

Summary of Draft Assessment of Ecological/Social/Economic Sustainability Conditions and Trends

Lincoln National Forest



Forest Service

Lincoln National Forest

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Summary

The Lincoln National Forest (NF) has completed a draft assessment report (36 CFR 219) of 15 resource topics, as required by the USDA Forest Service’s 2012 Planning Rule. The assessment process is designed to rapidly evaluate readily available existing information about relevant ecological, economic, and social conditions, trends, and sustainability and their relationship to the current Land and Resource Management Plan (Forest Plan), within the context of the broader landscape. The assessment uses information that is currently available in a form useful for the planning process, without further data collection, modification, or validation. The assessment report is not a decision making document, but provides current information on planning topics (36 CFR 219.19).

The purpose of this document is to summarize and highlight the key trends and risks to sustainability identified from the draft assessment report. The identified information in Volume I represent the results of assessing the Lincoln National Forest’s current conditions and trends and their departure from reference condition for ecological resources. The resources that are most departed are also the most at risk of not being sustainable under current plan management direction. The identified information in Volume II represent the results of assessing the social, cultural, and economic resources on the Forest. These findings from the draft assessment inform the need for current management direction outlined in the Lincoln National Forest’s 1986 Forest Plan.

The draft assessment report evaluated and identified many other topics that are not covered in this summary document. The reader is strongly encouraged to refer to the draft plan assessment report to learn more about how the resource areas were evaluated and how the key findings were identified. The full report is available at <https://go.usa.gov/xPYbu>.

Volume I – Ecological Conditions

The assessment process requires the analysis of eight ecological resource areas to determine the risks to sustainability under current plan management direction. The forest evaluated Terrestrial Ecosystems, Soils, Riparian Ecosystems, Watersheds and Water Resources, At-risk Species, Air Quality, Climate Change, and Carbon Stocks. A discussion of stressors or drivers leading to risks to sustainability for each resource is also included.

Assessing ecological integrity involves looking at the current condition of an ecosystem, comparing it to reference conditions, and measuring departure of the current condition from reference conditions. Reference conditions are the environmental conditions that infer ecological sustainability. In order to manage the ecosystems of today, it is important to know as much as possible about past ecosystem conditions, especially the conditions that existed before forest structure, composition, function, processes, and disturbances were altered by Euro-American settlers. Such conditions were not unchanging, but were sustained across what has been called a “natural range of variability” (NRV) or “historical range of variation” (HRV), generally estimate pre-European settlement conditions. NRV is the reference condition for many of the ecosystem characteristics analyzed. Where the characteristic or the data describing it do not compare well to the NRV reference condition, alternative reference conditions are defined based on the current understanding of conditions that would sustain ecological integrity. Those reference conditions are described in the sections where they are used.

Reference conditions are a tool for assessing ecological integrity and do not necessarily constitute a management target or desired condition. The comparison between reference and current conditions is used to determine the degree of departure and whether the trend is away or toward reference. When departure can be quantified, it is rated in this assessment on a scale from 0 to 100 percent, where 0 to 33 percent is considered “low,” and within reference condition. The “moderate” (34 to 66 percent) and

“high” (67 to 100 percent) classes are outside of reference condition, are uncharacteristic for the system, and are considered significant in terms of risk.

Ecosystem characteristics are specific components of ecological conditions that sustain ecological integrity. Key ecosystem characteristics, describing the composition, structure, connectivity, and/or function of an ecosystem, are identified and evaluated for each resource area, as applicable. Only those characteristics needed to provide the conditions necessary to maintain or restore the ecological integrity of terrestrial, aquatic, and riparian ecosystems in the plan area are considered in the assessment. Characteristics for different resources are described in their respective chapters.

Spatial Scales of Analysis

The assessment evaluates the risk to sustainability at three spatial scales. The goal of evaluating information about ecological integrity at a scale broader than the forest is to understand the context of management for resources within the forest. An understanding of the environmental context extending beyond the forest is necessary for determining opportunities or limitations for National Forest System (NFS) lands to contribute to the sustainability of the broader ecological systems, as well as the impacts of the broader landscape on the sustainability of resources within the forest. In some instances, a unique role of NFS lands may become apparent at this scale. The key findings are discussed at some or all of the spatial scales, which are included below for reference:

- **Context Scale** is needed to put the forest condition in context with the greater area, including lands beyond the forest boundary. The context scale informs the spatial niche of the forest in the greater landscape.
- **Plan Scale** showcases current condition and trends as an average of conditions across the Lincoln National Forest.
- **Local Scale** is valuable for describing departure patterns for a given characteristic and identifying where particular issues may need attention and drive forest plan components. This scale is not as likely to drive ecological need for change, but may drive development of plan components.

Water and air resource data and analysis do not always lend themselves well to these delineations and instead, use watersheds and airsheds. These spatial scales are described in more detail in relevant sections.

The assessment also uses the ecological response unit (ERU) system, which is a classification of sites with similar plant species composition, succession patterns, and disturbance regimes.

Drivers and Stressors

Drivers and stressors are recurring events, processes or actions that affect ecosystems. Ecosystem drivers can act as stressors where they occur outside the natural range of variation (NRV). Important drivers and stressors on the Lincoln NF are fire, insects and disease, climate change, grazing, invasive species, more localized floods, winds, vegetative succession, vegetation management, or other physical factors. Several of these drivers and stressors are discussed in this analysis. Others are discussed in the relevant resource analyses.

Stressors are natural or human caused alterations in system drivers that may directly or indirectly threaten resource sustainability. It is the combination of and interactions between system drivers and stressors that have resulted in current conditions discussed throughout the ecological volume of the assessment. There are two main questions that are asked to evaluate the sustainability of ecosystems:

are drivers and the effects of stressors operating within the NRV, and are ecosystems “resilient” to drivers and stressors.

Fire

Fire suppression, large-scale logging, even-aged timber management, and other factors have altered vegetation structure, contributing to increases in fire severity and frequency that historically maintained much of the structure of Forest ecosystems. This has led to wildland fire often being a system stressor, when historically it would be considered a system driver. While current wildland fire regimes are outside the historic range of variation for most ecosystems, management in place since the late 1900s may help move wildland fire regimes toward historic conditions.

Fuels reduction, along with suppression, helps to diminish the potential for catastrophic wildland fires, particularly in the wildland-urban interface (WUI). Fuels reduction treatments can be designed to approximate, or move local areas into alternative seral states to help meet landscape desired conditions.

Climate Change

There is broad agreement among climate modelers that the Southwestern US is experiencing a warming and drying trend that will continue well into the latter part of 21st century. While some models predict increased precipitation for the region, researchers expect the overall balance between precipitation and evaporation would still likely result in an overall decrease in available moisture. Temperatures are predicted to rise by 5 to 8 degrees Fahrenheit by the end of this century, with the greatest warming occurring during winter months. Some climate model results also suggest a fivefold increase in unusually hot days by the end of the century. The climate change vulnerability assessment (CCVA) results indicate that considerable portions of ecosystems in the plan area and characteristic plant communities within and near the Lincoln NF are at risk of ecological departure due to climate change, at present and in the future.

Based on the CCVA results, approximately 61 percent of the plan unit (including all ERUs or ecosystems regardless of land ownership) is at high or greater risk (vulnerability) due to climate change. Specifically, of the plan unit, 26 percent is at very high risk; 35 percent is at high risk; 29 percent is at moderate risk; and 10 percent is at low risk. At the local unit scale, the CCVA indicated the following areas to be most vulnerable to climate change: Rio Hondo, Arroyo del Macho, Rio Peñasco, and Salt Basin.

Of the major ERUs in the plan unit, Ponderosa Pine-Evergreen Oak, Piñon-Juniper Grass, Ponderosa Pine Forest, and Spruce-Fir Forest are the most vulnerable; and Mountain Mahogany Mixed Shrubland, Piñon-Juniper Evergreen Shrub, and Semi-Desert Grassland are the least vulnerable to climate change. Of the Forested ERUs, Ponderosa Pine Forest, Ponderosa Pine-Evergreen Oak, and Spruce-Fir Forest are most vulnerable.

Of the 95 sub-watershed scale units analyzed, 14 percent showed very high vulnerability; 60 percent showed high vulnerability; and 26 percent showed moderate vulnerability to climate change.

The CCVA results indicate that considerable portions of ecosystems in the plan area and characteristic plant communities within and near the Lincoln NF are at risk of ecological departure due to climate change, at present and in the future.

Insects and Disease

Insects and diseases are important components of forest and woodland ecosystems and can be both a system driver and stressor. It is only when their effects exceed what is desirable or disrupt ecological integrity that they become a concern.

The Lincoln NF has the same insect and disease associates that occurred 100 years ago, with the exception of a few introduced insects and pathogens, most notably white pine blister rust (WPBR). Invasive WPBR is expected to expand in terms of occurrence and severity. Moist drainages and higher elevation stands are the most vulnerable, especially where orange gooseberry, the preferred alternate host, is present. On drier, low hazard sites, infections and subsequent mortality are expected to be relatively low. Maintaining and promoting the broadest possible genetic diversity present, including adaptive traits important in a changing climate as well as blister rust resistance mechanisms, should help ensure the long-term survival of these unique trees.

Other than WPBR, the primary forest insects and diseases are native, with outbreaks tied primarily to drought or disturbance. However, climate change is anticipated to substantially change insect and disease dynamics, likely leading to increased tree mortality.

Grazing and Livestock

Herbivory disturbance regimes are drivers in nearly all ecological systems. It is both a system driver and a substantial stressor in the plan area. Elk were reintroduced to the Forest in the 1950s. These populations have steadily increased, particularly on the Smokey Bear and Sacramento Ranger Districts, and have contributed negative ecological impacts in some areas, particularly in aspen stands and riparian areas.

The Lincoln NF area has been grazed by domestic livestock, including cattle, sheep, swine, and goats, since around 1700. Currently the Lincoln NF is grazed primarily by domestic cattle, with some incidental grazing by horses and sheep. Nearly 957,000 acres of the Lincoln NF's approximately 1.1 million acres are grazed under permit. The Lincoln NF allows year-long grazing on summer and winter pastures, with approximately 13,000 head of livestock permitted to graze the allotments. Adaptive management of the rangeland resource allows for reduction in grazing numbers when natural conditions suggest a need.

Herbivory has the potential to impact the composition, structure and function of upland and riparian vegetation, as well as soil hydrologic function, stability, and nutrient cycling. Where decreases in herbaceous biomass occur, the ability of frequent fire ecosystems to carry low intensity fire can be reduced. It also reduces the risk of moderate and high intensity fire. Decreases in the herbaceous component reduces competition by grasses with woody species, allowing those woody species to expand or encroach into grasslands and woodland and forest openings. Sustained grazing over time can reduce species diversity as some plants are more palatable than others to specific ungulates.

While there is evidence that heavy grazing can degrade arid rangelands, some native plants are adapted to ungulate grazing and grazing animals may play a role in nutrient cycling. Properly managed grazing, with respect to utilization levels, season of use, and type of animal may minimize impacts to ecosystem function and can be sustainable over the long term.

Timber

Timber harvest is one way to work toward those desired or historic conditions that can also provide an economic benefit for the Forest and the surrounding community. Challenges to timber harvest include a lack of infrastructure and market, thus making timber a byproduct of forest restoration practices and not the driver. Vegetation management, including timber harvest and fuels management, has the most direct effect on restoring and maintaining desired or historic successional patterns on the landscape. However, residual effects of vegetation management including leftover debris may hinder natural succession.

Treatments that result in soil compaction can also inhibit succession and stall natural regeneration of understory and tree species. Disturbance from management activities can create opportunities for new

or spreading infestations of non-native invasive species, which can delay succession of native plants, or in extreme cases, convert the understory to a different plant community. In contrast, by scarifying seedbeds and promoting forest regeneration, carefully managed ground disturbance can be desirable.

Invasive Species

Invasive species are defined as an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Invasive species infest both aquatic and terrestrial areas. Invasive species introductions are a major threat to species biodiversity and are widely recognized as changing the way energy, nutrients, and water are exchanged in a system. Invasive species are also known to alter other factors, such as disturbance regimes, climatic and atmospheric composition, and physical habitat.

In recent decades, invasive plant species increased in abundance on the Lincoln NF and adjacent lands, which has led to increased public concern about the effects of invasive plants and greater demand for treatment. To date, the Forest has recorded the presence of at least 26 invasive plant species; however, no recent surveys have been conducted on the Smokey Bear and Sacramento Ranger Districts and no substantial surveys have been conducted on the Guadalupe District. As a result, the current number of infested acres is unknown at this time.

Musk thistle and teasel are the most abundant invasive plant species on the Forest, located along roads, stream corridors, riparian areas, grazed pastures and burned areas. These two species, along with grazing tolerant grasses such as Kentucky blue grass, contribute to the departed condition of riparian areas, meadows, and other sensitive areas that contain federally-listed species.

Exotic terrestrial animals of prominent concern on the Lincoln NF are the feral hoofed mammals, pig, horse, and Barbary sheep.

Terrestrial Vegetation

Ecosystem functionality can be gauged by assessing the condition of key ecosystem characteristics. Condition is assessed as the departure of current values for a character from a reference such as historical or potential value. Key characteristics were included where condition or trend would serve as an indicator of ecological processes and/or show effects of stressors on those processes.

Ecosystems on the Lincoln NF are classified as Ecological Response Units (ERUs). The Lincoln NF contains 15 upland ecological response units that make up approximately 96 percent of the Forest (Table 1). These consist of the major vegetation types found on the forest and their historical fire regime. Many of the ERUs have large presence on the forest relative to the larger area around it, and thus the Forest has a large role to play in maintaining the ecological integrity of ERUs. The primary ecological characteristic of ERUs is seral state proportion, or the relative amounts of all the seral states making up an ERU. This characteristic contributes to other characteristics such as fire regime, patch size, and snags and coarse wood.

Table 1. Proportion of upland ERUs on the Lincoln NF and within the greater context area (CA)

	Ecological Response Unit	ERU code	Context Acres	LNF Acres	% Forest
Forest	Spruce - Fir Forest	SFF	16,936	11,034	1.0
	Mixed Conifer w/Aspen	MCW	75,726	35,568	3.3
	Mixed Conifer - Frequent Fire	MCD	328,640	163,674	15.0
	Ponderosa Pine Forest	PPF	594,245	123,156	11.3

	Ecological Response Unit	ERU code	Context Acres	LNF Acres	% Forest
	Ponderosa Pine Evergreen Oak	PPE	40,375	8,661	0.8
Woodland	Piñon Juniper Evergreen Shrub	PJC	85,442	53,976	4.9
	Juniper Grassland	JUG	2,817,810	9,755	0.9
	Piñon Juniper Woodland	PJO	1,035,948	319,105	29.2
	Piñon Juniper Grassland	PJG	571,296	165,432	15.1
Shrubland	Gambel Oak Shrubland	GAMB	22,282	3,589	0.3
	Mountain Mahogany Mixed Shrubland	MMS	173,734	52,528	4.8
	Chihuahuan Desert Scrub	CDS	6,407,214	19,526	1.8
Grassland	Montane Subalpine Grassland	MSG	41,488	11,230	1.0
	Semi-Desert Grassland	SDG	15,141,603	65,888	6.0

Analysis is done at the plan scale, which is boundaries of the Lincoln National Forest. Where possible, qualitative or quantitative analysis is provided at a larger context scale which is the Ecological Subsections of the United States that contain the Lincoln NF and share its geophysical and ecological characteristics. Additionally, when possible, analysis within the plan area is done at a local, or watershed scale to highlight local differences in ERU condition.

Seral State

Seral state proportion is the percent of an ecological response unit in each seral state and is assessed at the context, plan, and local scales. Comparing current seral state proportion to reference proportions gives a measure of departure that indicates whether ecosystem integrity is at risk.

The SDG, GAMB, PPF, and MSG, ERUs are highly departed and the Lincoln NF should have a role in their restoration. Because the vast majority of SDG is off-Forest, the Lincoln NF's role may be limited on that systems.

The Forest may act as a refuge for the MCW, SFF, PJC, MMS, and MSG ERUs. Their distribution on the Lincoln NF may be small, however they are rare in the larger context landscape, and the Lincoln may play a role by maintaining intact reservoirs. Because four out of the five have moderate, but significant departure, the Forest can have a substantial role in their restoration, maintenance, and overall sustainability.

The PJO, PJG, MCD, and PPE ERUs are moderately departed, and present an opportunity for the Lincoln NF to have a substantial role in their restoration, maintenance, and overall sustainability. There is also an opportunity for the Lincoln NF to influence JUG's condition, by maintaining its already high ecological integrity on Forest.

Some ERUs on the Lincoln NF modelled seral state proportion into the future to determine the departure trend. Four were at moderate risk, and two are at high risk to ecological integrity. JUG, PJG, and PJO, and MMS were low risk. Recent management efforts to reduce encroaching juniper for fire protection and forage enhancement may have played a role in moving these ERUs toward reference conditions.

