Forest Reference and Current Structure					
Succession Class	A	B	C	D	E
Reference	10%	40%	25%	10%	15%
Current	%	96%	3.5%	0%	.4%

God has cared for these trees, saved them from drought, disease, avalanches, and a thousand tempests and floods. But he cannot save them from fools.

- John Muir

Dry- Mesic Mixed Conifer Forests

Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Structure	Forest Succession	POOR	DOWN/FLAT	Fire exclusion, historic grazing and logging	Wildfire, insects & disease,	FAIR	HIGH
Composition	Species Composition	FAIR	FLAT	Fire exclusion, historic grazing and logging	Increased shade tolerant, fire intolerant species	GOOD	MEDIUM
Disturbance	FRCC	POOR	DOWN/FLAT	Fire exclusion, historic grazing and logging	Vulnerable to climate, uncharacteristic wildfire	FAIR	HIGH
Habitat	Mexican spotted owl	POOR	DOWN/FLAT	Fire exclusion, historic logging	Loss of late closed forest habitats, old growth structure (snags, logs),	FAIR	HIGH
Habitat	Jemez Mountain Salamander	POOR	DOWN	Historic logging,	Loss of large down logs and snags, moist microclimate, lack of recruitment	FAIR	HIGH
Watershed	Forest structure	POOR	DOWN/FLAT	Fire exclusion, historic grazing and logging	Interception, sublimation of water. Loss of springs & openings, vulnerable to drought	FAIR/GOOD	HIGH
Soil	Erosion	FAIR	FLAT	Historic logging, grazing, road density/condition	Erosion and watershed function	FAIR/GOOD	MEDIUM

Dry-Mesic Mixed Conifer Forest Reference and Current Structure

Succession Class	A	B	C	D	E
Reference	15%	15%	10%	50%	10%
Current	0%	97%	3%	0%	0%

"Do not let your fire go out, spark by irreplaceable spark, in the hopeless swamps of the approximate, the not-quite, the not-yet, the not-at-all. Do not let the hero in your soul perish, in lonely frustration for the life you deserved, but have never been able to reach. Check your road and the nature of your battle. The world you desired can be won, it exists, it is real, it is possible, and it's yours." *–Ayn Rand*

Aspen forests are broadleaf forests dominated by aspen that occur from 8,600 to 10,200 ft. Conifers can be common, particularly as reproduction in the understory, but do not exceed 25 percent of canopy cover. Stands are typically considered successional to high elevation mixed conifer or spruce- fir forests following fire, but clonal aspen forests can be long-lived and occupy a site for long periods, particularly with repeated burning. The historic Fire Regime was a complex mixed severity regime (III). The frequency of all fires was between five and 25 years. Stand replacement fires occurred about every 50-100 years depending on site and fuel conditions. Mixed severity fires occurred at higher frequencies at return intervals of 40+ years. Surface fires occurred every 10-20 years but were limited in extent. Endemic disease (and insect outbreaks) would kill individual or small groups of aspen in most stands as aspen reached maturity.

In the past most large inventories and analysis on forest lands have been in support estimating timber volume or, more recently, assessing wildland fire risk. Consequently we have accumulated a greater understanding of ponderosa pine and mixed conifer forests and have less complete information available about other forest systems including aspen. Over the last decade there has been an emphasis on accelerating our understanding of this critical system including a series of local and national summits. Mixed conifer and aspen comprise approximately 15 percent of New Mexico's forest cover and are one of the state's most diverse forest types. They provide habitat for a variety of wildlife species, some at the heart of forest management battles. They shelter the headwaters of many of our critical watersheds, and are critical in the cycle of capturing and storing water and yielding springs and seeps. Besides being critical biological components, they have been long held as an icon for the beauty of western forests, often the focal image of art and photography portraying the changing seasons. The altered fire regime is changing overstory and understory composition and fire hazard and there is uncertainty about how to restore these forests.

The greatest threat to the health and vigor and future development of these stands is likely to be from climate or insects and disease triggered by climate. Aspen regeneration is particularly vulnerable to elk and is especially hard hit during years with late snowfall, light snowfall, and early spring melt. Deep, wet snow moves elk to lower elevations and otherwise protects young trees with cover. Our future management of fire will also be important.

