

# 2020 New Mexico Forest Action Plan

*A Collaborative Approach to Landscape Resilience*



September 2020



Energy, Minerals and Natural Resources Department



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Thinning project in mixed conifer forest near Gascon, NM. © Shannon Atencio/NMFD

# Acronyms

ABCWUA	Albuquerque Bernalillo County Water Utility Authority	NHNM	Natural Heritage New Mexico
AD	Administratively Determined	NMDGF	New Mexico Department of Game and Fish
BAER	Burn Area Emergency Response	NMED	New Mexico Environment Department
BEMP	Bosque Ecosystem Monitoring Program	NMFD	New Mexico Forestry Division
BIA	Bureau of Indian Affairs	NMFWRI	New Mexico Forest and Watershed Research Institute
BLM	Bureau of Land Management	NMHU	New Mexico Highlands University
BMP	Best Management Plan/Practices	NASF	National Association of State Foresters
BOR	Bureau of Reclamation	NMYCC	New Mexico Youth Conservation Corps
CDT	Continental Divide Trail	NPS	National Park Service
CDTC	Continental Divide Trail Coalition	NRCS	Natural Resource Conservation Service
CSP	Conservation Science Partners, Inc.	PODS	Potential Operational Delineations
CWPP	Community Wildfire Protection Plan	PRC	Public Regulation Commission
ECMD	Energy, Conservation and Management Division (EMNRD)	RECA	Rural Electric Cooperative Association
EDD	Economic Development Department	RFP	Request for Proposals
EDD/ORD	Economic Development Department, Outdoor Recreation Division	RHP	Returning Heroes Program
EDRR	Early Detection and Rapid Response	RMP	Resource Mobilization Plan
EEANM	Environmental Education Association of New Mexico	RMYC	Rocky Mountain Youth Corps
EMNRD	Energy, Minerals, and Natural Resources Division	ROW	Right-of-Way
EQIP	Environmental Quality Incentives Program	SFO	State Forester's Office or Santa Fe Office
ERT	Environmental Review Tool	SLO	State Land Office
ESD	Ecological Site Description	SMART	Stewardship Mapping and Reporting Tool
FCC	Federal Communications Commission	SWCD	Soil and Water Conservation District
FEMA	Federal Emergency Management Agency	SWERI	Soil, Water and Environment Research Institute
FFA	Future Farmers of America	TEUI	Terrestrial Ecosystem Unit Inventory
FHWA	Federal Highway Administration	TNC	The Nature Conservancy
FWMCG	Forest and Watershed Management Coordinating Group	TSP	Technical Service Provider
FWRI	Forest and Watershed Restoration Institute	UNM	University of New Mexico
GAP	Gap Analysis Project (USGS)	URGWOM	Upper Rio Grande Water Operations Model
ISC	Institute of Cognitive Science	USACE	United States Army Corps of Engineers
IWSRC	Interagency Wild & Scenic Rivers Council	USBR	United States Bureau of Reclamation
MMD	Mining Minerals Division	USFS	United States Forestry Service
MOU	Memorandum of Understanding	USFWS	United States Fish and Wildlife Service
MSI	Mountain Studies Institute	USGS	United States Geological Survey
NGO	Non-Governmental Organizations	UTF	Unable to Fill
NGTOC	National Geospatial Technical Operations Center (USGS)	WFSS	Wildland Fire Decision Support System
		WGA	Western Governors' Association
		WFLC	Wildland Fire Leadership Council
		YCC	Youth Conservation Corps

# Plant and Animal Names

Scientific names of plants and animals mentioned in the New Mexico Forest Action Plan. Because these names are scattered through this reference document, the scientific names are included in this list, rather than through the document at first use.

## Plants

Common Name	Binomial	Synonyms	Group
alligator juniper	<i>Juniperus deppeana</i>		trees
aspen	<i>Populus tremuloides</i>		trees
blue spruce	<i>Picea pungens</i>		trees
bristlecone pine	<i>Pinus aristata</i>		trees
corkbark fir	<i>Abies lasiocarpa</i>	sub-alpine fir	trees
douglas-fir	<i>Pseudotsuga menziesii</i>		trees
Engelmann spruce	<i>Picea engelmannii</i>		trees
Gambel oak	<i>Quercus gambelii</i>		trees
limber pine	<i>Pinus flexilis</i>		trees
ponderosa pine	<i>Pinus ponderosa</i>		trees
Rio Grande cottonwood	<i>Populus deltoides</i> ssp. <i>wislizeni</i>	<i>Populus wislizeni</i>	trees
Rocky Mountain juniper	<i>Juniperus scopulorum</i>		trees
Russian olive	<i>Elaeagnus angustifolia</i>		trees
saltcedar	<i>Tamarix</i> spp.		trees
southwestern white pine	<i>Pinus strobiformis</i>		trees
twoneedle pinyon	<i>Pinus edulis</i>		trees
wavyleaf oak	<i>Quercus X pauciloba</i>	<i>Quercus undulata</i>	trees
white fir	<i>Abies concolor</i>		trees
blue grama	<i>Bouteloua gracilis</i>		grasses
buffalo grass	<i>Bouteloua dactyloides</i>	<i>Buchloe dactyloides</i>	grasses
bush muhly	<i>Muhlenbergia porteri</i>		grasses
little bluestem	<i>Schizachyrium scoparium</i>		grasses
switchgrass	<i>Panicum virgatum</i>		grasses
sand blue stem	<i>Andropogon hallii</i>		grasses
western wheatgrass	<i>Pascopyrum smithii</i>	<i>Agropyron smithii</i>	grasses
galleta	<i>Pleuraphis jamesii</i>	<i>Hilaria jamesii</i>	grasses