Of the four ERUs showing moderate risk, both MCD and MCW are moderately departed currently, and remain stable over time. For these ERUs, current forest management has plan direction that is different from reference conditions to provide protections for wildlife species, particularly the northern goshawk

and the Mexican spotted owl. Under that management, trend is stable, and departure is expected to remain moderate in the future. The other two ERUs at moderate risk are the highly departed PPF and MSG types which are moving toward reference conditions.

The SDG and PJC ERUs are at high risk as modelled into the future under current management. Returning wildfire to these ERUs as a management tool might reduce risk for both of these ERUs.

Fire Regime

Fire Regime is the combination of Fire Frequency, Fire Severity, and Fire Regime Condition Class (FRCC) characteristics. Departures for fire frequency and severity are determined independently. Reference conditions, or the historic range of variation, were determined through a review and synthesis of literature. Fire frequency is measured in mean fire return interval, the number of years it would take for an area equal to the entire ERU to burn. On the Lincoln NF, only MMS shows low departure from reference, and PJC and PJG are moderately departed. All but three ERUs modelled are highly departed.

The historic distribution of low, moderate, and high fire severity is ecosystem specific and departure is the change in that distribution.

The Lincoln NF is trending away from reference conditions and under current management and disturbance regimes will likely continue. Management activities have not been able to keep up with natural processes and disturbance, and risk to ecological integrity is moderate to high.

Snags and Coarse Woody Debris

Snags and coarse woody debris (CWD) provide wildlife habitat and contributes to the formation of soil organic matter. Different vegetation types have historically characteristic amounts of CWD and snags. Deviation from those characteristic amounts may be an indication that ecosystem processes are not functioning as historically, and that ecosystem integrity is at risk. Only forested and woodland ERUs were analyzed.

Eight forest and woodland ERUs were analyzed for the plan area. Departure varied with ERU for all three characteristics. Departure generally trended toward more CWD and snags than in reference conditions. Snags in the 8-18 inch class were more abundant than reference for all ERUs. Snags in the greater than 18 inch class mostly exceeded reference conditions. For the Lincoln NF, risk to all ecosystems for the three combined characteristics is moderate. Current departure is primarily a function of natural disturbances and legacy conditions.

Ecological Status

Ecological status is the vegetative species diversity found in ecosystems. Integrated Landscape Assessment Project (ILAP) vegetation data was used to provide current conditions for ecological status. Reference conditions were developed for Terrestrial Ecological Survey (TES) map units based on vegetation analyses of sites considered to represent stable, diverse and functional ecosystems. Species cover values for both current and reference condition were summarized by genus for individual TES map units. Departure analysis was limited to only a few ERUs due to limited data availability. All ERUs analyzed were highly departed. High departure could arise from a change in species occurring in ERUs or in proportions of historically occurring species on the landscape. The Lincoln NF is at high risk for ecological status.

Vegetative Ground Cover

Vegetative ground cover is the combined percent cover of basal vegetation and litter. Ground cover departure may indicate some risk to the soil resource. Estimates of “natural” vegetative ground cover from the Terrestrial Ecosystem Survey provided reference conditions for the Forest. Current condition

comes from CNVSP plot data collected by the Forest since 2009. The current estimate reflects changes resulting from road construction or other development, concentrated recreation, management related ground disturbance, or legacy impacts from logging, grazing, etc.

Basal vegetation and litter were combined for both reference and current conditions. Departure values were mostly in the moderate range for ERUs where departure could be calculated. No ERUs were highly departed while PJG and PPF showed low departure.

Patch Size

Patch size plays a significant role in wildfire behavior and wildlife habitat use. Historic timber harvest and fire suppression are largely responsible for decreased fire frequency, increased fire severity, and an increase in closed canopies. Current landscape distribution of patches should resemble the distribution under reference conditions so as to best accommodate the varying preferences of all wildlife species and simultaneously mimic historic fire behavior.

Patch size is calculated based on the average of all patches of similar vegetation structure of an ERU that intersect the plan area. Patch size current conditions come from seral state proportion analysis. Reference conditions include ranges or individual values for an ERU from a synthesis of information provided in a number of sources. Departure from reference conditions indicate risk to the ecological integrity of the particular ERU.

For patch size, most ERUs on the Lincoln NF show high departure from reference conditions. Much of the departure might be explained in terms of relatively recent large scale disturbances including tree insect infestations and diseases, large wildfires, fire suppression, and increased tree growth in fire adapted forests and woodlands. In the absence of mechanisms to check encroachment, openings could be expected to become smaller. For woodlands and dry forested systems, larger patches than reference indicate more contiguous canopy, with associated elevated risks from uncharacteristic wildfire and insect/disease mortality. For both these systems, which represent the bulk of the ERUs, departure would likely remain the same or increase into the future.

Insect and Disease

Insect and disease damage and mortality to forest resources has been monitored through aerial detection surveys (ADS) on the Lincoln National Forest since 1996. The effects of insect and pathogenic infestations may not always result in mortality, but may limit forest growth, disrupt natural succession, alter fire regime, and increase the chances of mortality from other agents. The primary agents of mortality are bark beetles and engravers. Defoliators and other disease agents may cause damage that looks like mortality, and to a small extent create mortality, but more often increase vulnerability to primary mortality agents and fire events. Vulnerability to infestation is also enhanced by disturbance events such as wildfire or extended drought.

Mortality across the Forest was low (less than 400 acres/year) for most of the period from 1996-2010, with a small spike of just over 6,000 acres in 2003. A marked increase in mortality occurred in 2011, continuing through 2013, then dropping in 2014 and 2015. A recently released report shows 2016 mortality decreasing for the third straight year.

Mistletoes, both true and dwarf, are common on the Lincoln NF. The Lincoln NF has the highest level of infestation of all forests in the region, hypothesized to be due to the climatic regime of the Sacramento Mountains and the amount and timing of monsoonal rains.

White pine blister rust (WPBR) was first detected in the Southwestern Region in 1990 on the Lincoln NF, although it had probably been here since the 1970s. Climatic conditions on the Lincoln favor development of the rust during the monsoonal storms in the Sacramento and Capitan Mountains.

Overall Risk

Forested ERUs: The Lincoln NF has five forested ERUs: the SFF, MCW, MCD, PPF and PPE ERUs. Of the Lincoln NF's five forested ERUs, the MCW, MCD and SFF are moderately departed for seral state proportion, while PPF and PPE are highly departed. Modelling current management and disturbance regimes approximately 100 years into the future showed MCW and MCD remaining moderately departed while PPF improves slightly but remains highly departed. Most improvement is due to the growth of trees into larger size classes and succession of recently burned lands to forest. SFF was not modelled but is expected to improve as trees grow into larger size classes, in the absence of stand replacing disturbance. The trend for seral state also holds true for Fire Regime Condition Class (FRCC), which is dependent on seral state proportion as well as fire frequency and severity. FRCC departure is moderate for SFF, MCW and MCD and high for PPF. Fire severity has generally been moderately departed for SFF, MCD and PPF, but low for MCW, while fire frequency departure has been high for SFF, MCW, MCD and PPF. Fire severity may increase with anticipated climate change.

Snags in both the small and large size classes are generally highly departed and overabundant for all forested types except SFF which is lacking large snags. Coarse woody debris (CWD) is lacking in PPF, and overabundant in MCD, while MCW and SFF are not significantly departed. CWD recruitment will continue as snags fall to ground over time and, in the absence of fire, could contribute to increased surface fuel loadings.

Woodland ERUs: The Lincoln NF has four woodland ERUs: the PJO, PJG, PJC and JUG ERUs. All four are moderately departed for seral state proportion, a result of increased tree density across all types. Modelling current management and disturbance regimes indicate an improvement over time for the PJO, PJG and JUG ERUs, but PJC becomes more departed due to increased tree density. FRCC generally follows seral state departure, but fire frequency and severity vary among ERUs. PJG and PJO are experiencing more frequent, less severe fires while the JUG and PJC ERUs are experiencing less frequent, more severe fires than historically. Coarse wood (CWD), and snags were mostly highly and moderately departed for the PJO, PJG and PJC ERUs, with only large snags not significantly departed for the PJG ERU. Patch size is highly departed for the PJO, JUG and PJG ERUs, due to woody vegetation closing openings in the woodlands. Ecological status is highly departed for the PJO and PJG ERUs, primarily due to the shift in vegetative cover from more open grassy savannah to more closed canopy woodland.

Shrubland ERUs: The Lincoln NF has three shrubland ERUs: GAMB, MMS, and CDS. The GAMB and MMS are highly and moderately departed, respectively, for seral state proportion due to high tree densities. The CDS is not significantly departed. FRCC was not calculated for GAMB or CDS but follows seral state proportion. Only MMS was modelled into the future. Departure decreased with a reduction in closed tree states and an increase in open shrub states. Patch size is highly departed for CDS and MMS, with closed tree/shrub patches getting larger, and grass and forb openings getting smaller.

Grassland ERUs: The Lincoln NF has two grassland ERUs: MSG and SDG. Both are highly departed for seral state proportion, a result of encroaching woody vegetation. Conifer encroachment in the higher altitude MSG is primarily attributed to the lack of fire to reduce regeneration, while shrub and cactus encroachment into the lower elevation SDG may be due to historic grazing practices as well as lowering water tables favoring shrubs over grasses. Modelling MSG shows some improvement over time with a reduction in trees and an increase in grassland, but departure will always be at least moderate as native grasses have been replaced by non-natives such as Kentucky bluegrass over much of the ERU. SDG remains highly departed when modelled as woody vegetation increases. FRCC follows seral state proportion, and fire frequency and severity are highly departed for both ERUs with decreased frequency and increased severity. Patch size and ecological status are highly departed for both ERUs as open

grassland patches become smaller with increasing woody vegetation, and species composition shifts from grass dominated to woody plant cover, as well as a shift from native to non-native grasses.

Riparian Vegetation

Riparian areas are where ecosystems develop from the influence of water, along streams, lakes, springs and other waterbodies. On the Lincoln NF, riparian areas are generally very small with little transition to upland ecosystems. Many perennial streams on the Forest may have subsurface stretches where the ‘riparian area’ may look similar to, and respond to disturbances similarly to, the adjacent upland types. While changes in condition may be a function of normal processes following disturbance, other changes leading to vegetation type conversion may indicate management concerns or shifting climate. This may highlight a threat to the sustainability of the riparian ecosystem, as well as the ecological structure of the Lincoln NF as a whole. Much of the riparian vegetation within the Lincoln NF boundary is in headwater systems and many of the main watercourses are on private land.

Riparian ERU delineations on the Forest were based on the Regional Riparian Mapping Project (RMAP). The Lincoln NF contains 15 riparian ERUs in five groups that make-up approximately 0.3 percent of the Forest (Table 2).

Table 2. Riparian ERU acres for Lincoln NF and the context area

Riparian ERU Group	Riparian ERU	Context Area Acres	Context Acres %	Lincoln NF Acres	Lincoln NF Acres %	Lincoln % Context Area
CWG	Cottonwood / Hackberry	62	0.000	41	0.004	66%
CWG	Fremont Cottonwood / Shrub	102,179	0.309	218	0.020	0%
CWG	Narrowleaf Cottonwood / Shrub	2,105	0.006	64	0.006	3%
CWG	Rio Grande Cottonwood / Shrub	29,791	0.090	47	0.004	0%
DWG	Desert Willow	11,296	0.034	71	0.007	1%
DWG	Little Walnut / Desert Willow	364	0.001	325	0.030	89%
MCWG	Arizona Alder - Willow	511	0.002	46	0.004	9%
MCWG	Ponderosa Pine / Willow	1,076	0.003	298	0.027	28%
MCWG	Upper Montane Conifer / Willow	407	0.001	202	0.018	50%
MCWG	Willow - Thinleaf Alder	1,586	0.005	48	0.004	3%
WEG	Arizona Walnut	750	0.002	24	0.002	3%
WEG	Little Walnut - Chinkapin Oak	325	0.001	301	0.028	93%
WEG	Little Walnut - Ponderosa Pine	888	0.003	695	0.064	78%
WET	Herbaceous Wetland	115,294	0.348	435	0.040	0%

Percentages of land area in riparian ERUs are low for the Lincoln NF as well as the surrounding landscapes. Cottonwood/Hackberry, Little Walnut-Chinquapin Oak, Upper Montane Conifer/Willow, Little Walnut/Desert Willow, and Little Walnut-Ponderosa Pine ERUs show a higher occurrence (50 percent or greater) on the Lincoln NF relative to off-forest. The Little Walnut-Chinquapin Oak, Little Walnut/Desert Willow, and Little Walnut-Ponderosa Pine ERUs are found only in the Guadalupe Ranger District and adjacent lands. The Lincoln NF has roughly half the Upper Montane Conifer/Willow in the larger context area while Ponderosa Pine/Willow on the Lincoln NF makes up 28 percent of that ERU in the larger area.

Key ecosystem characteristics were analyzed for the Lincoln NF as data was available. Key ecosystem characteristics for riparian vegetation (ERUs) analyzed in this chapter include: seral state proportion; fire frequency; fire severity; fire regime condition class (FRCC); and proper functioning condition (PFC).

Seral State

Seral state proportion departure was calculated for riparian ERU groups in the same manner as for terrestrial vegetation seral state proportion. Departure was moderate for the WET, DWG, and MCWG groups, and low for CWG and WEG. The DWG has more in early seral and closed shrub/small to medium tree states, and lacking in open forest and shrub states and late seral closed large tree states. MCWG lacks early seral, and is over represented in shrub and tree state. WET is lacking in early seral proportion.

Fire Regime

The CWG ERUs were nearly all highly departed for fire rotation and severity with the exception of Rio Grande Cottonwood/Shrub which is only moderately departed for rotation. FRCC was moderate for the CWG as a group and for the individual ERUs. The DWG ERUs were also mostly moderately departed for FRCC, with the Desert Willow ERU highly departed for both rotation and severity, while the Little Walnut/Desert Willow ERU was not significantly departed for fire rotation and moderately departed for fire severity. ERUs in the MCWG group except Ponderosa Pine/Willow were highly departed for fire rotation. The Ponderosa Pine/Willow and Upper Montane Conifer/Willow ERUs are highly departed for fire severity, while departure for the Arizona Alder/Willow and Willow-Thinleaf Alder ERUs were not significant. FRCC was mostly moderate for the MCWG group, although the Upper Montane Conifer/Willow ERU had more than half in the highly departed FRCC. In the WEG group, Little Walnut-Chinquapin Oak was not significantly departed for fire rotation, severity, or FRCC, while the Little Walnut-Ponderosa Pine ERU is moderately departed for rotation and FRCC, and highly departed for fire severity. WET was moderately departed for all three measures.

Proper Functioning Condition Class

Proper Functioning Condition (PFC) is an assessment using a consistent approach for considering hydrology, vegetation, and erosion/deposition (soil) attributes and how well the physical processes are functioning. PFC rating categories are: Proper Functioning Condition (PFC); Functional-At Risk (FAR); and Nonfunctional (NON).

A number of factors identified as contributing to PFC are assessed to determine a PFC rating. Although the formal checklist was not used for most reaches in this assessment, the same hydrological, vegetation, and erosion/deposition (soil) factors guide the general determination of functionality of the riverine systems assessed.

There are approximately 174 miles of perennial streams on the three Ranger Districts of the Lincoln NF. Values for each watershed are composite estimates from resource specialists and PFC assessments done by private contractors. PFC for the Lincoln NF was calculated as the mean of the watershed values. No

weighting by area was done. As an estimate of PFC, the Lincoln NF is approximately 48 percent in proper functioning condition, 34 percent functioning at risk, and 18 percent non-functioning.

Data needs include more PFC assessments on the Forest. Currently, assessments are done in response to some specific management need, such as reviewing a grazing allotment management plan. PFC assessments at key locations that are representative of a watershed or sub-watershed and conducted on a systematic and repeatable basis would allow for more accurate monitoring of trends.

Overall Risk

The CWG shows low departure for seral state proportion at the plan scale. Currently, upland dominance types and exotic vegetation differ little from reference condition, and late seral stage with native trees having more than 25 percent cover is only slightly less than reference. Currently the early developmental stage of sparsely vegetated, recently burned, or otherwise low shrub or tree cover, is nearly twice as abundant on the landscape as in reference condition, while the mid-developmental state of native trees and shrubs is only half that of reference values. Grazing and recreation are the only managed activities occurring in this ERU. While overgrazing could have impacted recruitment of trees or shrubs post disturbance, it is more likely that recent fire and flood events are the source of departure. Only about 370 acres of this group occur on the Forest.