Because aspen *trees* occur within most forest types, aspen *forest types* can be difficult to delineate using remotely sensed imagery and data. In fact the vegetation mapping products used in this analysis have all disagreed on the extent of the forest type and the current structure. The location and structure of this forest type was determined based on local stand level and field sampled data.

Aspen – Out of Whack Summary Table

Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Structure	Forest Succession	POOR	DOWN/FLAT	Fire exclusion, historic logging, grazing, elk	Wildfire, insects & disease,	FAIR	HIGH
Composition	Species Composition	FAIR	UP	Fire exclusion, historic logging, grazing, elk	Increased conifer abundance, loss of clones, lack of recruitment vulnerable to climate,	GOOD	HIGH
Disturbance	Natural disturbance regimes	FAIR	DOWN/FLAT	Fire exclusion, grazing, historic logging, loss of beaver	Vulnerable to climate, loss of clones, lack of recruitment, change in composition	FAIR	MEDIUM
Habitat	Hairy woodpecker	POOR	DOWN/FLAT	Fire exclusion, wood cutting, historic logging	Loss of large down logs and snags, lack of recruitment	FAIR/GOOD	MEDIUM
Watershed	Forest structure	FAIR	DOWN/FLAT	Fire exclusion, grazing, historic logging	Increased Interception, sublimation of water by conifers, loss of springs, vulnerable to drought	FAIR/GOOD	HIGH
Soil	Erosion	FAIR	FLAT	Grazing, road density/condition Historic logging,	Vulnerable to erosion especially in the event of fire	FAIR/GOOD	MEDIUM

Aspen Forest and Woodland – Reference and Current Structure					
Succession Class	A	B	C	D	E
Reference	60%	25%	4%	10%	1%
Current	0%	98%	2%	0.%	0%

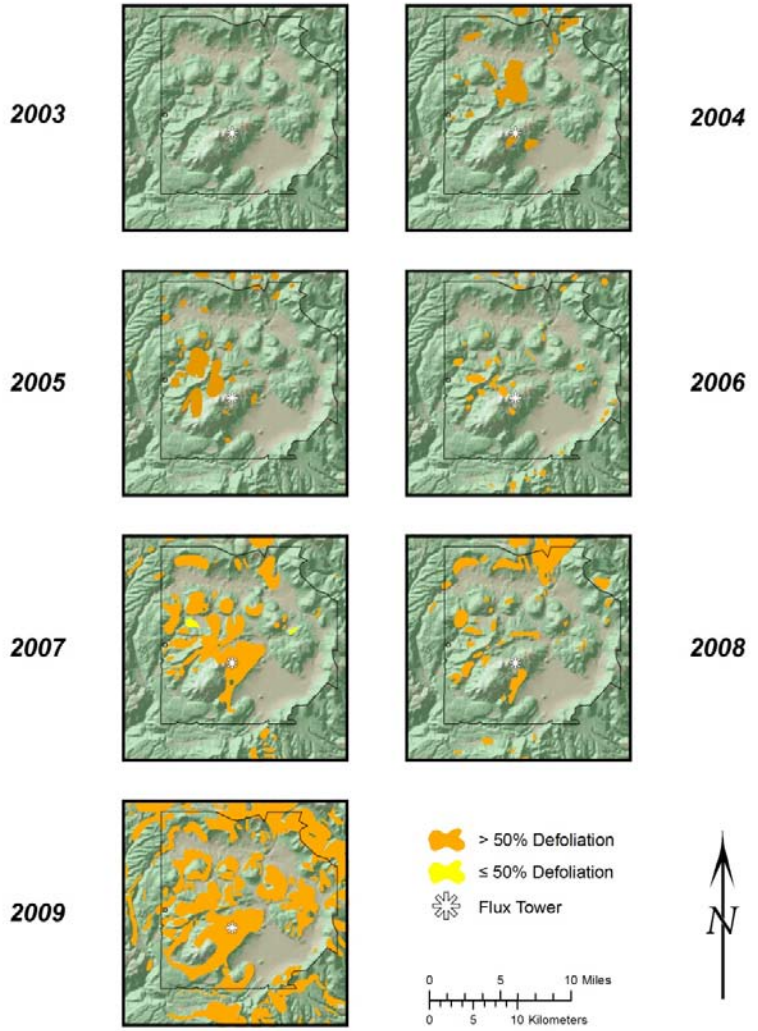
Stand Tall and Proud
Sink your roots deeply into the Earth
Reflect the light of a greater source
Think long term – Go out on a limb
Remember your place among all living beings
Embrace with joy the changing seasons
For each yields its own abundance
The Energy and Birth of Spring
The Growth and Contentment of Summer
The Wisdom to let go of leaves in the Fall
The Rest and Quiet Renewal of Winter
– *Ilan Shamir, Advice from a Tree*