## Animals

Common Name	Binomial	Synonyms	Group
pinyon jay	<i>Gymnorhinus cyanocephalus</i>		bird
juniper titmouse	<i>Baeolophus ridgwayi</i>		bird
Virginia's warbler	<i>Leiothlypis virginiae</i>		bird
Woodhouse's scrub-jay	<i>Aphelocoma woodhouseii</i>		bird
gray vireo	<i>Vireo vicinior</i>		bird
spruce beetle	<i>Dendroctonus rufipennis</i>		insects
spruce budworm	<i>Choristoneura freemani</i>		insects
fir engraver	<i>Scolytus ventralis</i>		insects





Capitan Timber Management Officer Frank Silva with cooperators on a thinning project in Timberon, NM. © Nick Smokovich/NMFD



# Executive Summary

The New Mexico Energy, Minerals and Natural Resources Department (EMNRD) Forestry Division and their many partners worked together to create this 2020 New Mexico Forest Action Plan. The plan provides an assessment of the current conditions of our natural resources and sets forth all-lands strategies that address key issues in forest and watershed management in a changing climate.

States are required by the USDA Forest Service (as authorized by the federal Farm Bill) to develop a Forest Action Plan on a recurring 10-year plan cycle. This 2020 plan builds upon the first plan developed in 2010. Two notable differences between the 2010 and 2020 plan are that this plan provides:

1. a vision and next steps for collaboration between agencies and organizations and is not just intended to guide the actions of the Forestry Division alone; and
2. strategies and priorities to implement the Agreement for Shared Stewardship signed by New Mexico Governor Michelle Lujan Grisham and USDA Forest Service Chief Vicki Christiansen on November 14, 2019.

The Agreement for Shared Stewardship strengthens an already solid partnership between the State of New Mexico and USDA Forest Service and establishes the Forest Action Plan as the primary tool to guide co-management of forests and watersheds in the state.

The 2020 New Mexico Forest Action Plan supports the Energy, Minerals, and Natural Resources Department's Strategic Plan and works within the context of other state plans, such as the New Mexico State Wildlife Action Plan, State Water Plan, Nonpoint Source Management Plan, and Statewide Comprehensive Outdoor Recreation Plan. The Division also incorporated new programs created in 2019 and 2020 at the Office of Outdoor Recreation (Economic Development Department) and Healthy Soil Program (New Mexico Department of Agriculture).

This plan further supports Governor Michelle Lujan Grisham's Executive Order 2019-003 addressing Climate Change and Energy Waste Prevention. The Forestry Division is charged with integrating climate mitigation and adaptation practices related to natural and working lands into state agency operations and promoting forest and watershed management that will help ensure the long-term sustainability and resilience of New Mexico's natural and working lands and reduce the vulnerability of natural resources and communities to climate risks.



Emily Fire in Turkey Mountains © Carmen Austin/NMFD



The Assessment (Chapter 2) section of the Forest Action Plan provides a geospatial analysis of the conditions and trends of forests and other natural resources in New Mexico as well as threats to forested lands, natural and cultural resources, life and property. The Assessment used over 200 layers of data collected from dozens of sources to look at eight themes, each with a stakeholder group that guided the use of the data. These themes were paired with eight key threats to help identify vulnerabilities. The analysis and some original data sets are included in an on-line Data Atlas, providing easier public access to the Assessment information than was previously possible.

The ultimate purpose of the Assessment is to gather and consider the best science available for developing Strategies (Chapter 3) and other decision making. The Assessment identifies high risk areas where hazards pose the greatest threat to resources, and priority areas where strategies can be implemented to protect and enhance public benefit from natural resources.

