Southwestern Jemez Mountains Landscape (SWJML)

Out of Whack Summary

Forests and Woodlands

Spruce-Fir

Aspen

Mixed Conifer

Ponderosa Pine

Piñon Juniper

Spruce-fir forests are a minor component in the SWJML but are a major element 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.
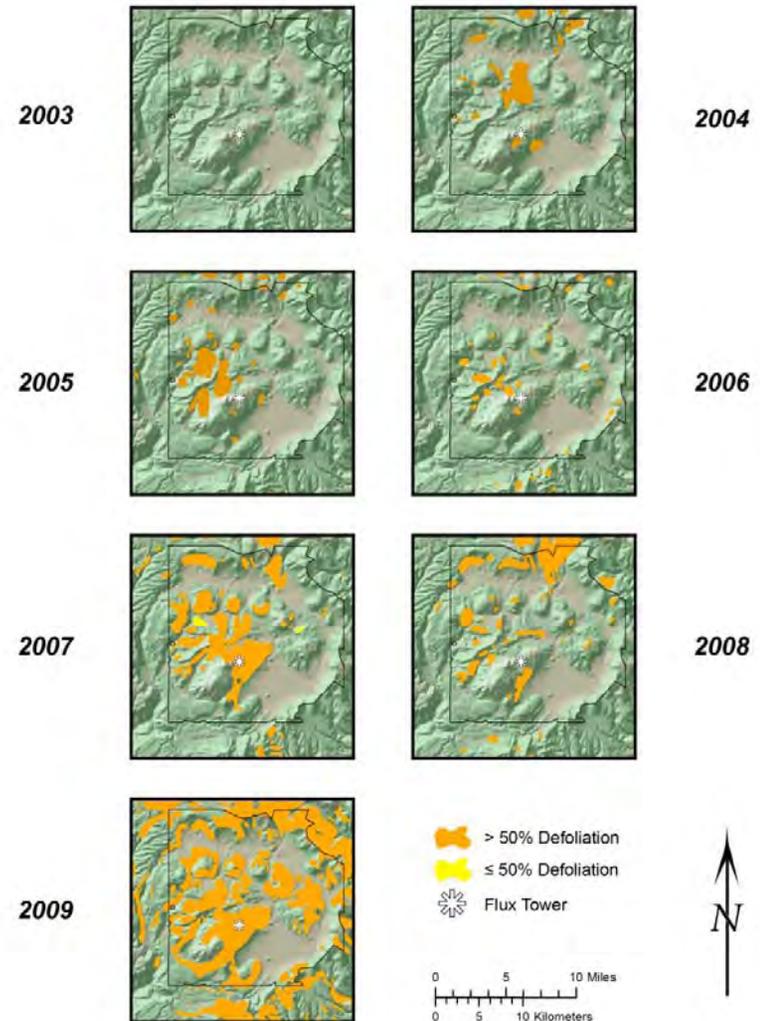
There are two distinct forest types represented in the spruce-fir forests: the cool, moist *Mesic Spruce Fir Forest,* and the *Dry- Mesic Spruce Fir Forest*.

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 historic logging 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 out of whack the spruce fir forests are used stand level, field sample data from the VCNP

2003 2004 2005 2006 2007 2008 2009

> 50% Defoliation
≤ 50% Defoliation
Flux Tower

0   5   10 Miles
0   5   10 Kilometers

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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

The mixed conifer forests of the SWJML are second in abundance next to the ponderosa pine forest and 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. Gambel oak is often the dominant shrub. Southwestern white pine and Rocky Mountain juniper can be present. Ponderosa pine regeneration typically occurs after fire. 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 and occurs in the canyons of the pine dominated mesas. The cool moist mixed conifer dominates the forested domes of the preserve. The drier type has been affected by fire exclusion and historic 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 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	1%	93%	5%	0%	0%

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, grazing, historic logging, woodcutting	Wildfire, insects & disease,	FAIR	HIGH
Composition	Species Composition	FAIR	FLAT	Fire exclusion, grazing, historic logging	Increased shade tolerant, fire intolerant species	GOOD	MEDIUM
Disturbance	FRCC	POOR	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, old growth structure (snags, logs),	FAIR	HIGH
Habitat	Jemez Mountain Salamander	POOR	DOWN	Historic logging, woodcutting	Loss of large down logs and snags, moist microclimate, lack of recruitment	FAIR	HIGH
Watershed	Forest structure	POOR	DOWN/FLAT	Fire exclusion, grazing, historic 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	4%	80%	15%	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, it's yours." –Ayn Rand

The aspen forests in the SWJML 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% 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 at 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 and 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% 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.
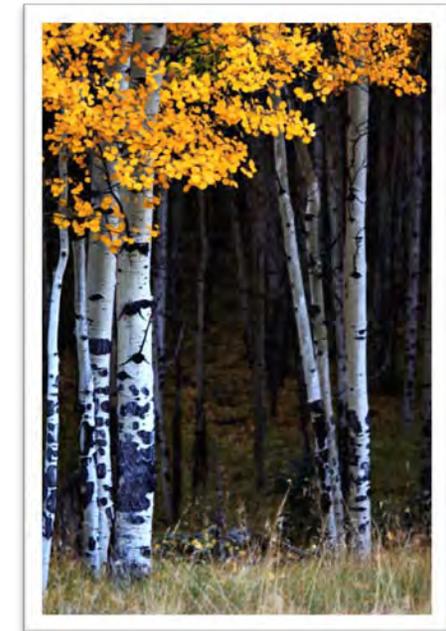
The greatest threat to the health and vigor and future development of these stands is likely to be from climate or insects and disease triggered by climate. Aspen regeneration is particularly vulnerable to elk and is especially hard hit during years with late snowfall, light snowfall, and early spring 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*