Spruce-fir forests are an important component in the VCNP's forest ecosystem, covering approximately 8,200 acres. They occupy much of the upper slopes and ridgelines along the caldera rim and on Redondo Peak.

There are two distinct forest types represented in the spruce-fir forests: the cool, moist *Mesic Spruce Fir Forest,* and the *Dry- Mesic Spruce Fir Forest*.

The overstory is typically dominated by Engelmann spruce and/or subalpine fir. Aspen is notably absent in the wet mesic type but may be a component of the dry mesic. Historic disturbance includes occasional blow-down, insect outbreaks and stand-replacing fire. Disturbance by fire is primarily long-interval stand replacement fires (Fire Regime IV), with minor amount of terrain influenced by moderately long-interval mixed severity fires.

The spruce-fir forests of the preserve were heavily impacted by historic logging and road building and are now dominated by mid-succession, closed canopy forest. This structure is setting the stage for an increased risk of stand replacement fire due to potential interactions with climate and insects. The long fire interval historically typical in these forests is due to the very short season in which forest fuels are dry enough to carry fire. Climate trends initiating an earlier, longer fire seasons could increase the risk of a stand replacement event in these young forests. While stand replacement fire is not uncharacteristic, such a fire at this time would set back the recruitment of mature forests which are currently lacking.



Other risks are from insects. Western spruce budworm and bark beetles are the most damaging insects in these high-elevation forests. The past few years have seen major mortality events among corkbark/subalpine fir throughout the southwest, including the VCNP. The time series maps to the right show defoliation from USFS annual aerial detection surveys.

Measures of just how departed the spruce fir forests are used stand level, field sample data from the VCNP

Spruce-fir Forest							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Restoration Outcome	Threat
Structure	Forest Succession	POOR	FLAT	historic logging	Wildfire, insects & disease,	FAIR	HIGH
Composition	Species Composition	FAIR	UP	historic logging		GOOD	MEDIUM
FRCC (FR IV)	FRCC Rating	FAIR	FLAT	historic logging	Vulnerable to climate, wildfire, and insects	FAIR	MEDIUM
Habitat	Red backed voles, red squirrels, cavity nesting species, JMS	POOR	FLAT	historic logging	Loss of moist microclimate habitats, open habitat and late mature forest habitats.	FAIR/GOOD	MEDIUM
Watershed	Forest structure	FAIR	FLAT	historic logging	Interception, sublimation of water. Loss of small meadows, vulnerable to drought	FAIR/GOOD	HIGH
Soil	Erosion	FAIR/POOR	FLAT	Historic logging, road density/condition	Erosion, disruption in hydrology.	FAIR/GOOD	HIGH

Spruce-Fir Forest and Woodland					
Succession Class	A	B	C	D	E
Reference	15%	20%	15%	20%	30%
Current	0	90%	10%	0	0

It is not so much for its beauty that the forest makes a claim upon men's hearts, as for that subtle something, that quality of air that emanation from old trees, that so wonderfully changes and renews a weary spirit.
-Robert Louis Stevenson

A fine scale mapping project delineated 17,500 acres of upper and lower montane grasslands on the VCNP. Despite their seemingly high abundance on the VCNP, montane grasslands are relatively uncommon in New Mexico. Other than in the Jemez Mountains, they are found only at the highest elevations of the Sangre de Cristo Mountains along with scattered occurrences in the Sacramento Mountains and in the Gila. The montane grassland ecosystems include upper and lower montane grasslands.