At the plan scale, the CWG ERUs were nearly all highly departed for fire rotation and severity with the exception of Rio Grande Cottonwood/Shrub which is only moderately departed for fire rotation. FRCC was predominately moderate for the CWG as a group and for the individual ERUs. At the local scale individual ERUs in CWG had fire rotations ranging from 11 to 442 years, and fire severity from 13 to 78 percent. Fire appears to return relatively frequently, but with high severity. This may relate to CWG being somewhat departed for seral state, with the early seral state dominating. Fire regime condition class is moderately departed in general for the group, more due to fire rotation and severity departure than seral state which is not significantly departed. High severity fires in the recent past may account for the current amount of early seral state, nearly double the reference value.

The DWG is moderately departed at the plan scale for seral state proportion. Upland dominance types and exotic vegetation differ little from reference condition, and late seral stage of native trees is only slightly less than reference. Mid and late-seral open states are much less abundant than reference conditions while early seral and mid-seral closed states are much more abundant than reference. Grazing and recreation are the only managed activities occurring in this ERU. Approximately 396 acres of this group occur on the Forest.

Fire regime is moderately departed for the DWG of riparian ERUs at the plan scale. The DWG ERUs were mostly moderately departed for FRCC, with the Desert Willow ERU highly departed for both fire rotation and fire severity, while the Little Walnut/Desert Willow ERU was not significantly departed for fire rotation and moderately departed for fire severity. Fire severity and fire rotation is highly departed for the Desert Willow ERU, while fire regime condition class is moderate. The Little Walnut/Desert Willow ERU has low departure in the Upper Pecos North local unit but is highly departed in the Upper Pecos South unit, even though they show the same mean fire rotation. This is a function of assuming the adjacent upland ERU fire regime for determining local departure. Fire severity departure is low for the Little Walnut/Desert Willow ERU in both local units, although severity differs greatly, again from assuming local upland fire regimes. Fire regime condition class is moderately departed in general for the group, a function of seral state departure. The DWG group was moderately departed for seral state departure, with the shrubby-small tree closed state over-represented. Depending on the adjacent upland ERUs, fire may not occur often or carry from the upland into riparian, but seral state departure in DWG may provide the potential for higher severity fires.

MCWG is moderately departed at the plan scale for seral state proportion. Upland dominance types and exotic vegetation is more abundant than reference although still low, but the mid-development stage is much more abundant than reference. Conversely, the early seral state is much less abundant than reference. The ERUs that make up this type span much of the elevational gradient within a number of upland ERUs of the forest, so it is possible that fire suppression may have the effect of maintaining closed tree and shrub states without resetting to early seral states. Approximately 296 acres of this group occur on the Forest.

All ERUs in MCWG were highly departed for fire rotation except Ponderosa Pine/Willow, which was not significantly departed. The Ponderosa Pine/Willow and Upper Montane Conifer/Willow ERUs are highly departed for fire severity, while departure for the Arizona Alder/Willow and Willow-Thinleaf Alder ERUs is not significant. FRCC is mostly in moderate for the MCWG group, although more than half the Upper Montane Conifer/Willow ERU is in the highly departed FRCC. The four individual ERUs that make up the group range from 20 to 682 years for fire rotation and from 13-21 percent fire severity. None of the individual ERUs have high departure values for fire severity. At the Local scale, the Willow-Thinleaf Alder ERU in Rio Ruidoso has the highest fire rotation of 682 years, while the Upper Montane Conifer/Willow in Reventon Draw has the shortest at 20 years. This may be reflective of the fire regimes in the adjacent upland ERUs, and recent fire history on the Forest.

WEG shows low departure from reference condition. Upland dominance types and exotic vegetation differ little from reference condition, and late seral stage of native trees is only slightly more than reference. Currently the early developmental stage of sparsely vegetated, recently burned, or otherwise low shrub or tree cover, is nearly twice as abundant on the landscape as in reference condition, while the mid-developmental state, of native trees and shrubs is only half that of reference values. Approximately 1,319 acres of this group occur on the Forest.

In WEG, Little Walnut-Chinquapin Oak is not significantly departed for fire rotation, severity or FRCC, while the Little Walnut-Ponderosa Pine ERU is moderately departed for fire rotation and FRCC, and highly departed for fire severity. Of the three individual ERUs in the group, two occur only in the Guadalupe Mountains. The third, Arizona Walnut, had no acres burned in the time period 1996-2015. Fire rotation and severity are probably reflective of adjacent upland ERU fire behavior.

The Wetland ERU is moderately departed at the plan scale for seral state proportion. A large proportion of the ERU is in the Upland Dominance type/exotic vegetation, implying either a shift in vegetation to either upland or non-native grasses, or perhaps encroachment from adjacent upland vegetation types, perhaps due to falling water tables. There have been no inventories of riparian wetland vegetation, but anecdotal evidence suggests that native wet sedges and grasses have been replaced with non-native forage grasses. Relatively no early seral or post disturbance vegetation exists currently compared to a reference of 15 percent, and mid development herbaceous and shrub states is much less currently than in reference condition. Grazing is the only managed activity occurring in this ERU. Approximately 435 acres occur on the Forest.

The Wetland ERU is moderately departed for fire rotation interval, severity and FRCC. Fire rotation intervals appear to be much less than in reference, while severity was greater. Fire regime condition class was 100 percent in condition class II for the plan area, as well as for the two local units where the ERU occurs.

Soils

The primary ecosystem characteristics, soil condition and soil erosion hazard, are directly linked to the ability of the soil to withstand disturbances from management activities and natural events while maintaining site productivity and sustainability of the soil resource.

The Forest has experienced several recent years of drought with occasional normal levels of seasonal moisture. Reduced precipitation results in reduced vegetative growth, reduced surface organic matter and nutrient cycling and lower site productivity. Ineffective vegetative ground cover puts the soil at risk of accelerated erosion during peak storm events and subsequent erosion and loss of soil productivity. As the potential for vegetation mortality increases, there is an increased risk of wildfire spread and subsequent accelerated erosion resulting in overall watershed degradation.

ERUs are assigned a soil condition category, satisfactory, impaired, or unsatisfactory, which is an indication of the status of soil functions. Most areas that are currently unsatisfactory for soil condition probably would have had satisfactory soil condition historically.

Approximately 67 percent of the Lincoln NF is in satisfactory soil condition. More than half of the upland ERUs have satisfactory soil conditions. These include SFF, MCW, MCD, PPF, PPE, PJC, PJO, GAMB, MSG, SDG, and CDS. Approximately 33 percent of the Lincoln NF is in impaired and unsatisfactory soil condition. The Piñon-Juniper ERUs have portions of the ERU that are impaired and unsatisfactory soil condition due to high amounts of bare soil from drought, grazing, and dense overstory due to lack of fire. These individual ERUs include JUG, PJG, and MMS. The loss of soil productivity (unsatisfactory soil condition) through a reduction in soil function is due to a lack of effective vegetative ground cover and organic matter.

Across the Lincoln NF, JUG and PJC have high departure. Erosion is visible in these ERUs in the way of gully erosion, deposition, pedestalling of grasses, bare soil, and compaction. MSG, SDG, and PPE ERUs have a moderate departure. These areas are experiencing the same visible erosion indicators but with a lesser degree of departure. The remaining ERUs have low departure overall, however there are areas within those ERUs that are experiencing moderate to high departure on a more site specific bases.

Eight of the ERUs have a stable trend, these include SFF, MCW, MCD, PPF, PJC, PJO, GAMB, and CDG. These ERUs have less than 24 percent of unsatisfactory soil conditions. The remaining 7 ERUs have 25 percent or more unsatisfactory soil conditions thus are trending away from reference conditions.

Four out of the 14 ERUs analyzed on the Lincoln NF are considered to be at high risk for soil condition. They are PPE, JUG, PJG, and MSG. A high risk rating indicates that these ERUs are moving away from reference conditions. Lower elevation ERUs, such as SDG, and MMS received a moderate risk rating. These areas have effects from historical grazing and management.

PPE, PJC, and PJG ERUs are significantly departed and have unsustainable levels of soil loss to sustain inherent site productivity. The remaining ERUs analyzed on the Lincoln NF have current soil loss rates that do not exceed threshold soil loss rates and are considered low in departure. All of the ERUs analyzed on the Lincoln NF have current soil loss rates that exceed natural soil loss rates.

Slopes over 40 percent are considered inherently unstable and have been excluded from mechanical vegetation treatments on the Forest. Approximately 68 percent of the Forest occurs on slopes over 40 percent. All ERUs contain areas with slopes of over 40 percent, but the SFF ERU has the largest area.

The PPE ERU has a significant departure due to high and moderate burn severities. These areas have experienced slow recovery of vegetative ground cover and loss of soil site productivity.

PPE, PJC, and JUG ERUs are trending away from reference soil loss conditions. The vegetative groundcover is uneven in the current conditions as indicated by higher percentages of bare soils.

Although the remaining ERUs are not significantly departed overall, there are areas that are experiencing accelerated soil loss. Of those areas, 5 percent have exceeded the threshold soil loss rate.

JUG, PJG, GAMB, MSG, MMS, and CDG ERUs have a slight erosion hazard rating. In the grassland, shrubland, and woodland ERUs, the slight erosion hazard rating is typically associated with lower slope gradients and more level landforms.

ERUs that have 50 percent or greater combined of moderate and severe erosion hazard class are SFF, MCW, MCD, PPF, PPE, PJC, PJO, and SDG. The moderate and severe erosion hazard class indicates a high probability that accelerated erosion would occur if erosion control measures are not addressed or when natural or management induced disturbances occur.

PPE is the one upland ERU that has 50 percent or greater for severe erosion hazard.

Water Resources

This analysis includes an evaluation of current and historic (where possible) water resources, disturbances and processes, trends and projected future conditions, and an evaluation of ecosystem risks with the objective of identifying specific ecological needs for change in the forest plan.

Spatial Scales for Water Resources

Watersheds are defined by the extent of the topographic area that drains to a single point in a stream or river system. The United States is divided and subdivided into successively smaller hydrologic units (watersheds). Watersheds are defined by using the Hydrologic Unit Code (HUC) level watershed classification. The hydrologic units are nested within each other and range from the largest (regions) to the smallest (sub-watersheds).

This analysis uses sub-basins for the broadest scale of assessment and sub-watersheds for the finest scale. Fourth-level (sub-basin-level) and 5th-level (watershed-level) hydrologic unit codes are used for the context area assessment and 5th- and 6th-level (sub-watershed-level) hydrologic unit codes are used for the assessment at the planning unit scale (within the national forest boundary). There are 34 fifth-level watersheds 122 fourth-level sub-watersheds that lie partly or entirely within the Lincoln National Forest. The following figures display the scales of analysis used for the watershed assessment.

The plan area is located within portions of 34 watersheds and 122 sub-watersheds. The Lincoln National Forest contains 174 miles of perennial streams within 32 of these watersheds. The majority of the watersheds on the Lincoln NF contain streams that eventually drain to the Pecos River east of the Forest. The influence of these watersheds on the ecological sustainability of the Pecos River system are diminished as a result of the presence of dams and reservoirs within or adjacent to the Forest, which control water discharge off the Forest. Groundwater and surface water originating from the Forest are used for drinking water, waste disposal, livestock and agricultural uses, industry, recreation, and wildlife.

Risk Assessment and Analysis

Risk assessments for perennial streams and springs are based on an analysis of representativeness and redundancy. Representativeness is evaluated by assessing whether an ecosystem characteristic is under or over-represented within the forest by examining the proportional occurrence of an ecosystem characteristic at the forest compared to the larger scale (context scale/sub-basin). Redundancy is used to describe the risk of losing an ecosystem characteristic on the forest following a single disturbance. This is based on the premise that if the ecosystem characteristic is in multiple places across the landscape (high redundancy) then the loss or elimination of this characteristic is low following a single disturbance event. The combination of these two indices are used to describe the overall risk of losing an ecosystem characteristic on the forest.

Perennial Streams

The entirety of the Rio Peñasco and Agua Chiquita are impaired. Four out of the five watersheds in the Rio Peñasco Sub-basin with perennial streams are at high risk. These are all along the Rio Peñasco and Agua Chiquita. The Rio Peñasco flows east with its headwaters being on the Lincoln National Forest along Sunspot Highway and its confluence with the Pecos River over 100 miles downstream, however, many of the stream miles run through private land and then flows outside the boundary of the Forest.

The Rio Hondo Sub-basin has the next highest number of impaired stream miles (96.93) contained within three watersheds. Impairments include e-coli, nutrients, temperature, turbidity, and low flow alterations. The Rio Ruidoso, which drains east, has approximately 60 miles of impaired stream. It flows into the Rio Hondo, which continues to flow east. Most of these sections of stream are surrounded by the Lincoln National Forest but are on private land. Almost 13 miles of the mainstem of the upper part of the Rio Bonita is impaired for e-coli. The uppermost portion at the headwaters is on the Lincoln National Forest but further downstream much of the stream is on private inholdings that are surrounded by the Forest.

In the Tularosa Sub-basin there are four watersheds that contain almost 35 miles of impaired streams. These impairments include E. coli, temperature, and sedimentation/siltation. Most of these impaired stream sections run through private inholdings with very few sections of stream being on the Forest. Other small sections of stream in this sub-basin are impaired with low flow alterations, temperature, and e-coli.

In the Upper Pecos-Black Sub-basin, all of the stream miles are impaired with PCB or DDT in fish tissue. Although these watersheds are in the context area, they are spatially far removed from the Lincoln National Forest and the impacts from the Forest are either absent or extremely minimal. The greatest concentrations of points of diversion of all types are in the population centers on the west side of the Sacramento Mountains and around Carlsbad. Concentrations are also found around Roswell and in the municipalities in the vicinity of the Smokey Bear Ranger District of the Lincoln National Forest.

Springs

There are 501 springs within the plan area. The sub-watersheds that have high or moderate-high risk ratings are evenly distributed throughout the Forest. Overall, 17 of 62 spring sites inventoried were rated as “undisturbed”, 16 as “slight”, 21 as “moderate”, and 5 as “high”. Three springs were not given a rating or the rating was not recorded. Major factors that lead to moderate and high ratings are spring developments, diversion structures and livestock (domestic and feral) disturbances. Trends are stable since the number of spring developments are not expected to increase substantially.

Groundwater

Groundwater basins that overlap the plan area include the Tularosa, Hondo, Peñasco, Salt, Roswell Artesian, and Carlsbad Basins. Although some basins only have a small amount of land within the plan area, these areas provide a substantial amount of recharge for the basin and provide a substantial benefit as drinking water, as well as for agricultural, and industrial uses in the area surrounding the Forest. Changing precipitation patterns may inhibit recharge of the many aquifers within these basins. Under the current management scenario trends for ground water conditions would be site specific and variable, with some local areas moving upwards and some downwards.

Water Withdrawals

Water withdrawals through surface water diversions and groundwater pumping exceed the natural range of variation.

The Lincoln National Forest has a number of permits that are state appropriative uses, meaning the Forest has applied for water rights through the Office of the State Engineer to put the water to beneficial use. These uses include administrative, domestic, fire suppression, recreation, livestock watering, fish game propagation, irrigation, and mining of which the highest use is livestock watering.

Watershed and Sub-watershed Condition

Watersheds are analyzed for proper functioning condition. In the plan area, seven sub-watersheds are functioning properly, 78 sub-watersheds are functioning at risk, and 18 are impaired. Of these sub-watersheds, only three have low to moderate/low risk and seven are assigned a moderate risk rating. Twenty-two of these sub-watersheds are assigned moderate/high to high risk ratings. A majority of the sub-watersheds in the plan area do not have any perennial streams. All of these perennial streams lie within sub-watersheds that have been identified as being at high risk or high/moderate risk. The Rio Hondo and Rio Peñasco Sub-basins have the greatest number of high and moderate/high risk ratings. The Rio Ruidoso and Rio Bonito Watersheds have the highest risk due to the lack of distribution of perennial streams and the low representativeness of perennial streams within the respective sub-watersheds compared to the amount of land managed by the Lincoln National Forest within the sub-watershed. All watersheds within the Rio Peñasco Sub-basin are at either high or moderate/high risk.

Air Resources

The assessment defines the relevant airshed as the area within 300 kilometers (186.4 miles) of the Lincoln NF. Although the Lincoln NF occurs across four counties in New Mexico, the Lincoln airshed covers most of New Mexico, plus all, or portions of, 36 counties in southwest Texas and part of the State of Chihuahua in Mexico.

New Mexico Ambient Air Quality Standards (NMAAQs) include standards for total suspended particulate matter (TSP), hydrogen sulfide and total reduced sulfur for which there are no national standards. Currently, the plan area meets all national and New Mexico ambient air quality standards.