Ponderosa pine forests dominate the SWJML, comprising a third of the total vegetation. 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 on the southwest mesas in the landscape 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.
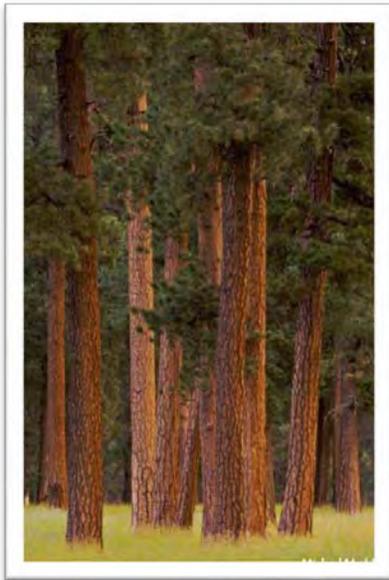
Ponderosa pine forests, so adapted to frequent fire, are the most out of whack forests relative to the reference condition. The exclusion of fire at the turn of the century allowed abundant reproduction to survive. These seedlings quickly grew to a size where they could withstand low intensity fire. 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). During the reference period crown fires were a rare event if they occurred at all. Currently these forests could support thousands of acres of crown fire under hot, dry, windy conditions. Grazing, historic historic logging, and road building have also contributed to the current condition. Woodcutting, including the "poaching" of large trees and snags is an import factor in the loss of habitat features for many species.

The small communities of Sierra los Pinos, La Cueva, Thompson Ridge and Seven Springs are all completely intermixed within the ponderosa pine forests. A large crownfire event in the ponderosa pine may have catastrophic consequences to area residents. In addition, crownfires of various size and scale simply did not occur at any measurable scale in ponderosa pine forests during that era. These forest systems, the vegetation, soils, water, and wildlife; are not adapted to respond to these events. 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	6%	80%	8%	3%	2%

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

–Basho, Matsuo

The piñon-juniper woodlands occur on warm dry sites on mountain slopes, mesas, plateaus and ridges on sites ranging from deep, well-drained soils on nearly flat slopes, to shallow, steep and rocky sites. These woodlands are dominated by Rocky Mountain juniper, piñon pine and one seed juniper. The one seed juniper may co-dominate or replace the Rocky Mountain juniper at higher elevations.   Some areas have seen a marked decline in the abundance of piñon as a result of the 2002 bark beetle outbreak. Understory layers are variable with the most common shrub associations being sage, Gambel oak, and mountain mahogany depending on the site. These woodlands generally host a sparse to absent understory of grasses, sub shrubs, and forbs.   The historic fire regime is characterized by somewhat frequent mosaic fire with very infrequent replacement fires generally spreading from adjacent forest types. The measures for the woodlands are derived from course scale data produced by the LANDFIRE project and reviewed by local resource specialists using limited field data.

Piñon-juniper woodlands are generally regarded as of little economic importance save for fuellwood, and the edible nuts they produce. Some even view the woodlands as competitors with grasses for space, and regard them as invasive of rangeland.   However, Native American peoples made extensive use of these woodlands for at least two millennia. Today, the artifacts of these cultures remain in these woodlands and they continue to connect the people of the area Pueblos to this landscape. These woodlands are out of whack today based on measures of structure composition and function. These systems are out of whack as a result of a combination of fire exclusion, grazing, road density/condition, wood cutting, and off road use.

Besides their cultural significance they are managed today as important components of the watershed and valuable habitats for plants and wildlife. Many animal species find refuge in piñon-juniper woodlands, including mule deer, elk, turkey, desert cottontail, and pinyon jay. Below are photos of the woodlands above Jemez Springs (left), above the Jemez River (center), and with a shrubby understory (right).

Piñon Juniper Woodlands

Key Attribute	Indicator	Current Rating	Trend	Causes	Effects	Potential Outcome	Threat
Structure	Forest Succession	FAIR	DOWN/FLAT	Bark beetle, grazing, woodcutting	Wildfire, insects & disease, loss of habitat	GOOD	HIGH
Composition	Species Composition	FAIR	DOWN/FLAT	Bark beetle, grazing, woodcutting	Increased shade tolerant, fire intolerant species	GOOD	MEDIUM
Disturbance	FRCC Rating	FAIR	FLAT	Grazing, road density/condition, off road use, woodcutting	Loss of herbaceous fuels	FAIR	HIGH
Habitat	Pinyon Jay	FAIR	FLAT	Grazing, road density/condition, off road use, woodcutting	Loss of open habitat and late mature forest habitats	FAIR/GOOD	MEDIUM
Watershed	Forest structure	FAIR	FLAT	Grazing, road density/condition, off road use, woodcutting	Interception, sublimation of water. Loss of springs, vulnerable to drought	FAIR/GOOD	HIGH
Soil	Erosion	POOR	DOWN/FLAT	Grazing, road density/condition, off road use, woodcutting	Vulnerable to erosion in the event of fire, rills and cuts during monsoons.	FAIR/GOOD	HIGH

Piñon Juniper Woodland – Reference and Current Structure

Class	A	B	C	D	E	**Unchar.
Reference	10%	20%	25%	35%	10%	0%
Current	14	36%	21%	3%	8%	19%

**Canopy closure >70% is considered uncharacteristic

There is a serene and settled majesty to woodland scenery that enters into the soul and delights and elevates it, and fills it with noble inclinations.
– Washington Irving

No pessimist ever discovered the secret of the stars, or sailed to unchartered land, or opened a new doorway for the human spirit.

–Helen Keller