The grasslands have adapted to frequent, low intensity fire (Fire Regime I). The exclusion of fire combined with climate, grazing, and road building has led to increasing encroachment by conifers as well as the establishment of non-native species, and noxious weeds. A 2007 study by Jonathan Coop found that the extent of the grasslands has been reduced by 18 percent since 1935 and fire had already been absent for over 50 years. The losses are a cumulative effect of grazing, fire exclusion, conifer encroachment (a cause as well as effect), and changes in hydrology caused by density and condition of roads, with climate trends also a contributing factor.

Primary components of the upper montane grasslands are Parry's danthonia-Thurber's fescue and Thurber's fescue-Kentucky bluegrass (shown below left associated with the valles of the VCNP and below the summary table associated with high-elevation montane forests). Primary components of the lower montane grasslands (shown below, right) are Arizona fescue-pine dropseed and Arizona fescue -Kentucky bluegrass. Note: Kentucky bluegrass, a European pasture grass now considered naturalized, is a primary component throughout this system. Forest meadows are also present at various scales throughout the SWJML.

The assessment of ecological departure for the grasslands was based on field sampled data from nearly 700 plots including systematic repeat samples taken twice a year for six years at 41 ecological sites. Measures included species composition, cover by grass, litter and bare ground, grass production, water quality, and stream condition. The measures were compared to an estimated optimum condition. Forest meadows are mapped; however data on the condition, and more importantly, loss of these systems over the last century are not well documented. This important issue requires additional assessment and study to quantify and develop plans for restoration.

> The most variegated carpet of flowers I ever beheld lay unrolled before me – red, yellow, violet, blue, every color, every tint was there… The finest artificial garden in the world would sink into insignificance when compared with this parterre of nature's own planting."
>
> *-Charles Sealsfield, 1843*

Montane Grasslands							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Structure	Ecological Departure	FAIR/POOR	FLAT	Past grazing, roads, recreation, seeding	Vulnerability to drought,	GOOD	MEDIUM
Extent	Conifer Encroachment	FAIR/POOR	DOWN	Grazing, fire exclusion, climate, conifer encroachment, road density	Transition from grassland to forest, loss of habitat, change in soil, increased sublimation.	FAIR/GOOD	HIGH
Composition	Ecological Departure	FAIR/POOR	FLAT	Past grazing, roads, recreation, seeding w/non natives	Encroachment of conifers, naturalized non-natives, presence of noxious weeds	GOOD	MEDIUM/HIGH
Disturbance	FRCC Rating	FAIR	FLAT/DOWN	Grazing, seeding, fire exclusion	Vulnerable to climate	FAIR	MEDIUM
Habitat	Gunnison prairie dog, ground nesting birds and mammels	FAIR	FLAT	Grazing, recreation	Loss of habitat	GOOD	MEDIUM

"In nature there are neither rewards nor punishments; there are consequences."

Robert Green Ingersoll

The riparian areas, wet meadows and wetlands associated with the rivers, streams, and creeks comprise ecosystems and habitats which support and connect all the systems, habitats, and life within the VCNP. The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands, and rapid recovery from fire events. Wet meadow types seldom burn. Hydrological events are the major disturbance agent in these systems. In addition, beaver were historically. Loss of beaver through trapping and habitat degradation is both a cause and effect to the level of departure in the current condition. These systems are especially vulnerable to climate trends and events.