Generally, for most pollutants (CO, NO_x, SO₂, and VOCs) in the Lincoln airshed, mobile source emissions are decreasing. However, these improvements are largely negated by increases in emissions from oil and gas production in the Permian Basin and point sources in Mexico. Trend analysis for carbon monoxide (CO) and nitrogen oxide (NO_x) shows a projected decrease in emissions through 2025 for the Lincoln airshed. Sulfur oxide (SO₂) emissions are expected to increase in the Lincoln airshed. Volatile organic compound (VOC) emissions in the Lincoln airshed are dominated by oil and gas area emission sources primarily from Texas. Total VOC emissions in the Lincoln airshed are projected to increase through 2025. Particulate emissions, both coarse particulate matter (CPM) and fine particulate matter (FPM), are expected to increase slightly across the Lincoln airshed through 2025 by approximately 14 percent.

Air quality and the ecosystem services provided by air are generally stable but are at moderate risk based on current conditions and trends for air quality measures on the Lincoln NF. A moderate risk to air quality exists due to a decreasing trend in pollutants of concern including sulfur dioxide, coarse particulate matter, and ozone; an exceedance in nitrogen for critical loads for lichen species; fairly stable visibility over the last 10 years; and air quality within regulatory levels for National Ambient Air Quality Standards (NAAQS), although the trend based on projected emission inventories is of concern for ozone, coarse particle pollution, and sulfur dioxide.

Overall, air quality and the values dependent on air quality on the Lincoln NF are generally in good condition or are improving as most pollutants are decreasing; however, visibility and ambient air quality conditions associated with particulate matter are expected to continue to have episodic periods of very

high levels—as a result of wildfires and increases in fugitive dust due to the effects of climate change. Also, impacts from emissions along the US-Mexico border are a significant concern and also an area of significant uncertainty in terms of the magnitude and subsequent impacts. Lastly, modeled critical loads from nitrogen deposition are insufficient to assess the full range of possible impacts to the ecosystems potentially affected.

Carbon Stocks

Carbon stocks are the amount of carbon stored in vegetation and soils. The emission of greenhouse gases by human activities and natural processes contribute to the warming of the Earth's climate.

In 2005, U.S. forests were estimated to be sequestering nearly 220.5 million tons of carbon, suggesting that forests and woodlands of the Southwest could have a significant role to play in the sequestration of carbon and climate change mitigation. There are other components (for example forest products) that would provide a more complete picture of carbon stock and flux, but for strategic purposes of forest planning the following components are readily assessed: biomass, carbon emissions, and soil organic carbon.

Biomass (vegetative carbon) serves as an integral component in forest carbon cycles. Forest vegetation, through the process of photosynthesis, converts atmospheric carbon dioxide to carbohydrates (referred to as carbon fixation). The primary influences on biomass carbon stock are plant growth (primary productivity) which serves to increase biomass carbon stock, decay and decomposition which slowly decreases biomass carbon stock, and disturbance in the form of fire and harvest. The overarching pattern of biomass carbon stock projections on the Lincoln NF indicates an increase in total carbon storage above current conditions in most modeled ERUs, with an overall increase of 23 percent (just over 5.5M tons). This translates to an increase beyond reference condition levels across the Lincoln NF. The greatest proportional increases in biomass carbon stocks are predicted to occur in the woodland systems, with biomass carbon greater than doubling in JUG and PJG, and increasing by over 60% in PJC and PJO over the 100 year projection period. Smaller changes from current condition are predicted in the grassland, shrubland and forest ERUs, ranging from a 6 percent reduction in biomass carbon in MMS to a 30 percent increase in PPF.

Currently there are no binding commitments by the federal government to regulate carbon emissions (carbon dioxide), though there has been increasing activity at local levels to control carbon emissions. The best way to manage carbon stocks and emissions on national forest land was investigated by the nearby Apache-Sitgreaves National Forest. In their study it was found that taking no action to reduce emissions or increase carbon stock resulted in the lowest total carbon emissions; alternatives with management action produced five times more carbon emissions. However, carbon emissions by wildfire (the largest contributor to emissions on the Lincoln National Forest) was lowest in the treatment alternatives (thinning), than in the no-action alternative.

Soil organic carbon (SOC) is the energy source for soil organisms which, through their activity and interactions with mineral matter, impart the structure to soil that affects its stability and capacity to provide water, air, and nutrients to plant roots. The current trend of sustaining SOC is strongly influenced by vegetation growth and by activities that remove biomass; including climatic factors that influence the rates of weathering and decomposition of above- and belowground biomass. Given the projection that biomass carbon will potentially increase into the future, it is logical to assume that SOC will remain the same, or potentially increase, under current rates of decomposition.

At-Risk Species

The 2012 Planning Rule requires the Forest Service to assess the Forest's at-risk species. There are two categories of at risk species. At-risk species include those recognized under the Endangered Species Act (ESA) as endangered, threatened, proposed or candidate, plus species of conservation concern (SCC) designated by the Regional Forester. An SCC is a species, other than ESA endangered, threatened, proposed and candidate, that is known to occur in the plan area and for which the Regional Forester of the Southwest Region has determined substantial concern about its capability to persist over the long-term in the plan area. The 2012 Planning Rule provides direction for the process of identifying and assessing potential SCC.

We found 259 species (excluding ESA-listed species) to be associated with at least one of the four counties that encompass Lincoln NF and to meet an initial criteria for consideration as potential SCC. On the Forest, 171 of those species were found to occur. Of those, 122 did not have information to indicate substantial risk of extirpation on the Forest. The remaining 49 species will be carried forward as proposed SCC for the Lincoln NF. With 49 proposed SCC and 9 ESA-listed species, the total number of proposed at-risk species for Lincoln NF is 58. More than half are flowering plants. There are no amphibians or reptiles proposed.

Each at-risk species was ascribed to particular ecological response units (ERUs), special habitat features, water resources, and threats. The highest numbers of proposed at-risk species were associated with the Ponderosa Pine ERU. The proportion of all proposed at risk species that use Ponderosa Pine was 50 percent, followed closely by Mixed Conifer (47), and then by Piñon-Juniper (40), Riparian ERUs (29), Spruce Fir (28), Chihuahuan Desert Scrub (22), Mountain Mahogany Mixed Shrubland (19), Juniper Grassland (19), Semi-Desert Grassland (16), and Montane Subalpine Grassland (7).

Most (43) of the species are associated with Aquatic, Wet, or relatively Moist microenvironments and habitats, with 15 attributed to Dry environments. Regarding landform type, the largest number of species (12) were associated with canyon bottoms, streamsides, and lower slopes. Combined, aquatic, meadows, marshes, springs, riparian, canyon bottoms, streamsides, and lower slopes were attributed to 24 of the 58 species. The Basin/lower slope landscape setting was attributed to 26 species, and 5 were attributed to prominently inhabiting both basin/lower slope and upland settings. Upland was attributed to 27 species.

Threats most frequently attributed to at-risk species were related to fire regime modification issues (47 percent of species), followed by grazing issues (31 percent), climate change/severe weather (31 percent), recreation/military/work disturbance (29 percent), hydrological modifications (24 percent), and invasive/problematic species (22 percent). The number of threats per species was particularly high in Cave, Meadow, Spring, Montane Subalpine Grassland, and Aquatic associated species, and fewest for Rock associated species.

Volume II – Social, Cultural, and Economic Conditions

Volume II of the Lincoln National Forest (NF) Assessment discusses the ways in which humans interact with and use the Lincoln NF (e.g., recreation, roads, wood products, scenery), including current conditions, trends, and the ability of the Lincoln NF to continue to support these uses into the future. The area has a long history of human occupation that precedes the establishment of the Lincoln NF. Native Americans, Hispanic, and Anglo-American traditional communities have in the past and continue to use the Forest for economic, social and cultural purposes. Communities served by the Lincoln NF, as well as visitors, hold expectations as to what the Lincoln NF can offer them in terms of livelihoods, traditional uses, clean air and water, forest products, and recreation.

Volume I covered the ecological functions of the Lincoln NF, including vegetation, fish and wildlife, soils, water, and air. The human uses of the forest rely on the continued healthy functions of the systems in Volume I. Because of that dependence, the risks noted in Volume I will also apply to the future sustainability of human uses of the forest.

Area of Influence

The Counties immediately surrounding the forest include Chavez, Eddy, Lincoln and Otero Counties. The area covered by these four counties represents the area where activities supported by Forest Service land management such as timber, range, and recreation, most directly occur. This is referred to as the area of influence. Together, these counties contain approximately 11 percent of the population of New Mexico. In 2010, the average population density was 9 people per square mile on average, which was about 60 percent of the state's average.

Social and Economic Conditions

Population Characteristics

Population trends for race and ethnicity vary by the counties served by the Lincoln National Forest. Although the ethnic composition of Chaves and Eddy Counties are overall quite similar to the whole of New Mexico, Lincoln and Otero Counties have fewer Hispanics and Latinos (30 and 35 percent in 2010) than the overall population of New Mexico (46 percent in 2010). Hispanic or Latino populations have increased in the area of influence over the past three decades, and this is a trend that is expected to continue. The only exception to this trend occurred in Lincoln County between 1990 and 2000, when the population exhibited a marked increase in the number of non-Hispanic retirees.

There has been a trend of higher education attainment of residents throughout New Mexico, including the four counties within the Lincoln NF area of influence. This trend is expected to continue. This is important in that educational attainment is closely tied to one's ability to generate income.

Economy

Communities adjacent to public lands can benefit economically from visitors who spend money on items such as hotels, restaurants, ski resorts, and gift shops. In areas that have natural and social amenities and offer recreational opportunities, travel and tourism can significantly contribute to the local economy. However, travel and tourism industries often pay relatively low wages, and many of these jobs are part-time or seasonal.

Unemployment rates increased throughout the area during the Great Recession and continued to climb through 2010; however the rate of increase has slowed. Within the area of influence, employment increased by 89 percent between 1970 and 2015.

From 2001 to 2015, two of the three sectors that added new jobs were mining and construction, a part of the non-services industry; while the third was from the services related industry.

The three industry sectors with the largest number of total jobs in 2015 included the healthcare and social assistance sector, retail trade, and the government. The government has consistently provided a significant portion of jobs within the area of influence since 1970. On average, the government provides approximately 19 percent of total employment within the area of influence.

The distribution of household income has improved over time in these four counties. The portion of households with incomes of less than \$35,000 has declined, while the portion with incomes greater than \$50,000 has consistently increased. This trend is similar to that which has occurred across New Mexico, and is expected to continue. The portion of individuals living below poverty within the area of influence

has declined in Lincoln, Chavez, and Eddy Counties; the portion has increased in Otero County, based on 2006-2010 data.

Lincoln NF Economic Contributions to the Area of Influence

For over a century, communities have relied on the Lincoln NF as a source of sustenance. Many people that live within the area of influence have families who go back several generations, having supported themselves as ranchers, miners, or in the timber industry. Some of these uses may have included more cultural, historical, or traditional purposes such as hunting, fishing, gathering plants for food and medicinal uses, and firewood gathering.

Over the past few decades, uses of the Lincoln NF have shifted. Resource based industries such as mining, oil and gas extraction, ranching, and timber harvest have declined; amenity based activities such as recreation and residential development have emerged as the predominate use in and around the Lincoln NF. At present, the vast majority of visitors come to the Lincoln NF to engage in recreation activities.

The Forest continues to provide benefits that have been historically significant, as well as offering other more modern opportunities such as mountain bike trails.

The extraction and consumption of forest products (e.g., timber and livestock forage), recreation visitors, and forest expenditures (e.g., equipment and salaries) contribute to economic activity in the area of influence. Market transactions attributable to activities on the Lincoln NF support an estimated 991 jobs and \$31.5 million in labor income in the regional economy.

In looking at seven program areas influenced by Lincoln NF management, grazing and Forest Service expenditures contribute the most to employment in the regional economy. Although livestock grazing supports the most jobs, Forest Service expenditures contribute nearly double the income of that generated by livestock grazing.

Grazing, timber, oil and gas, and forest expenditures provide economic contributions; however, recreation and tourism contribute more than all of the other resource areas combined.

Lincoln NF also contributes to local counties through payments in lieu of taxes and the Secure Rural Schools program. This revenue sharing primarily helps fund schools and roads but in recent years has helped support Firewise Community programs; reimburse counties for emergency services on national forests; and helped fund the development of community wildfire protection plans. In the late 1980s, due largely to declines in timber sale receipts, payments to qualifying states began to drop significantly and fluctuate. Over the years since then Congress has responded by amending the act to stabilize payments to states.

Cultural and Historic Resources and Uses

Cultural Relationships

Human occupation of the areas in and around the Lincoln NF has spanned thousands of years. Although it is unclear when humans first inhabited the area that comprises the Lincoln NF, much of the Southwest was occupied by 10,000 B.C.

Riparian areas on the forest tend to be limited, but are associated with several rivers including the Rio Ruidoso, Rio Bonito, Rio Peñasco, and the Sacramento River, along with numerous streams and intermittent washes. Both prehistoric and historic properties occur in association with riparian areas. Historic Period properties tend to be farming and ranching related on the Smokey Bear and Sacramento Ranger Districts. Railroad grades in the Sacramento Mountains tend to follow drainages and sawmills are often located on the banks. Prehistoric sites are most often found in association with little walnut

ponderosa pine, little walnut chinkapin oak, and little walnut desert willow, all of which are found on the Guadalupe District. There is a substantial concern for the effect of erosion on washing away archaeological sites.

Four sites have been listed on the National Register of Historic Places, including: the Cloudcroft Trestle, the Bonito pipeline, the Wizard's Roost (a prehistoric solar observatory), and the Jicarilla Schoolhouse. This area is also famous for Smokey Bear, a cub burned in a fire in the Capitan Mountains in 1950 who was transported to a zoo in Washington D.C. and who became the living symbol of fire prevention. Smokey Bear is now buried at a museum in Capitan, N.M. There are numerous caves of national significance both on the Guadalupe and Smokey Bear Districts. Caves on the Lincoln NF provide unique and varied recreational opportunities ranging from first-time novice caving experiences to very experienced expedition-class cavers.

Wildland Urban Interface

The wildland urban interface (WUI) is the area commonly characterized as the transition zone where urban development intersects with private and public wildlands.

It is now common to have a large number of homes, second homes, and vacation homes bordering or surrounded by public lands in the western United States including lands adjacent to the Lincoln NF. While the degree of risk may vary from one place to another, given the right conditions, wildfire can affect people and their homes in almost any location where ignitable vegetation is found. Even structures not immediately adjacent to wildland vegetation are at risk of damage from fire, because embers can be transported by wind and ignite homes a mile or more ahead of the flame front. Furthermore, as more people live or work in the WUI, the costs to reduce fire risk, manage wildfires, and protect human lives and homes have risen sharply in recent decades. The Lincoln NF area of influence contains roughly 1/6th of New Mexico's wildland-urban interface, which is approximately 102 sq. miles. Nearly all of this WUI is within Lincoln and Otero Counties.

Defending homes from the risk of wildfire is a major cost for public land agencies, not only in terms of the billions of dollars spent each year but also the number wildland firefighter lives that are injured or killed. Otero and Lincoln Counties are ranked first and third in New Mexico (out of 33 counties), respectively, for the risk of wildfire on lands in the WUI. Homes in the WUI adjacent to the Lincoln NF were heavily impacted in the 2000s by large fires. The data show a significant increase in the number of structures lost from the 1990s to 2000s. In the 1990s, eleven structures were lost on the Burgett Fire in 1993, while 445 structures were lost in multiple large fires in the 2000s. This includes 80 structures that were lost on the Scott Able fire in 2000. The greatest number of structure lost was during the 2012 Little Bear fire where 254 structures burned.

This trend may be expected to continue or increase on the Lincoln NF as more and more people inhabit WUI areas, and warmer temperatures, less snow pack, and drier forests result in longer more intense fire seasons across the West. However, since the advent of the National Fire Plan in 2000, the purpose for implementing vegetation treatments has significantly expanded to include hazardous fuels reduction and restoration objectives. As a result, the number of acres treated has significantly increased within the last decade and the focus has shifted to protecting values at risk (both structures and other values like cultural sites) in or near the WUI.

The number of acres treated within the WUI in the 1990s was 26,510 acres and by the 2000s that number increased nearly four-fold to 100,422 acres. Furthermore, the Lincoln NF strives to engage other government agencies, non-government organizations and public stakeholders to collaboratively identify and engage in work to reduce risk in the WUI through concerted planning efforts (i.e. Community Wildfire Protection Plans) and vegetation treatments. Both the Smokey Bear and Sacramento Ranger

Districts have long-standing partnerships with the Greater Ruidoso Area and Otero County Working Groups, respectively, which have been actively engaged in the planning and implementation of vegetation treatments on the Forest. These groups include stakeholders from the Mescalero Tribe, other federal agencies, private contractors, educational institutions, as well as municipal, county, and state governments. In addition, the Lincoln NF works with private landowners to conduct fuels reduction treatments on their lands through the National Forest Lands (NFL) program.

Areas of Tribal Importance and Uses

The Lincoln National Forest (Forest) maintains a governmental relationship and routinely consults with three federally-recognized tribes based in New Mexico and Arizona: the Pueblo of Zuni, the Hopi Tribe, and the Mescalero Apache Tribe (MAT). The Lincoln NF consults with them on policy development, proposed plans, projects, programs, and Forest activities that have the potential to affect tribal interests or natural or cultural resources of importance to the tribes. The Lincoln NF developed a consultation program in the late 1990s and continues to build and enhance its working relationship with these tribes.

All three tribes have expressed some level of interest in the resources and management of the Forest and sometimes provide input to the Forest pursuant to Section 106 of the National Historic Preservation Act and the National Environmental Policy Act. These tribes recognize the lands managed by the Forest as part of their aboriginal or traditional use areas and acknowledge contemporary use of these lands for traditional cultural and religious activities.

Places and properties valued and used by the tribes for a variety of purposes have been identified on every unit of the Lincoln National Forest. Properties of cultural and religious significance can have traditional cultural or religious significance for a number of reasons. Some of these include locations with long-standing cultural use, locations of buried human remains repatriated under NAGPRA, locations where ceremonial objects have been retired, locations of contemporary ceremonies, and locations where specific forest products are gathered for ceremonial use.

The tribes consider all of these types of locations to be traditional cultural properties (TCPs). Some locations such as shrines, caves, springs, and resource collection areas have long-standing and ongoing historical, cultural, and religious significance. The Forest has formally documented three of these locations as traditional cultural properties, some of which have been determined eligible for the National Register. These consist of site-specific locations. Other locations remain minimally documented, but clearly meet the criteria of a TCP.

In addition to specific noted locations, entire mountain ranges are commonly regarded as sacred, and viewed as an integral part of a tribe's cultural landscape. Sierra Blanca, the Guadalupe Mountains, Three Sisters Mountain, and Oscura Mountain Peak represent the direction of everyday life for Apache people. The Capitan Mountains also have associated stories important to Apache culture. For more distant tribes, such as the Hopi and Zuni, which are currently based in Arizona and western New Mexico, some of these mountain ranges served as a distinctive landmark or way point to aid in travel.

Many tribes also rely on the Forest for products for personal, commercial and ceremonial use. Plants are used for food, medicine and items like cradle boards or brush structures. Piñon nuts are one example of a forest product commonly gathered for both personal and commercial use. The collection and sale of piñon nuts is important because tribal members may rely on the nuts for income. Firewood is another forest product that is widely collected by tribal members for personal and ceremonial use. This includes juniper, pinyon, oak, and ponderosa pine. There is also a heavy reliance on forest products for traditional and cultural purposes.

The Lincoln NF shares a common boundary with the Mescalero Apache Reservation. One of the vehicles used currently by the US Forest Service in ecosystem restoration is the Tribal Forest Protection Act of 2004 (Public Law 108-278) which allows tribes to propose projects on National Forest System lands to protect their own trust resources. The Tribal Forest Protection Act (TFPA) authorizes the secretaries of the USDA and USDI to give special consideration to tribally-proposed stewardship contracting or other projects on Forest Service or BLM land bordering or adjacent to Indian trust land to protect Indian trust resources from fire, disease, or other threats coming off of Forest Service or BLM land.

Another vehicle with which to accomplish ecosystem restoration is the Collaborative Forest Restoration Program (CFRP). Two collaborative forest restoration projects were funded through 2015, for collaboration and fuels treatments on the Lincoln NF and Mescalero Tribal lands. The other CFRP proposal is the Ruidoso WUI Interagency Fuel Reduction and Prescribed Fire Implementation Project. The CFRP project for thinning in Mexican Spotted Owl (MSO) Protected Activity Centers (PAC's), involves mechanical thinning on the Sacramento Ranger District and Mescalero Tribal lands.

The Reserved Treaty Rights Land (RTRL) program is another grant program that can be used to treat Forest land adjacent to reservations. The MAT and the Forest, in collaboration with the Bureau of Indian Affairs (BIA), have developed a five year plan that builds on the TFPA contract in 16 springs. The Smokey Bear Ranger District is working with the MAT to complete planning for a restoration project to remove fire killed trees at Ski Apache. The project will be funded under RTRL. The MAT operates the ski area under a Special Use Permit.

Multiple Uses

There are four types of multiple uses considered in this chapter, which include rangelands, timber/forest products, water, and fish, wildlife, and plants.

Rangeland

Livestock grazing has important economic and cultural value to communities surrounding the Lincoln NF. Many livestock operations rely heavily on the use of public lands to remain viable. Resource conditions are directly affected by stocking levels and range management practices.

Grazing permit holders own the livestock that graze the allotment and additional private property that serves as basis for the permit. The permits are held by individuals, families, partnerships and corporations. Nearly the entire Lincoln NF is either within an active, vacant or closed grazing allotment with a few exceptions such as administrative sites and designated watershed areas. Currently, the Lincoln is divided into 120 grazing allotments. There are 102 active allotments, meaning they have a current active permit issued to a permittee. One allotment is vacant (the permits were waived back to the forest without preference, and new permits have not been issued). Seventeen allotments were formally retired from grazing and are currently listed as closed. Some active allotments have entire pastures or areas that are in non-use for various reasons ranging from permittee personal convenience to fire or drought.

About 65 percent of the forest is classified as capable to sustain livestock grazing, with the remaining 35 percent classified as incapable for grazing activities due to steep slopes or because the herbaceous vegetation produced is insufficient to sustain livestock grazing. Factors affecting current grazing management and resource condition include increasing concerns with spread of invasive plant species, feral hog impacts, encroachment of woody vegetation, and drought. These factors all lead to reduced forage availability either in the short or long term.

Many stressors affect the long-term ability of national forests to sustain productivity of rangelands. Influences beyond the Forest include fractured ownership of private lands and legal uncertainties about

land titles, as well as Fish and Wildlife Service listing of the New Mexico Meadow Jumping Mouse as an endangered species, necessitating strict protections for its riparian habitat. Human vectors have introduced invasive species that out-compete nutritious forage. In the past 30 years, an average 11 percent decline in precipitation has necessitated adaptive management in numbers and timing of livestock.

One opportunity to help maintain forage on these lands are projects that reduce piñon juniper densities and increase grass production. Many such projects have been accomplished on the Lincoln NF through hazardous fuel reduction treatments, wildlife habitat improvements, and to improve range vegetation.

Timber

Timbered areas provide wildlife habitat, food, and browse for a variety of animal species and humans, and fiber in the form of lumber, paper, fuelwood, and biomass. Especially important to humans are the social and cultural ecosystem services that timber provides to society including a variety of wood products, Christmas trees, and botanical products.

The ability to gather firewood for heating and cooking is important for many of the families and communities around the assessment area. Firewood gathering is often a family social event, but more importantly, firewood from the Lincoln is how many people heat their homes at a large economic savings over propane, natural gas, and electricity. Other wood products that come off the Lincoln NF, such as Christmas trees, transplants, nuts, and plant materials, are also important cultural and social products gathered from the forest.

Suitable timber lands on the Lincoln NF comprise 21 percent of the forest. They include Spruce Fir, Mixed Conifer, and Ponderosa Pine Forest types. Current stand conditions are generally overly crowded with trees of young and mid-aged trees, often with moderate to high levels of dwarf mistletoe and root rot, creating conditions more prone to insect outbreaks and greater susceptibility to crown fire. Historical logging practices and fire suppression have created a landscape that is more homogenous than what would be expected than what would occur under the frequent fire regime that vast majority of these forest types developed.

New Mexico's National Forest timber harvest has followed a pattern similar to that of many western states. The decline of harvest levels on National Forests in the early 1990s was due to a combination of pressures related to threatened and endangered species, appeals and litigation directed at federal timber sales, market demand and federal budget levels. In New Mexico, the listing of the Mexican Spotted Owl had a profound impact on national forest harvest levels. Logging on the Lincoln NF generated an average annual revenue from logging between 1970 and 1989 of approximately \$11,000,000 per year with a high year of almost \$24,000,000 in 1972. Between 1990 and 1999, logging revenues decreased 86 percent to approximately \$1,500,000 per year. The economic loss incurred by the four counties over those years was estimated at \$14.7 million.

Currently, fuelwood and miscellaneous products such as posts and poles, Christmas trees, and transplant permits form the backbone of the existing markets for the Lincoln NF. The Lincoln NF currently has an annual timber target of 4.25 million board feet per year down from 6 million board feet per year from previous years. This volume is sold and removed through conventional timber sale contracts, stewardship agreements and contracts, service contracts, fuelwood sales both commercial and personal use, and through sales of miscellaneous forest products. Currently, there are five active small production sawmills in Otero County, multiple firewood processors throughout the four counties, and one full production pallet mill in Canutillo, Texas. Local sawmills and processors currently produce a variety of wood products. The Lincoln NF, after a ten year period of passive management and a decline in timber sale activities, is generally shifting planning and implementation efforts to primarily

encompass forest ecosystem restoration and management of larger landscapes. This is creating local and regional interest in the feasibility of commercial use of traditionally sub-merchantable materials, such as small-diameter, dimensional lumber and wood-based energy production.

Condition and trends within suitable timber areas is predominantly linked to healthy vegetative types. Two principle threats to the suitable timber lands are stand replacing wildfires and insects and diseases. Suitable timber lost to wild fires is a total of 2 percent for all timber types. Suitable timber lands affected the most are dry mixed conifer and pine, both because they are found at lower elevations, are relatively dry, are most departed in terms of excessive tree density and fuel accumulation. A comparison of the predicted loss of trees from insects or disease with the suitable timber map shows that the areas at greatest risk are the wet and dry mixed conifer, aspen and mixed conifer mixed with aspen. A total 8 percent of the suitable timber may be impacted by the possible insect and disease within the next 14 years. It is clear that insect and disease has a greater direct threat on suitable timber than wild fire; however, damaged and stressed timber from the insect and diseases can result in a higher fire hazard.

The increased emphasis in forest ecosystem restoration projects should allow the continued ability to contribute to both timber and fuelwood demands. An increase in forest restoration projects will be vital to help sustain forest and watershed health, prevent uncharacteristic wildfire, reduce insect and disease outbreaks, and improve or maintain wildlife habitat, as well as to contribute to local economies.

Water

All natural water flowing in streams and found underground in New Mexico is declared to be public and subject to appropriation for beneficial use. In New Mexico, beneficial use can include domestic use, livestock and wildlife watering, irrigation, prospecting and mining, or construction of public works, highways, and roads. Water for instream flows and fish culture is not considered a beneficial use.

In New Mexico, the State Engineer is charged with administration of surface and ground water use within the state. This applies to new appropriations, transfers of location, changes in beneficial use, changes in points of diversion, or enlargements. Spring developments and stock tanks are classified as surface waters which are regulated by stream systems, while wells are categorized as groundwater, which is regulated by declared underground water basins.

There are four basic rules that govern New Mexico's water laws and administration, including:

1. **"First come, first served."** Water in New Mexico is governed by the "doctrine of prior appropriation."
2. **Water must be applied to a beneficial use.** Under New Mexico water law, beneficial use is the basis, measure, and the limit of the right to use water.
3. **Water rights are transferrable.** In New Mexico, water rights may be bought, sold, and moved around within a basin, subject to approval by the State Engineer. Users may change the point of diversion, purpose of use, and place of use.
4. **"Use it or lose it."** Unlike other property rights, failure to utilize a water right for a period of time may result in a permanent forfeiture of the right to use water in the future.

The State Engineer has declared stream systems and underground water basins throughout the state and administers water rights subject to rules and regulations that are specific to each basin. The core components of water rights administration consist of the place and purpose of use, priority date, point of diversion, allocation, and timing of diversion.

Water resources are described in terms of hydrologic units. These hydrologic units are nested within each other and are categorized from the largest geographic area (i.e., region) to the smallest (i.e., sub-watershed). The Lincoln NF boundary encompasses approximately 1.1 million acres that lie partially within six sub-basins including the Tularosa Valley, Arroyo Del Macho, Rio Hondo, Rio Peñasco, Upper Pecos-Black, and Salt Basin.

Water resources on the Lincoln NF include streams, springs, wetlands, riparian corridors, and the underlying groundwater that support these features. Most of these water resources are used for consumptive purposes such as drinking water, livestock watering, and agricultural irrigation, as well as oil and gas exploration and development. Both the sights and sounds of clear water, along with the associated riparian vegetation and wildlife, are often cited as valued amenities that draw people to live in communities surrounding the Lincoln NF. In addition, the distribution of water, whether it be naturally occurring on the landscape or constructed features (i.e., trickle tanks and troughs), is critical for wildlife management and hunting opportunities.

Within the Lincoln NF boundary, nearly 3,850 water rights exist, and many others are adjacent to the Lincoln NF boundary. These rights are primarily used for livestock and domestic purposes (i.e., private inholdings, campgrounds and other administrative sites). Of these, approximately 32 percent are held in ownership by the United States of America, and 68 percent are privately-held.

New Mexico's climate has historically exhibited a high range of variability. Periods of extended drought, interspersed with relatively short term, wetter periods, are quite common. Regional climate assessments have found that temperatures in the southwestern United States have increased and are predicted to continue to increase. Serious water supply challenges are expected as snowpack and streamflow amounts are projected to decline in parts of the Southwest, resulting in decreasing surface water supply reliability for cities, agriculture, and ecosystems.

Within the six sub-basins that constitute the Lincoln National Forest context area, 15 water bodies are impaired. Nonpoint sources of pollutants for surface water quality include wildfire, grazing, agriculture, recreation, hydro-modification, streambank destabilization or modification, removal of riparian vegetation, road and highway maintenance, land disposal, resource extraction, road runoff, and septic tanks.

Water is one of the important resources of the Lincoln NF, ecologically and socially. However, ongoing and future concerns for water quality and quantity will continue to be an issue considering ecological pressures and increasing demands.

Fish, Wildlife, and Plants

Wildlife, fish, and plants on the Lincoln NF contribute to social wellbeing and quality of life by promoting recreational and educational opportunities. The Forest Service maintains a stewardship responsibility for the habitat, while the state manages wildlife populations and hunting and fishing programs. The state's Habitat Stamp Program contributes to various habitat improvement projects on the Lincoln NF through a competitively awarded grant process. The trend in this program is to provide money for maintenance of existing improvements, with less emphasis on funding of new projects.

Culturally, hunting is an important activity for the people of New Mexico. Early inhabitants hunted and lived off the land. Many of the people in rural areas and small towns in southwestern New Mexico continue this traditional practice that provides food, is a bonding activity between parents and children, and is a way of teaching children about nature and the land around them. Recently, sport hunting has emerged as a social recreational activity, which can involve larger groups, off-highway vehicles, and hunting camps. The growth of sport hunting has given rise to a community of commercial outfitters and

guides. The Lincoln NF is known for its trophy animals, especially elk, which attract hunters from all over the country. Ranchers are taking advantage of the hunting opportunities by developing outfitting and guiding businesses. Outfitters and guides look to the Lincoln NF for special use permits that allow them to guide hunters on Forest Service lands. Some rely on this as a main portion of their income. The Lincoln NF provides habitat for 10 legally-hunted big game or trophy species, multiple small game species, and 4 legally-fished species.

Some national data sources suggest a slight downward trend in consumptive fish and wildlife activities. Bird-watching is on the rise, however, and the greater Lincoln National Forest area contains 1 Important Bird Area (IBA).

Recreation and Scenic Character

Participation in outdoor recreation activities is the way that most Americans come to know their national forests and grasslands. The Lincoln NF consists of “sky islands,” isolated mountain ranges surrounded by desert. One of the smaller forests in the west, the Lincoln NF has three distinct districts, each with its own personality and constituents. Outstanding recreational opportunities from the most primitive and wild to the highly developed are available throughout the year.

Around the tourist town of Ruidoso, the Smokey Bear District consists of the White, Capitan, Jicarilla, and Carrizo Mountains, and the hills above Highway 70 east of Ruidoso Downs. Both of the Lincoln NF’s Wilderness areas, comprising about 82,924 acres, are located within this district and a large amount of equestrian use and outfitter/guiding for hunting occurs here. Mountain biking is popular and walking and biking trails close to town have been developed in partnership with local agencies and organizations. The southern-most major ski area in the United States sits on both the District and the Mescalero Apache Reservation offering snow-based activities in the winter, zip lining in the summer.

The Sacramento District has the majority of developed campgrounds on the forest and is a destination for motorized trail riders. Encompassing about one-half of the forest, this district is the largest contiguous area of forest and is also provides special use permits to outfitter/guides for hunting in this area. Locals are proud of their railroad logging history, which they highlight with their rail trails. The clear skies of the Sacramento Mountains make this area popular for astronomers, both professional and amateur.