Montane wet meadows support herbaceous vegetation dominated by a combination of facultative wetland as well as upland species. They most commonly occur on valley bottom surfaces that are not part of the active floodplain (terraces and lower alluvial slopes). They can extend up drainage ways and in springy areas of the surrounding valley alluvial piedmont slopes. Primary components include native and naturalized alliances including tufted hairgrass/woolly cinquefoil, Baltic rush-Kentucky bluegrass, Baltic rush-tufted hairgrass, and Kentucky bluegrass-common dandelion

Montane wetlands are dominated by obligate and facultative wetland species. They occur along valley bottom drainage ways that are part of the active floodplain. They can extend up drainage ways and into springy areas of the surrounding valley terraces alluvial piedmont slopes. These areas also include small inclusions of aquatic vegetation. The montane riparian system adjacent to streams consists of shrubland (shown left) and grassland (shown right) communities.

Montane shrublands occur along perennial mountain streams and fen margins. Elevations typically range from 8,300 to 9,400 ft. Streamside communities are dominated by thinleaf alder and occasional blue spruces. Understories are forb-rich and luxuriant, and typically have numerous obligate wetland species. On a regional basis these riparian shrublands occupy less than 1% of the Southern Rocky Mountain landscape. They are considered rare and globally threatened. The primary ecological management issues revolve around protection of water quality and quantity, and the enhancement of these sites for their intrinsic biodiversity values and importance to wildlife.

RIPARIAN *WETLANDS *WET MEADOWS – Out of Whack Summary Table							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Structure	Vegetation Succession	FAIR	UP	Grazing, earthen tanks, roads, recreation, non-native seeding, loss of beaver	Vulnerability to drought, impacts to stream function, loss of wetlands, loss of beaver.	GOOD	MEDIUM
Composition	Ecological Departure	FAIR/POOR	FLAT	Grazing, earthen tanks, loss of beaver, roads density/condition, recreation, seeding	Naturalized non-natives, loss of beaver, presence of noxious weeds, localized salt cedar	GOOD	HIGH
Disturbance	Beaver	FAIR	UP	Grazing, seeding, fire exclusion, loss of beaver	Loss of wetlands, loss of beaver	GOOD	MEDIUM
Habitat	NM Meadow Jumping Mouse, Northern leopard frog	FAIR	FLAT	Grazing, roads, recreation, seeding, earthen tanks, disease (frog)	Loss of habitat, absence of species	GOOD	HIGH

"Today the network of relationships linking the human race to itself and to the rest of the biosphere is so complex that all aspects affect all others to an extraordinary degree. Someone should be studying the whole system, however crudely that has to be done, because no gluing together of partial studies of a complex nonlinear system can give a good idea of the behavior of the whole." *-Murray Gell-Mann*

The President's Executive Order on Invasive Species defines invasive species as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." All ecosystems (rangelands, forests, grasslands, riparian areas, wetlands, lakes, and streams) are vulnerable to invasion by non-native weed species. The State of New Mexico maintains a list of species considered noxious in the state. The list places a weed designated as noxious into one of three categories for treatment:

- Class A species are currently not present in New Mexico, or have limited distribution. Preventing infestations of these species and eradicating existing infestations is the highest priority.
- Class B species are currently limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread.
- Class C species are wide-spread in the state. Management decisions for these species should be determined at the local level, based on feasibility of control and level of infestation.

Currently the VCT is actively eradicating weeds deemed noxious in the state of New Mexico which are known to occur on the preserve including:

- Canada thistle (*Cirsium arvense*) (Figure 1, left) a Class A noxious weed,
- Bull thistle (*Cirsium vulgare*) a Class C noxious weed,
- Musk thistle (*Carduus Nutans*) (Figure 2, center) a class B noxious weed,
- Oxeye daisy *(Leucanthemum vulgare)* (Figure 4, right), a Class A noxious weed.

Canada and bull thistle as well as oxeye daisy are being treated annually with an herbicide, Clopyralid, trade name Transline. Musk thistle is primarily treated by digging up the plant and removing the seed heads. Canada and musk thistle has been successfully eradicated in half the known locations and reduced 80-90 percent in other treated locations. However new locations have been discovered; likely spread through gophers and road maintenance activities. All locations of bull thistle have been reduced in size and density however the difficulty remains in preventing all plants from seeding. Though normally biennial, the thistle appears to be adapting to local precipitation patterns and reproducing both as an annual or biennial.

Cheatgrass *(Bromus tectorum),* a Class C noxious weed, is found to be spreading in road cuts likely through road maintenance activities. An event or disturbance such as drought or fire could provide an opportunity for this invasive to move into the valles and forests with negative and perhaps permanent ecological consequences. Goatheads *(Tribulus terrestris)* have been sighted on the preserve and are being dug or pulled on site by employees to try and eliminate these exotic, invasive and generally miserable plants (although not designated as noxious). Other noxious

weeds that are known in the region but have not yet been found on the VCNP include Dalmatian toadflax *(Linaria genistifolia spp. dalmatica)* and yellow toadflax *(Linaria vulgaris)*, both Class A weeds.

"Cursed is the ground because of you; through painful toil you will eat of it all the days of your life. It will produce thorns and thistles for you, and you will eat the plants of the field. By the sweat of your brow you will eat your food until you return to the ground,"

– Genesis

Figure 1 - Canada thistle (left), musk thistle (center), oxeye daisy (right) (Photo ©Al Schneider, www.swcoloradowildflowers.com)

Sweet flowers are slow and weeds make haste.

– William Shakespeare

Figure 2 – Cheatgrass (left), Dalmatian toadflax (center), yellow toadflax (right) (Photo ©Al Schneider, www.swcoloradowildflowers.com)

The VCNP is within the Jemez River Watershed meaning the waters eventually drain into the Jemez River. These streams flow through the landscape, sustaining both the plants and animals that live in the water and the land. The quality and condition of these waters is a mirror, reflecting the quality and condition of the ecosystems that surround it.

Key indicators in determining if these systems are departed are measures of water quality, stream condition, and the presence of native species.

Water quality compares the designated uses, or the types of life and uses the water *should* support (based on state standards), against what can currently be supported. A rating of GOOD means the water is supporting all designated uses. A rating of FAIR is used when the stream is failing to support one designated use. A rating of POOR is used to indicate more than one designated use is not being supported. It should be noted that standards for water quality or either impaired or not impaired. We use the rating FAIR acknowledging that it is useful but not consistent with standards for evaluating water quality.

Stream condition compares national standards for measures of riffles, large woody debris, pool development, pool quality, and stream bank condition (width, depth, stability, vegetative cover and diversity, etc.) with current measures. These conditions are reported as Properly Function Condition (GOOD), Functioning at Risk (FAIR), or Not Properly Functioning (POOR). Upward trends are likely due to improving the management of grazing, recreation, and motorized access.

Native species rating indicates the presence or absence of native fish. A GOOD rating is given if all native species are present. A FAIR rating allows one native species to be missing from the species composition. A POOR rating is given when two or more native species are missing from the mix. Loss of beaver is both a cause and effect of the current departure.

The streams in the VCNP are diverse, from the (shown left), Eastfork of the Jemez River flowing through the forests (shown left), or San Antonio Creek winding through the grasslands of the Valle San Antonio (shown right). On a landscape scale the streams flowing through the valles as a single channel are quite different than the historic multichanneled marshland that existed prior to the introduction of livestock. For the purposes of restoration we have evaluated each creek and river individually, sometimes by reach or segment, to determine if it is ecologically departed.

San Antonio Creek 31.5 miles (2 reaches)							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Water Quality East Fork to VCNP Boundary	Supporting Designated Uses	FAIR	FLAT	Roads, loss of riparian habitat, natural sources, recreation, grazing, site clearance, stream bank destabilization	Not fully supporting high quality coldwater aquatic life	FAIR/GOOD	HIGH
Water Quality VCNP Boundary to Headwaters	Supporting Designated Uses	FAIR	FLAT	Roads, loss of riparian habitat, natural sources, grazing, site clearance, stream bank destabilization	Not fully supporting high quality coldwater aquatic life	FAIR/GOOD	HIGH
Condition East Fork to VCNP Boundary	Proper Functioning Condition	POOR	FLAT	Roads, natural sources, recreation, grazing, timber harvesting, stream bank destabilization	Loss of habitat, effects to water quality	FAIR/GOOD	HIGH
Condition VCNP Boundary to Headwaters	Proper Functioning Condition	FAIR	UP/FLAT	Roads, natural sources, recreation, grazing, timber harvesting, stream bank destabilization	Loss of habitat, effects to water quality	FAIR/GOOD	HIGH
Composition	Native Fish	POOR	FLAT	Water quality, condition, predation, competition from exotics	Absence of RGCT, Rio Grande chub & sucker	GOOD	MEDIUM