Adjacent to Carlsbad Caverns, the Guadalupe District draws cavers from all over the world to explore undeveloped caves. Fall brings hunters to the steep ridges and canyons of this district. Sitting Bull Falls, an oasis in the desert is busy year-round.

Based on an analysis of the niche of the Lincoln NF relative to recreation, the primary recreation opportunities on the Lincoln include climatic relief from the summer heat, easily accessible day use activities in dispersed settings, scenic touring, and opportunities for family gatherings in developed sites. Visitors participate in a variety of activities, with the most popular being viewing natural features, hiking and walking, relaxing, and driving for pleasure.

Access and Facilities

Recreational access to the Lincoln NF is generally good. A network of State highways and county roads provide access to national forest roads and trailheads from the various metropolitan areas and smaller surrounding communities. A well-developed network of road and trails provides a variety of non-motorized and motorized recreational experiences. The Lincoln NF manages 128 non-motorized and 57 motorized trails covering nearly 550 miles, and 927 miles of motorized routes on roads open for use by high clearance vehicles (Maintenance Level 2). Other infrastructure that provides recreational access includes trailheads, parking lots, vistas, and other developed recreation facilities. With 16 developed

campgrounds, 6 group campgrounds, and 3 dispersed developed areas, a variety of camping opportunities are available throughout the Lincoln NF. Varying levels of facilities are available from highly developed campgrounds to minimally developed campgrounds. Although some of the developed sites on the Lincoln receive heavy visitor use, the developed facilities are thought to be adequate to meet demand. Dispersed camping is allowed within most areas of the Lincoln NF.

In 2006 the Lincoln NF began a comprehensive analysis of the existing recreation facilities to evaluate how these facilities might operate more efficiently while receiving the required maintenance. This was an inward evaluation of what the Lincoln NF offers to the public, the financial costs of facilities and visitor use to better meet the changing preferences of our users. This evaluation identified the Lincoln NF as a dispersed day-use forest; the campgrounds that are offered are likely adequate for current and projected use; and that most visitors to the Lincoln NF choose to stay off-Forest (e.g. at hotels or RV parks).

Travel Management

The Lincoln NF has a travel management plan that designates a system of roads and trails open for motorized vehicle travel. Open roads and trails are designated as such on the Lincoln NF's Motorized Vehicle Use Map (MVUM). The Lincoln NF has worked to physically close or sign roads that are not part of the open transportation system. Roads that are not physically closed are often used by motor vehicles either intentionally (signs are often vandalized) or unintentionally.

There are many locations on the Lincoln NF where the public has historically been allowed informal access to the forest through private land. As times and owners have changed, some people have chosen to gate or otherwise close public access through their private land to roads and trails on the national forest. The forest goals are to acquire legal access to popular forest sites where possible, but right-of-way acquisitions are rare for a variety of reasons. This trend of reduced access through private land is expected to continue in the coming years.

Although new rights-of-way would be difficult to acquire, the Lincoln NF could revisit the Travel Management Plan to reevaluate use patterns and offering. However, it is unlikely that changes in Travel Management would be at the pace of future desired uses from the public.

The variety of uses can create conflicts between user groups. This is predominately occurring between the non-motorized and the motorized uses throughout the Lincoln NF. There is a large concentration of this within the highly motorized use areas of the Sacramento Ranger District. User conflict between motorized and non-motorized uses is expected to continue and possibly increase. Conflicts also occur between mountain bike users and equestrians and hikers.

Sustainability

Historically the Lincoln NF, like most national forests, relied primarily on appropriated funds to support its recreation program. Over time, the costs of doing business have increased and budgets have been declining. The Lincoln NF now depends on a wider variety of funding sources including volunteers and partners, fee revenue, and grants to meet recreation needs. The volunteer and partnership program on the Lincoln NF significantly contributes to the recreation program, with both on-the-ground accomplishments, and by building community and goodwill.

The Lincoln NF partners with various organizations, which allows both the Lincoln NF and outside organizations to leverage available resources to meet mutual goals. Key areas where partnerships and volunteers are helping to meet resource management objectives include:

- Wilderness monitoring

- Visitor information and education
- Trail maintenance
- OHV education and route maintenance
- Monitoring and management of developed and dispersed recreation sites
- Cave and karst resource management

In 1997, Recreation Fee Demonstration Authority (referred to as “Fee Demo”) allowed the Forest Service and other land management agencies to pilot fee collection at a wider variety of recreation sites. In 2004, the Federal Lands Recreation Enhancement Act made Fee Demo permanent and provided the legal authority for the Secretary of Agriculture to establish, modify, charge, and collect recreation fees at Federal recreational lands and waters. The Lincoln NF continues to collect recreation fees at 17 recreation sites, six managed on the Smokey Bear and Guadalupe Ranger Districts and eleven concessionaire-managed on the Sacramento Ranger District. Over the last ten years, an annual average of \$51,869 was collected from the six fee recreation sites managed by Lincoln NF. There is no clear trend of increasing or decreasing recreation fee income for the Lincoln NF. Fee collections have varied significantly (from a low of \$28,287 in 2012 to a high of \$85,406 in 2010) and are highest when fire danger is low and the entire Lincoln NF is open to visitation, all recreation fee sites are open (both Sitting Bull Falls and South Fork Campground, two of the Lincoln NF’s most popular sites have been closed various years due to fire and flood damage), and the price of gasoline is low and people are more likely to travel. Fee sites on the Lincoln NF are a critical component of the Forest’s sustainable recreation program both because of recreation opportunities they provide and income they generate.

With current levels of appropriated funds, retained fees, partnerships and volunteer labor, the Lincoln NF is able to operate and maintain the existing recreation program, however, some services are lacking, such as patrols of illegal off-highway use. These types of situations provoke visitor complaints and dissatisfaction with their recreation experience. Limited funding is available to improve visitor satisfaction or offer new and different recreation opportunities as visitor demand changes.

Visitor Use and Demographics

Recreation provides significant contributions to local and nearby communities within the Lincoln NF since recreational activities are one of the main reasons people come to this area. The Lincoln NF is known as an ‘introductory forest’ in which most visitors do not know the difference between being in a National forest and other undeveloped land ownerships. Thus, it is important to provide education and recreation opportunities that visitors will desire so that the forest remains relevant.

There are three primary groups of visitors that visit the area based on the 2014 National Visitor Use Monitoring Survey (NVUM):

- Locals—access to the forest is a very short travel distance, 25 miles or less.
- Near-by neighbors—access to the forest is a travel distance of 26-200 miles.
- Destination visitors—access to the forest is a travel distance of 200 or more miles.

Accordingly, one-quarter of Lincoln NF visitors are “local”; almost 35 percent are considered “near-by neighbors”; and over 40 percent of visitors are “destination” visitors, traveling more than 200 miles to the Lincoln NF. The 2014 NVUM results estimated total visitation to the Lincoln NF at 767,000 people; this is a 10 percent increase from 2009.

Destination visitors likely come to southern New Mexico to visit multiple sites including the Lincoln NF, but also Park Service units (the Sacramento Ranger District is situated on the road between Carlsbad Caverns and White Sands National Monument) and destination tourist towns like Ruidoso and Cloudcroft. Destination activities might include caving, skiing or zip-lining.

For many in southeastern New Mexico, west Texas and Chihuahua, Mexico, the cool pines of the Sacramento Mountains are the closest respite from summer heat. In addition to locations of visitors, the percentage of visits based upon the type of recreational activity trended the same, with the vast majority of visitors (84 percent) primarily participated in what is considered dispersed or general forest visits.

The 2014 NVUM results also show that 59 percent of visits are made by males versus 41 percent by females. Hispanic/Latinos (26.5 percent of visitors) are the most common racial or ethnic minority. The Lincoln NF will need to better serve this segment of the population to maintain relevancy. This may require more forest information in both English and Spanish and opportunities for large groups of people to recreate together.

Visitors are relatively evenly represented in each decade of life from those in their twenties through those in their fifties with a slight uptick in the sixties when more people are retired, many still physically able and with more free time. Visitation falls off for those over seventy as it may become more difficult to travel and participate in outdoor activities.

Average overall satisfaction of all visitors for 2014 is high with 69 percent of all visits rating their visit as very highly satisfied. The trend to provide tourism type guides via the internet and social media is increasing, especially where maps are concerned. The forest service as a whole, including the Lincoln NF, has not kept up with electronic technology trend. There is a need to use the latest technology to provide maps, guides, suggestions of where to visit, activities, etc.

Environmental Influences

Several recent uncharacteristic, stand-replacing wildfires on the Lincoln NF have affected the quality of recreational settings. In order to protect the public during drought conditions, the Lincoln NF may at times put restrictions on fires allowed in the forest. There are stages of fire restrictions ranging from no open campfires (Stage 1) to a full forest closure (Stage 3). When fire restrictions are in effect at any level, fewer people visit the forest. Over the past five years with the exception of 2016, some fire restrictions have been in place on the Lincoln NF generally from May through July. Over the past ten years, the Lincoln NF has been closed to all visitors three times for a period of two or more months. In addition to impacting forest visitors, local communities and their economies suffer as well. Fires affect trail conditions and create visitor hazards. The scenic quality of an area is also affected by fire.

In addition to environmental conditions, unmanaged recreation has been identified by the Forest Service as one of four key threats to the Nation's forests and grasslands. The use of off-highway vehicles is seen as a major component of unmanaged use. Off-highway vehicle use trends (including increasing numbers of participants and changing technology that has allowed access to previously inaccessible areas) impacts recreational settings because of dust, soil disturbance, the spread of noxious weeds, a proliferation of unauthorized routes, and other damage. Visitors also can cause damage. This can include vandalism, graffiti, and more subtle impacts such as trampling, creation of bare ground, and user created trails.

Scenery

The scenic character of the Lincoln NF stands out, making it a major local, regional, and national recreation and living destination. The mountain landscapes are a focal point viewed from Alamogordo, New Mexico, and the backdrop to communities in the area. When managing for scenic resources, concern levels are used to measure the public importance placed on landscapes viewed from travel ways and use areas. Roads off-forest as well as most Forest roads, trails, and recreation sites have high value for viewing scenery, especially those along the Sunspot and Billy the Kid Scenic Byways, designated

wilderness areas and the wilderness study area. Users expect to see a natural-appearing landscape. Perennial streams and cold and hot springs throughout the landscape, unique waterfalls, diverse vegetation, higher elevation tree-covered mountains, and steep, vibrant colored cliffs and canyons combine to provide for distinctive landscapes over much of the Forest. The water, landform, and vegetation attributes provide for unique and outstanding scenic quality.

Large areas of the Forest contain naturally evolving landscapes where processes occur with very little human intervention. The scenic character is intact with only minute, if any, deviations, such as non-motorized trails. These areas include two wilderness areas and inventoried roadless areas that have seen little human influence and make up about 10 percent of the Forest.

Most of the Forest area, about 40 percent, has a natural appearing scenic character and appears unaltered, although some human activities are present. Although roads and trails are evident, they serve as the viewer platform, offering opportunities and access to view scenery.

Moderate scenic integrity, or landscapes that appear slightly altered, is characterized by noticeable evidence of human activities and management along roads and trails where administrative facilities and recreation developments such as campgrounds, visitor centers, trailheads, and picnic areas are noticeable, but remain subordinate to the scenic character being viewed. About 48 percent of the Forest falls into this category.

Low existing scenic integrity, or landscapes that appear moderately altered, is characterized by more intensive vegetation management and small developed communication sites and utility corridors. About 2 percent of the Forest is in this category. About 1 percent of the Forest has larger electronic sites, major utility corridors, ski area development, or mining activity, which have a heavily altered scenic character.

Viewing natural features or scenery has been among the top two recreation activities on the forest during the last two rounds of National Visitor Use Monitoring. The population growth of regions surrounding the Forest and suburban development encroaching on lands adjacent to the Forest bring challenges for managing scenery. Change from a rural or urban setting to a natural appearing setting are often quite abrupt. However, communities and homeowners value the natural appearing backdrop that the Forest provides.

Most noticeable changes to scenic conditions across the landscape occur through natural processes such as wildfires or flooding. These natural disturbances will continue to shape the vegetation and landform features of the landscape, affecting the overall sustainability of the scenic character. Fire can also benefit scenic character. Historic fires on the Sacramento Mountains have resulted, at certain elevations, in large areas of aspen, which provide beautiful golden fall colors intermixed against green conifer covered mountains. Other factors which will continue to affect the sustainability of the scenic character of the forest include drought conditions affecting vegetation and water features, invasive species affecting native vegetation, tree encroachment on meadows and other forest openings, and conifer encroachment on aspen.

Designated Areas

A designated area is an area or feature identified and managed to maintain its unique special character or purpose. In the case of statutorily designated areas, the forest plan may include a recommendation to Congress regarding a designation. These areas are then managed as proposed designations until Congress either formally designates the area or releases it from further consideration; whereas administrative designations may be made by the Regional Forester as land use allocations in the forest plan.

Designated or eligible areas on the Lincoln NF include:

- Wilderness Areas (2)
- Wilderness Study Area (1)
- Eligible Wild And Scenic Rivers (17 totaling 132.8 Miles)
- National Recreation Trails (2)
- Inventoried Roadless Areas (12)
- Significant Caves (246)
- Proposed Research Natural Areas (3)
- National Forest Scenic Byway And 1 National Scenic Byway (2)
- Critical Habitat Areas Under Endangered Species Act (2)

Designated areas provide important but usually immeasurable contributions to the social and economic sustainability of the Lincoln NF. The designated areas on the Lincoln NF, especially wilderness, scenic byways, and significant caves, serve as destinations for visitors. While scenic byways will continue to receive high visitor use levels, the opportunities for primitive and unconfined recreation offered by wilderness will attract a smaller subset of users. During the forest plan revision process, inventories and evaluations will be conducted for wilderness, wild and scenic rivers, and research natural areas to determine if additional areas should be designated, and, in some cases to determine if proposed areas should be carried forward into the new forest plan. Additional types of designated areas may be inventoried and evaluated during forest plan revision for potential designation.

Designated areas function to store of carbon, filter water, regulate climate etc. Designated areas often provide high-quality water, soil, and air resources, as well as playing a role in conserving biodiversity and facilitating connectivity.

Designated areas may also contribute to social and economic benefits, including recreational and scenic opportunities, places to connect with nature and spirit, therefore contributing to local economies. They may also offer connections with history and provide places for research.

Wilderness

There are two congressionally designated wilderness areas on the Lincoln NF totaling approximately 83,252 acres (8 percent of the Lincoln NF). Both the White Mountain Wilderness and the Capitan Wilderness are located on the Smokey Bear Ranger District. Most of the White Mountain Wilderness was designated under the 1964 Wilderness Act, with additional acres added, along with the Capitan Mountains Wilderness designated under the 1980 New Mexico Wilderness Act. Of the approximately 767,000 visitors to the Lincoln NF, over 21,000 enjoy visiting wilderness. There are also two congressionally designated National Park Service wilderness areas adjacent to the south end of Lincoln NF, Carlsbad Caverns and Guadalupe Mountains.

The qualities of wilderness include natural quality, undeveloped quality, untrammled quality, opportunities for solitude and unconfined recreation, and other features of value.

Relative to the Lincoln NF, threats to wilderness quality include:

- Invasive species - specifically invasive plants and feral pigs, continue to be one of the key threats to wilderness character, and require long term focus and effort to manage.
- Natural role of fire—fire is a significant natural force in this wilderness and continued focus on effective management of wildland fire is critical to maintaining the natural and untrammled qualities of wilderness. However, management of natural fire starts will continue to be challenging due to the proximity of the White Mountain Wilderness to the WUI with all its resources at risk.

- Recreation sites - there is concern that with planned improvements to the existing trail system, use will increase, and existing campsites will receive even more pressure. Another concern is concentrating users in a smaller area because of the effects of the wildfires on previously used areas.

Currently there is a Regional Forester approved analysis for aerial gunning of feral hogs by the Department of Agriculture's Animal and Plant Health Inspection Service and a pending analysis for treatment of non-native invasive plants in the White Mountain Wilderness. It is anticipated that the aerial gunning and the selected tools for invasive plant treatment will continue for the foreseeable future.

The White Mountain wilderness borders the community of Alto and other rural communities to the east and these communities have changed from rural and isolated housing and ranching to fully developed sub-divisions of both permanent and seasonal residences. On the eastern edge of the White Mountain Wilderness it is easy to hear cars, car horns and other such sounds. Many property owners back up to the wilderness boundary, often entering the wilderness on day hikes and short excursions. Many visitors are unaware of the wilderness boundary or the purpose for designated wilderness. As this interface between subdivisions and the wilderness boundary continues to expand, it will be important to increase efforts to educate the local communities and visitors about wilderness values.

It is not anticipated that there will be a measurable change in visitor use patterns in the future in the Capitan Mountains Wilderness, based on its remoteness, inaccessibility, user types, and lack of water.

Wilderness Study Areas

The 20,913 acre Guadalupe Escarpment Wilderness Study Area (WSA) was reviewed by Congress as part of the New Mexico Wilderness Act of 1980. Located on the Texas-New Mexico border, the Guadalupe Escarpment WSA links Carlsbad Caverns and Guadalupe Mountains National Parks. It was recommended for wilderness by the Forest Service, but Congress determined that further study was needed to allow time to determine whether the area has a high potential for oil and gas.

In 2001, approximately 27,300 acres of National Forest System lands were withdrawn from location and entry under the United States mining and mineral leasing laws for a period of 20 years, in order to protect the Guadalupe Cave Resource Protection Area. The withdrawal area includes the Guadalupe Escarpment Wilderness Study Area's 20,913 acres along with 6,387 adjacent acres to the north.

The Guadalupe Escarpment WSA is extremely rugged with majestic vistas. Access to the area is by trail or rough class 2 roads. The area encompasses the majority of the more significant caves on the Guadalupe District. The wilderness characteristics and condition of the WSA has remained stable due to its extremely rugged and remote location.

National Trails

The Dog Canyon National Recreation Trail is a popular trail primarily in the spring and fall months when temperatures are cooler. The trail is open to hikers and equestrian users, but equestrian use is low due to the steepness and narrowness of the trail and the lack of water within the canyon. Hikers generally enjoy the trail for day trips only.

The Rim National Recreation Trail, designated in 1978, was the first Forest Service trail in New Mexico to be designated as a National Recreation Trail under the National Trail System Act of 1968. The trail itself is a combination of old Indian paths, railroad grades, and homestead trails all linked together by new sections of trail. It runs north to south along the top of the Sacramento Mountains offering beautiful

views of the Tularosa Basin. Currently, the Rim Trail is 31.2 miles long and open to hiking, skiing and snowshoeing, horseback riding, mountain biking, and motorcycling.

Inventoried Roadless Areas

Official roadless area boundaries were established in the 2000 Forest Service Roadless Area Conservation Final Environmental Impact Statement. Although the boundaries of the roadless areas will not be reconsidered during plan revision, these areas will be evaluated for potential suitability as wilderness areas. There are 244,515 acres of inventoried roadless areas on the Lincoln NF, located on all three districts in 14 units.

The Roadless Area Conservation Final Rule prohibits road construction, reconstruction, and timber harvest (with exceptions) in inventoried roadless areas (IRA). Roads and motorized trails can be present within IRAs, and the Roadless Rule does not prohibit motorized travel on existing roads or motorized trails. Threats to the IRA characteristics mandated for protection by the Inventoried Roadless Rule include the occurrence of new and existing unauthorized user-developed motorized routes. However, trends are for specific management actions under implementation of landscape restoration/management decisions to rehabilitate and reduce existing unauthorized routes, and prevent the occurrence of new ones.

Cave and Karst Features

Karst is a landform produced by the dissolution of limestone, dolomite, marble, gypsum, or salt. Features often associated with karst terrains include sinkholes or closed depressions, caves, dry valleys, sinking streams, springs, and resurgences. Groundwater recharge in karst areas often occurs rapidly as surface water enters karst features and is quickly transported through open conduits to either shallow or deep aquifers. This water can then remain underground or emerge back to the surface in springs, seeps, or wells.

A cave is defined as any naturally occurring void, cavity, recess, or system of interconnected passages occurring beneath the surface of the Earth large enough to permit an individual to enter, whether or not the entrance is naturally formed or human-made. A cave resource is any resource occurring within a cave. Cave resources include, but are not limited to biological, geological, mineralogical, paleontological, cultural, or hydrologic features.

Cultural evidence found in and around a few caves on the Lincoln NF area suggests moderate to significant use by Native Americans and Euro-Americans. Native Americans in the area used caves for food storage and processing areas, water sources, shelter, religious and ceremonial sites, and burial. Euro-Americans used caves for shelter, livestock pens and watering areas, trash dumps, tourist attractions, and recreation.

Some Lincoln NF caves have functioned as natural faunal traps for several thousand years yielding bones of mammals that are now extinct or no longer common in the area.

Cave resources are fragile due to their association with other resources such as groundwater hydrologic systems and biological communities. Caves are complex ecosystems not only because of the fragile nature of their components but also because of the length of time the ecosystem needs to respond to change. As such, caves, karst terrain and their associated resources are considered nonrenewable.

The limestone karst regions west and southwest of the city of Carlsbad are known worldwide for their cave resources. Once a living reef on the edge of an inland sea, the Guadalupe Mountains are home to over five hundred known limestone caves ranging from a few feet long to one hundred and thirty miles of surveyed passage in length and up to sixteen hundred feet in depth. More than 120 significant

limestone caves are found within lands managed by the Guadalupe Ranger District. Many of these caves occur in the rough canyons on the south end of the Guadalupe District. They range from very large, simple chambers to complex mazes of interconnecting passages. Several caves have been mapped to lengths of over 3 miles with a few approaching 10 miles.

Unique mineralogy, the absence of organics, and isolation from surface influence in some of the deeper caves contribute to unique environments that foster the growth of microbial colonies. These colonies are of great interest to microbiologists. Many of the microbial communities discovered by researchers in the caves of this region have proven to be new species.

Most of the Guadalupe limestone caves have developed extensive cave formations. Massive one hundred foot tall column formations are present as well as delicate selenite needles. This draws cavers from all over the world.

The Sacramento Ranger District has 10 known caves largely formed via tectonic events or from downward seeping surface waters. While not as decorated or large as caves on the Guadalupe District, they play an important role hydrologically and as habitat for cave adapted wildlife such as bats. Some of these caves receive a moderate amount of recreational visitation.

The Smokey Bear Ranger District has 30 known limestone caves and many known karst features. The most well-known cave is Fort Stanton Cave. While the only known entrance to Fort Stanton Cave System is located on lands managed by the Bureau of Land Management, several miles of surveyed passage has been found under the jurisdiction of the Lincoln NF. Other caves, ranging in length from a few hundred to a few thousand feet are also found on the Smokey Bear Ranger District.

While most damage to Lincoln National Forest caves has been caused due to over use by generally well intentioned users, some damage has been malicious and significant. Over the years, several gates have been breached and significant damage in the form of graffiti and formation breakage has occurred in a few of the more accessible caves. Graffiti has been removed and many formations have been carefully epoxied back into place where they can continue to naturally repair themselves. However, several areas within a few caves maintain strong visible evidence of vandalism.

A cave permit system has allowed for the protection of sensitive bat populations roosting within gated and ungated caves. Once disturbed populations in several caves have begun to return to their historical numbers or greater by management actions limiting access during roosting times. This is also true in relation to other wildlife species such as Mexican Spotted Owls who use several caves on the Guadalupe Ranger District to raise young.

It is expected that there will be a continued increase in interest of cave and karst resources. Cave visitation numbers will remain steady for caves under the cave permit system since access is controlled. As caves become more popular, entry authorization requests are likely to increase. Potential cave closures due to the possible spread of White Nose Syndrome (which affects bats) could dramatically cut visitation on a temporary basis to certain caves.

New caves will likely be found as exploration of the rugged canyons continue. A need for survey, mapping, inventory, and often times, installing gating is likely to continue. Scientific research is expected to continue and could increase as new discoveries are made and technologies developed.

Research Natural Areas

Research natural areas (RNA) are part of a national network of ecological areas designated in perpetuity for research and education and to maintain biological diversity on NF System lands. They are areas set aside by the Forest Service to preserve a representative sample of an ecological community; primarily

for scientific and educational purposes. Research natural areas provide minimally disturbed areas for study, an ecological baseline, and comparison with adjacent multiple use lands.

The forest plan revision process will evaluate whether additional areas are appropriate for designation as research natural areas. The Regional Forester designates research natural areas, with concurrence of research station directors.

The 1986 Lincoln Forest Plan includes management direction for the proposed (but never officially designated) three RNA's, one within each Ranger District. The purpose of these proposed designations was to provide opportunities for non-disruptive research and education. There is no harvest of forest products including fuelwood in these areas.

The William G. Telfer Proposed RNA on the Smokey Bear Ranger District near Ski Apache ski area occurs at 10,000-10,600 feet elevation. This boreal forest environment is insular in nature and contains examples of spruce-fir and associated plant communities at their southernmost geographical limits in the United States, including the most extensive stand of the corkbark fir/cardamine groundsel plant association. In 2012, the entire RNA was burned to varying degrees of severity. Currently there is no grazing activity on the RNA, and motorized access by road is limited to agencies that operate an adjacent telecommunications site, including road maintenance (hikers can walk up the road). Two hiking trails across the RNA and allow non-motorized access, but otherwise have a limited insignificant impact on the RNA. The RNA may not meet the needs for which it was created as a study site for old growth Spruce-Fir forest. This proposed research natural area will be reevaluated during the plan revision to determine whether it should be carried forward in the planning process and formally designated as a Research Natural Area.

The Haynes Canyon Proposed RNA on the Sacramento Ranger occurs between 7,900 and 9,500 feet. Forests of white fir/Rocky Mountain maple habitat type occur generally on the north-facing slopes. South-facing slopes are populated mostly by Gambel oak stages of white fir/Gambel oak communities. The lower slopes and forested ravines contain stands of the white fir/bigtooth maple communities. In the narrow canyon bottoms, bluegrass sod extends between stringers of Douglas-fir, occasional ponderosa pine, and white fir. The RNA was proposed to represent mixed conifer forest as an outstanding example of the white fir/ Rocky Mountain maple habitat type. The condition of this area remains generally unchanged except for natural succession since its initial proposal date acquiring further old growth characteristics with no history of wildfire or insect and disease disturbances. There is no grazing in the RNA and there have been no vegetation management activities since proposal. There is a recreational trail through the RNA and its adjacency to a major local highway and private land makes it easily accessible to recreationists, but the steepness of the canyon and density of the forest restrict off road or trail impacts. Barring a large disturbance such as a severe wildfire, wind throw or flooding, the RNA should retain the late and old growth characteristics it represents. This proposed research natural area will be reevaluated during the plan revision to determine whether it should be carried forward in the planning process and formally designated as a research natural area.

The condition of this area remains unchanged since its initial proposal date with no history of wildfire or insect and disease disturbances. This proposed RNA will be reevaluated during the plan revision to determine whether it should be carried forward in the planning process and formally designated as a RNA.

The Upper McKittrick Proposed RNA on the Guadalupe Ranger District is at the southern border of New Mexico, adjacent to Texas. It was proposed as an example of relatively untouched chaparral as influenced by the adjacent Chihuahuan Desert. Mountain mahogany makes up about 91 percent of the RNA. Topography and lack of water have limited historic grazing, and none is permitted there now.

Current conditions have changed little since proposal with no history of wildfire or insect and disease disturbance. This proposed research natural area will be reevaluated during the plan revision to determine whether it should be carried forward in the planning process and formally designated as a research natural area.

The 1986 Lincoln Forest Plan indicated the Last Chance Canyon should be evaluated for designation as a special botanical area. Botanical areas are administrative designations of land that contain plant specimens, plant groups, or plant communities that are significant because of their form, color, occurrence, habitat, location, life history, arrangement, ecology, rarity, or other features. Although this area is included in the current forest plan, a map of the area was not formally established and it was not officially evaluated or designated. This area will be reevaluated during the plan revision to determine if it should be carried forward in the planning process and formally designated as a botanical area.

Scenic Byways

The National Scenic Byways Program is administered by the U.S. Department of Transportation (USDOT), Federal Highway Administration. It was established to help recognize, preserve and enhance selected roads throughout the nation. The U.S. Secretary of Transportation recognizes these designated roads based on one or more intrinsic qualities — archaeological, cultural, historic, natural, recreational, or scenic. Complementing the USDOT program is the USDA Forest Service National Forest Scenic Byways Program that was established in 1988 to showcase driving routes located on National Forest lands that provide access to outstanding scenic corridors and important natural, recreational and historic features.

There is one National Scenic Byway and one National Forest Scenic Byway associated with Lincoln NF.

The only National Scenic Byway on the Lincoln NF is the Billy the Kid National Scenic Byway, which was designated in 1998, and is an 84.0 mile long loop in the heart of Lincoln County. The Wild West lore of gunfights, horses, outlaws, Buffalo Soldiers, and Smokey Bear comes to life along the Billy the Kid Byway. Only a small portion of this byway falls on Lincoln NF lands along New Mexico State Highway 48. Continued collaboration and management of this small area needs to be done in partnership the local communities to ensure that the essence of this area is maintained. Portions of the Billy the Kid Scenic Byway's outstanding scenery opportunities were affected by the Little Bear Fire in 2012.

The Sunspot Highway National Forest Scenic Byway on the Sacramento Ranger District is a 13.6 mile long two-lane highway traversing the front rim of the majestic Sacramento Mountains offering travelers a variety of panoramic views. Along the way, there are a variety of opportunities for the visitor such as camping, hiking, wildlife viewing, motorized use, and winter recreation. At the end of the scenic byway, travelers will find the Sunspot Observatory, the Apache Point Observatory, and the Sunspot Visitor Center and Museum. A management plan has never been created for this national forest scenic byway. Visual qualities are beginning to decline along the Sunspot Scenic Byway due to encroachment of mixed conifers within pure aspen stands.

Critical Habitat for Threatened or Endangered Species

The Lincoln NF includes designated (by the US Fish and Wildlife Service) critical habitat for the Mexican spotted owl (MSO), and the New Mexico (NM) meadow jumping mouse. A total 203,620 acres of designated critical habitat for MSO occurs on the Lincoln NF. This encompasses habitat that has been determined to contain primary constituent elements of critical habitat required for survival by the MSO, which is mixed conifer and pine-oak forest types, canyons and cliffs, and riparian areas. Critical habitat areas for the Mexican spotted owl is under threat from fire hazard and from insect and disease. The designated areas for the jumping mouse fall within 5 individual stream segments in the Sacramento

Mountains, covering a total of 22.5 miles of stream length. Critical habitat areas for the NM meadow jumping mouse have decreased due to long term drought conditions.

Wild and Scenic Rivers

The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. There are three classifications of wild and scenic rivers including wild, scenic, or recreational. For a river to be eligible for wild and scenic river designation, it must be free flowing and, with its adjacent land area, must possess one or more outstandingly remarkable values. Outstandingly remarkable values are specific to each river segment and may include scenic, recreation, fish, historic, and cultural values.

Currently, there are no designated wild and scenic rivers on the Lincoln NF. The forest plan revision process will include a comprehensive evaluation of the potential for rivers in the plan area to be eligible for inclusion in the National System. This evaluation process requires all rivers named on the standard U.S. Geological Survey 7.5 minute quadrangle map to be included for evaluation. If a previous eligibility study was conducted, those segments that were part of that previous study do not need to be reevaluated, unless there have been changed circumstances that may affect their eligibility. The 1993 preliminary analysis of eligibility and classification for wild, scenic and recreational river designation will be used to inform the river evaluation for the plan revision, and any changed circumstances that may affect the eligibility of river segments will be considered and documented. The Lincoln NF, in its initial evaluation of eligible river segments included all named rivers on USGS quads within Lincoln NF lands and as such, meets the requirements and is not required to conduct any further evaluations during this plan revision process.

The following river segments, during the 1993 study, were determined to be eligible for inclusion in the Wild and Scenic Rivers System during the 1993 preliminary analysis of eligibility and classification (Table 3).

Table 3. Eligible Wild and Scenic Rivers for the Lincoln NF and their Eligibility Category

Stream Reach Name	Eligibility Category	Condition
Big Canyon	Wild	Damaged by Wildfire
Bluewater Creek, Hale Canyon	Wild	Damaged by Wildfire
Dog Canyon	Recreational	
Duran Canyon	Wild	Damaged by Wildfire
Fresnal Canyon	Recreational	
Last Chance Canyon	Wild	Damaged by Wildfire
Monument Canyon	Recreational	

Stream Reach Name	Eligibility Category	Condition
North McKittrick	Wild	
Pancho Canyon	Scenic	Damaged by Wildfire
Rio Peñasco	Recreational	
Rio Ruidoso	Recreational	Damaged by Wildfire
Sacramento River	Recreational	
Sitting Bull Falls	Wild	Damaged by Wildfire
South Fork Bonito Creek	Recreational	Damaged by Wildfire
Three Rivers	Recreational	
Turkey Canyon	Wild	
Upper Dark Canyon	Wild	Damaged by Wildfire

These rivers have not been designated as Wild and Scenic; however, they are listed on the National Park Service - National Wild River Inventory as potential candidates to the River System. Management of these areas to protect their unique characteristics of wild and scenic will need to continue within the new forest plan.