I see an America whose rivers and valleys and lakes – hills and streams and plains – the mountains over our land and nature's wealth deep under the earth -- are protected as the rightful heritage of all the people.
- Franklin D. Roosevelt

East Fork of the Jemez River – 21.1 miles (2 reaches)							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Water Quality	Supporting Designated Uses	FAIR	FLAT	Roads, natural sources, recreation, grazing, timber harvesting, stream bank destabilization	Not fully supporting high quality coldwater aquatic life	FAIR	HIGH
Condition San Antonio to VCNP	Proper Functioning Condition	FAIR	Down	Roads, natural sources, recreation, grazing, timber harvesting, stream bank destabilization, loss of beaver	Loss of habitat, effects to water quality, loss of beaver	FAIR/GOOD	HIGH
Condition VCNP to Headwaters	Proper Functioning Condition	FAIR	UP	Roads, natural sources, recreation, grazing, timber harvesting, stream bank destabilization	Loss of habitat, effects to water quality	GOOD	HIGH
Composition	Native Fish	FAIR	FLAT	Water quality, condition, predation competition w/exotics	Absence of RGCT	GOOD	MEDIUM

"The survival of man in a world in which decency and dignity are possible, is the basic reason for bringing man's impact on his environment under informed and responsible control"

-Senator Henry Jackson, upon introducing Senate Bill 1075 (ultimately NEPA).

Jaramillo Creek 12.1 miles

Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Water Quality	Supporting Designated Uses	FAIR	UP/FLAT	Roads, natural sources, grazing, stream bank destabilization, wildlife other than waterfowl (elk)	Not fully supporting high quality coldwater aquatic life	GOOD	HIGH
Condition	Proper Functioning Condition	GOOD	FLAT	Improvements due to exclusion of livestock, reduction in vehicles	Absence beaver	GOOD	HIGH
Composition	Native Species	FAIR	FLAT	Water quality, predation by, competition with exotics	Absence of RGCT	GOOD	MEDIUM

La Jara Creek 5.3 miles:

Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Risk/Priority
Water Quality	Supporting Designated Uses	FAIR	FLAT	Roads, natural sources	Not fully supporting high quality coldwater aquatic life	GOOD	HIGH
Condition	Proper Functioning Condition	Not Measured	-			-	-
Composition	Native Species	Not Measured	-			-	-

When you drink the water, remember the spring.
- *Chinese Proverb*

Redondo Creek 6.1 miles:							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Water Quality	Supporting Designated Uses	FAIR	UP/FLAT	Roads, loss of riparian habitat, natural sources, grazing	Not fully supporting high quality coldwater aquatic life	GOOD	HIGH
Condition	Proper Functioning Condition	GOOD	UP			GOOD	HIGH
Composition	Native Fish	FAIR	FLAT	Predation by exotics	Absence of RGCT	GOOD	MEDIUM

Rito de los Indios 4.5 miles:							
Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Water Quality	Supporting Designated Uses	FAIR	UP/FLAT	Natural sources	Not fully supporting high quality coldwater aquatic life	GOOD	HIGH
Condition	Proper Functioning Condition	FAIR	UP/FLAT	Roads, loss of beaver	Road crossing stream, loss of beaver	GOOD	HIGH
Composition	Native Fish	FAIR	FLAT	Water quality, condition, predation by competition with exotics	Absence of RGCT	GOOD	MEDIUM

The rivers are our brothers. They quench our thirst. The rivers carry our canoes, and feed our children. If we sell you our land, you must remember, and teach your children, that the rivers are our brothers and yours, and you must henceforth give the rivers the kindness you would give any brother.

Chief Seattle – 1854