Infrastructure

Infrastructure is defined as the physical facilities and systems constructed to support the use of National Forest System lands. There are five major categories that include National Forest System roads, National Forest System trails, aviation facilities, administrative and recreation facilities, and other facilities.

Roads

There are approximately 2,686 miles of currently existing National Forest System roads under Forest Service jurisdiction on the Lincoln NF. The roads are managed and maintained to various road standards, or maintenance levels, depending on management objectives. The roads range from paved roads regularly maintained to rough high-clearance roads with little to no regular maintenance. Insufficient budgets and too many roads have affected the ability of the Forest to maintain all system roads to their objective maintenance level. The Lincoln NF has been successful in cooperating with counties to maintain roads that are used by the general public and local communities. However, deferred maintenance needs required to bring the existing National Forest System roads on the Lincoln NF to their objective maintenance level exceeds \$40 million. In addition to National Forest System roads, many unauthorized routes exist that are not part of the Lincoln NF transportation system but the Lincoln NF has not done a comprehensive inventory or compilation of these routes.

Eight bridges on the Lincoln NF are currently rated with all major components in fair condition and 5 bridges with all major components in good condition. No road bridges on the Lincoln are closed to traffic due to their condition rating or safety concerns.

Currently, the Lincoln has a forest-wide designated road or trail system in effect since 1986; cross-country motorized travel is not permitted except for snowmobile use and dispersed camping up to 300 feet from designated motorized routes. Regulations were published in November 2005 in the Federal Register under the heading, "Travel Management; Designated Routes and Areas for Motor Vehicle Use; Final Rule." The regulations require all Forest Service units to designate a system of National Forest System roads (system roads), National Forest System trails and areas on National Forest System lands for motor vehicle use and to publish this designated system of roads, trails and areas on a motor vehicle use map (MVUM). To comply with the 2005 Travel Management Rule, the Lincoln NF compared existing Forest Plan direction with the provisions of the Rule and engaged in a travel analysis process to analyze its existing designated system of roads and trails, and determined that the existing policy and system had provided sufficient access and served natural resource management programs as well.

National Forest System roads are used for management of public lands as well as for some commercial use. Forest Service staff use National Forest System roads for a variety of administrative purposes including fire management, law enforcement, resource management (e.g. hazardous fuel reduction), and facilities management (e.g. maintenance work in a campground). Ranching, utility, telecommunication, and mining permittees and operators depend on National Forest System roads to maintain their permitted operations. Many National Forest System roads are also used by permittees as part of special use authorizations for activities such as hunting guide access, outfitter provided off-highway vehicle opportunities, and special use recreation events such as bicycle races.

Trails

The Lincoln NF trail system consists of approximately 515 miles of trails developed to various standards and characterized by managed use and designed use. There are five trail classes, ranging from the least developed (trail class 1) to the most developed (trail class 5). The majority of the trails on the Lincoln NF are class 2 and 3. About 29 percent of trails are maintained to standard. The portion of the Lincoln NF trail system that is maintained to standard is maintained with internal and external funding and personnel. Grants and agreements along with volunteers and partners maintain an ever increasing amount of the Lincoln's trail system. The total estimated cost for deferred maintenance of the Lincoln's trail system is approximately \$1.3 million, indicating a backlog of work and current substandard trail conditions.

All trails outside of wilderness are open potentially to hiking, pack and saddle, biking, and/or motorized use. Trails inside of wilderness are only open to hiking and/or pack and saddle. Most trails on the Lincoln NF have more than one managed use allowed per trail.

Trails offer both a means of transportation for activities such as hunting and wildlife viewing, and are also a destination in and of themselves for local and out of area visitors. This draw during all seasons of the year brings in substantial economic influx to the area. It is important that the needs of the public are met and that trails and other infrastructure are accessible and maintained for users of all ages and abilities. It will also be necessary to find a balance with other users and resource needs of the forest and an ever growing use of motorized Off-Highway Vehicles.

It is anticipated that demand for road use will increase with growing populations and desire for access to recreation opportunities and national forest commodities.

Aviation Facilities

Aviation facilities for the Lincoln NF include airstrips, heliports, launch pads, and other developed facilities such as an air tanker base used by the Forest Service and other agencies. Airstrips are popular destinations for backcountry pilots. There are two known historic airstrips located within the Lincoln NF. They include the Sunspot “Heliport” Airstrip and the Bluewater Airstrip on the Sacramento Ranger District. Neither of these airstrips are officially part of the Lincoln NF transportation system. Launch pads for recreational hang-gliders and para-gliders are another form of aviation facilities on the Lincoln NF. On the Sacramento Ranger District the Horse Ridge Launch Pad is actively used by recreational pilots.

Other Infrastructure

Four inventoried dams are located within the boundaries of the Sacramento Ranger District. Three permitted dams, Curtis Canyon Dam, constructed in 1959, Graveyard Canyon Dam, constructed in 1960, and Bear Canyon Dam, constructed in 1960 are owned and managed by Otero County Soil and Water Conservation District. The fourth dam, Parker Canyon Dam was constructed in 1966, and is owned and managed by the Forest Service. In 2007, an inspection found the Curtis Canyon and Bear Canyon Dams to be in good condition with only minor maintenance needed. The Graveyard Dam was found to be in fair condition with major work needed to remove sediment buildup in the reservoir. Deferred maintenance needs were projected to cost \$95,000. The dams and reservoirs were built to store water for flood control purposes. The 2007 inspection on the Park Canyon Dam found this dam and reservoir to be in poor condition. In 2013, the dam was breached and in 2016 the hydrologic redesign was completed. The dam and reservoir were originally built for livestock water supply purposes.

Administrative and Recreation Facilities

Administrative facilities include office buildings, work centers, visitor centers, fire lookouts, warehouses, communications buildings, and other utility buildings. Administrative facilities also include living quarters such as barracks and individual residences. The Lincoln NF manages and maintains 31 administrative sites, 9 of which include lookouts. Development and management of the administrative sites are guided by a Facilities Master Plan.

Recreational facilities include toilet buildings, shower buildings, storage, entry stations, shade structures and other structures maintained for public recreational use in campgrounds, camping areas, interpretive sites, and picnic or day use areas. The Lincoln NF manages and maintains 29 developed recreation sites; however, recreational facilities are not exclusive to developed sites.

Approximately 13 recreation and/or administrative sites are served by Forest Service-owned waste-water systems and approximately 8 sites are served by Forest Service-owned water systems. Four systems are rated with a facility condition rating of poor. Current estimate of deferred maintenance needs on the Lincoln NF is approximately \$21,000 for water systems and \$178,000 for waste water systems. The future trend may be to decommission water systems resulting in reduced services at campgrounds.

Due to the aging of buildings, increasing deferred maintenance costs and budget reductions, the trend in direction from the Forest Service Washington Office is to focus on decommissioning facilities and reducing square footage.

Despite the challenges faced in terms of budget limitations and resource protection concerns, the Lincoln NF has generally been able to meet the current plan objectives in the management of administrative facilities and has been successful in providing safe recreational experiences for its visitors. Facilities are provided for employees to work in that are safe and functional. Water and wastewater systems are provided that are meeting all operational safety requirements. Although the

trend for funding is declining, there is no known resource damage occurring as a result of the management of administrative and recreational facilities on the Lincoln NF.

Land Ownership, Status, and Use

Land ownership

Land ownership is the basic pattern of public and private ownership of both surface and subsurface estates and legal restrictions and permissions on the use of the land. It refers to the ownership of land and interests in land. Land status is defined as the ownership record of title to lands, including withdrawals, rights, and privileges affecting or influencing the use and management of National Forest System (NFS) lands.

There are just under 14 million acres of land in the four counties (Otero, Lincoln, Eddy, and Chaves) that encompass the Lincoln NF. Within this expanse, there are distinct patterns of land ownership and use, each of which carries important implications for current and future forest management. The total forest acreage of the Lincoln NF is 1,095,470 acres with 166,425 acres in other ownership within the boundaries.

The Lincoln's three ranger districts are not contiguous with each other, with more than 30 miles separating them. The Smokey Bear Ranger District is bound to the north, west, and east primarily by private land with some State and BLM lands. To the south the district is bound by the Mescalero Apache Indian Reservation and the Village of Ruidoso. The Sacramento Ranger District is bound to the north by the Mescalero Apache Indian Reservation, to the south by the Fort Bliss Military Reservation, and to the west by the City of Alamogordo. In addition, the district is bound to the west, south and east by private land, State land, and BLM land. The Guadalupe Ranger District is bound predominately by BLM land on all sides with some State and private land inter-dispersed. To the south, the district is additionally bound by National Park Service land.

In addition, private inholdings of various sizes are scattered throughout the planning area. For the most part, these private inholdings were created when homestead entries were patented to private individuals. Due to the high number of inholdings within the Lincoln NF boundary and the amount of private land abutting the forest, unauthorized use, trespass, and encroachment occurs along the boundaries. Trespass cases include equipment being stored, roads being created, and entire homes and other structures being built on National Forest System lands.

All four counties in the Lincoln NF area of influence, and most of the neighboring cities and villages, have comprehensive, long-range general plans. Comprehensive plans identify areas as to their suitable status for future residential, commercial, industrial and agricultural development or activities, and in some cases, expectations for coordination of uses between private landowners and Federal agencies administering land in the respective counties.

Land Uses

Many land uses are covered by special use authorizations, which include permits, leases and easements that allow occupancy, or use, on National Forest System lands. Special use authorizations are legal instruments whose terms and conditions are fully enforceable when reasonable and consistent with law, regulations, and policy.

The Forest Service divides management of special uses into two categories, lands and recreation. There are 378 special use authorizations issued on the Lincoln NF, of which 30 percent are for recreation uses. Special uses can be short-term (e.g. recreation event authorizations) or long-term (e.g. ski area permit). There are two ski areas/lifts permitted on the Lincoln NF. Ski Apache is partly located on the Mescalero Apache Indian Reservation, but mostly on the Smokey Bear Ranger District. Ski Cloudcroft is partly on

the Sacramento Ranger District, but mostly on the Village of Cloudcroft land. Both bring substantial economic impacts to the communities of Ruidoso and Cloudcroft during the winter months, an important influx of money during normally low visitor use months.

Access

Access to the Lincoln NF is primarily through US Highways, State Highways, County Roads, and Forest Roads. A large portion of the Lincoln NF can be accessed directly from the open NFS roads (30 percent of US Forest System lands within ¼ mile, 52 percent within ½ mile and 77 percent within one mile of these routes).

Reasonable access to private land is a right granted by the Alaska National Interest Lands Conservation Act (ANILCA 1980), which applies to other states besides Alaska. However, this right only applies to a private inholding (i.e. a parcel of private land completely surrounded by NFS land). The Lincoln NF is legally obligated to allow physical access to private property that is identified as an inholding where other reasonable access does not exist. The Forest Service is not required to physically construct an identified access route or to absorb the construction cost, and the manner in which access is provided to a private inholding is a discretionary management decision.

Rights of Way

The Lincoln NF has a ‘checker board’ style of non-US Forest Service lands within its boundaries and as such has a significant access need. The Lincoln NF currently has 206 access road and trail easements across private land. There are a number of acquired Rights-of-Way (ROW) in place but a number more that could be acquired.

Energy Resources, Mineral Resources, and Geologic Hazards

Energy and Energy Facilities

The U.S. Department of Energy and the National Renewable Energy Laboratory (NREL) have published wind and solar resource maps for New Mexico, depicting wind resources for potential future industry development. NREL identified the Lincoln NF as a National Forest Unit with a high potential for the development of two or more solar and wind energy sources. The potential for wind energy is highest on the Guadalupe Ranger District and fair-to-moderate on the rest of the forest. At this time there is not any development of solar or wind energy on the Lincoln NF, but there has been significant development in areas adjacent to the Forest. The New Mexico Renewable Portfolio Standard attracted industry to the region by offering incentives for companies to invest. As of 2016, there is a utility-scale solar plant in all four counties generating a total of 29.9 megawatts of power. Two more facilities are permitted for development in the near future and two are pending approval. The Anderson Wind Project, in Chaves County, is currently operating with a capacity of 15.0 megawatts.

There are currently no hydroelectric or geothermal facilities on the Lincoln NF or within the four county area of interest with none predicted in the future. Potential for hydroelectric development within the plan area is extremely low due to the lack of water resources on the Forest.

Small diameter wood products produced by the Lincoln NF could potentially have great social value by creating another local economy while meeting and enhancing restoration efforts. Interest in biomass and other products such as biochar has grown and the technology has improved. In the past ten years, Otero and Lincoln Counties have investigated the feasibility of woody biomass facilities, but thus far nothing has emerged. The Lincoln NF, in combination with other sources, has great potential to supply woody biomass for local industries.

Minerals

The Lincoln National Forest has a long history of mining. There were selected areas within the Smokey Bear Ranger District that were historically mined, including in the White Oaks, Nogal, and Gallinas Mining Districts, which produced significant amounts of precious and heavy metals (i.e., gold, silver, lead and copper) in the early 1900s. Lesser districts such as Oscuro, Jicarilla, and Schelerville produced metals intermittently in the late 1800s to early 1900s. World War II caused a revival of mining for a limited time in these districts but economic conditions limited production following the war. The known deposits of the area do not favor economic exploitation and the sporadic production and irregular prospecting history likely preclude the development of major mines in the area. Mineral activity now consists of individual prospecting by claimants, primarily in the Jicarilla district. At present, the Smokey Bear Ranger District has one authorized Plan of Operation for access across a National Forest System road to an iron mine on private lands.

Copper and lead mining contributed to the economy have historically occurred on near the High Rolls area on the Sacramento Ranger District. This largely occurred from 1900 through 1945 and has declined since World War II. There are currently no active mines on the Sacramento or Guadalupe Ranger Districts.

Leasable minerals are subdivided into two classes: fluid and solid. The most common fluid leasable minerals include oil and gas resources, geothermal resources, oil shale, and tar sands. Solid leasable minerals include coal, sodium, potassium, and phosphate. Coal mining was once a prosperous industry in Lincoln County in the White Oaks area and extensive coal deposits were found near Capitan in the late 1800s. From the late 1800s to the early 1900s Lincoln County was the third-ranking producer of coal in New Mexico. Coal beds were found to be interrupted by numerous faults and dikes, making them difficult to mine and that led to closing of the majority of the coal mines in the early 1900s. The White Oaks District continued to produce coal for local use, including generating electric power for the town of Carrizozo until 1939. It is unlikely any future coal mining will occur due to economic costs and value of the resource. Currently, there are no oil or gas leases on the Lincoln NF and no leases for solid resources either.

Mineral materials, such as sand, gravel, and other common variety materials, fall under the category of “saleable” mineral resources. Forest Service policy is to make mineral materials on National Forest lands available to the public and to local, State, and Federal government agencies where reasonable mitigation of effects on other resources is assured and where disposal of these commodities is allowed by forest plans. In general, mineral materials are disposed through a sales contract, personal use permit, or a free use permit. Unlike locatable minerals (due to the 1872 Mining Law), disposal of mineral materials on National Forest System lands is discretionary.

There is one active commercial salable minerals pit on the Lincoln NF on the Sacramento Ranger District. The Apache Pit gravel site covers approximately 18 acres and has operated for more than 20 years. In 2011, a pit expansion plan was developed for future use based on the available material (approximately 1.5 million cubic yards) for an estimated 30 years of additional operation.

Transmission Corridors

There are numerous sub-transmission, distribution, and unground transmission lines across the Lincoln NF serving local communities and neighboring counties. There are currently no high voltage transmission lines (greater than 229 kilovolts) crossing the Forest. Within Lincoln County, the SunZia Southwest Transmission Line, two 500 kilovolt overhead parallel lines and substations, serve southwest New Mexico and southern Arizona. Another major transmission line, a 345 kilovolt line, crosses Otero, Chavez, and Eddy Counties serving western Texas and southern New Mexico. Additional development of

renewable energy could max out existing transmission corridors, which could prompt a need for new transmission lines over Forest Service lands.

Abandoned Mines and Geologic Hazards

The main geologic hazards of the Lincoln NF are flash flooding, rock falls and debris flows. All of these to an extent have affected roads, trails, recreation areas, and infrastructure. Recreation residences on the Smokey Bear Ranger District have been impacted by flash flooding and debris flows. Widely unregulated, production from mines throughout the Lincoln NF yielded a variety of metals and minerals with booms in the late 1800s and again during World War II. The decline of mining since in mid-19th century has left behind hundreds of abandoned mines, many on National Forest System lands. The Southwestern Region and the Lincoln NF have an active abandoned mine land (AML) program with the program priorities being closing AML sites near trails, campgrounds, roads, and any other populated areas. Over the past 20 years, about 50 abandoned mine features on the Lincoln NF have been addressed, including mines currently being closed in the Smokey Bear Abandoned Mine Lands (AML) project.