The ten strategies set forth in this 2020 plan are:

1. **Restore Forests and Watersheds** addresses the legacy of fire exclusion and current land conditions to mitigate catastrophic wildfires burning much hotter than previously experienced with forest management treatments.
2. **Fire Management** restores the ecological role of fire to foster resilient landscapes and watershed health; sustains wildfire response on state and private lands; supports regional, state, and national wildfire response on all jurisdictions; and fosters collaboration of post-fire response after high severity wildfire.
3. **Private Land Stewardship** provides strategies to improve and support private land stewardship and provide services to assist landowners, including both government agencies and non-governmental organizations (NGOs), with tools for resource stewardship that contributes substantial public benefits.
4. **Utility Rights of Way** addresses the risk of wildfire ignition and threat of damage to utility infrastructure by increasing vegetation management along right of ways.
5. **Rare Plants** are addressed by incorporating key actions from the Division's Rare Plant Conservation Strategy to ensure protection of New Mexico's extraordinary plant diversity.
6. **Reforestation** addresses the need to reforest burned areas and bridge the state's reforestation backlog, and to do so with seedlings that will mature into trees capable of withstanding the anticipated growing conditions of the future.
7. **Urban Forests and Communities** addresses the need for trees where 80% of New Mexicans live and obtain essential benefits such as cooling shade, clean air and stormwater runoff reduction.
8. **Restoration Economy** is the driving force behind forest management activities and addresses the need to invest in workforce development for all of these strategies, and to rebuild and retool forest industry and wood processing to capture the by-products of restoration and manage forests for resilience in changing climate conditions.
9. **Land Conservation** provides a statewide blueprint for land conservation to guide the investment of state and federal funds to provide tax credits for conservation easements or purchase land or easements and increase collaboration among local government agencies, non-governmental organizations, and land trusts.
10. **Outdoor Recreation** is positioned to become a major economic driver in the state and the strategy identifies the importance of forest management to provide beautiful and safe places for recreation.

In addition to identifying ten strategies to address the natural and human-caused threats considered in the Assessment, the plan also identifies priority landscapes for the application of the strategies. The Assessment models were augmented with a Scenario Investment Planning (SIP) process supported by the

Rocky Mountain Research Station (RMRS) National Fire Decision Support Center and vetted by local subject matter experts. The effort generated a set of priority landscape maps (Chapter 4) that include:

1. **Priority Landscapes** for restoration across all jurisdictions with forest and woodland cover types and identifies the top 500 watersheds in the state ranked by wildfire risk and importance for water source protection and biodiversity. These priority landscapes account for approximately 20% of all watersheds at risk.
2. **Shared Stewardship** for high priority landscapes on National Forest System lands and adjacent lands and identifies the top 250 watersheds in the state ranked by wildfire risk and importance for water source protection and biodiversity.

The Assessment, Strategy and Priority Landscapes chapters provide information to guide all forest and watershed managers in the state to invest and leverage resources where they will garner the greatest benefit. This plan will guide partners in planning, funding and conducting restoration activities across jurisdictions over the next 10 years.

The Forestry Division acknowledges the vast gifts of expertise, opinion, and assistance from over a hundred individuals statewide via the Forest and Watershed Coordinating Group. The breadth and depth of this plan is attributable to the diverse participation from many stakeholders.



Forests near Taos, NM. © Laura McCarthy/NMFD

# I. Introduction

New Mexico, like other western states, faces urgent issues concerning forests and watersheds, including catastrophic wildfires, invasive species, epidemic insect outbreaks, and changing climate conditions. Increasing severity of wildfires are expanding risk to communities, firefighters, and natural resources — especially water supply. Scarce, but precious, surface and ground water are of utmost importance.

The State Energy, Minerals and Natural Resources Department (EMNRD) Forestry Division has collaborated with many partners to develop this *2020 New Mexico Forest Action Plan* (NMFAP or the Plan) to provide the most current analysis of the condition of our natural resources, and develop strategies for the next decade on how best to address identified issues in forest and watershed management, including our urban and community forests.

The *2020 New Mexico Forest Action Plan* is built on previous plans and lays the foundation for future plans. Most importantly, this plan provides today's best assessment of resources, identifies current issues, and outlines collaborative and calculated strategies and actions to achieve a shared vision of forest resilience. Although this Plan represents a continuance of values and actions that place healthy resilient forests in New Mexico as a guiding beacon, this Plan in many ways represents a departure from the 2010 plan (the forest action plan in 2010 was titled: *New Mexico Natural Resource Assessment, Strategy and Response Plan*). The key difference, besides access to better data and analysis tools, is that this is a plan for a collaboration of agencies and organizations, and not just intended to guide the actions of the Forestry Division.

This plan supports Governor Michelle Lujan Grisham's *Executive Order 2019-003* addressing Climate Change and Energy Waste Prevention. This Executive Order recognized that the impacts of climate change create new risks and exacerbate existing vulnerabilities in communities across New Mexico and present growing challenges for human health and safety, quality of life, and economic growth.

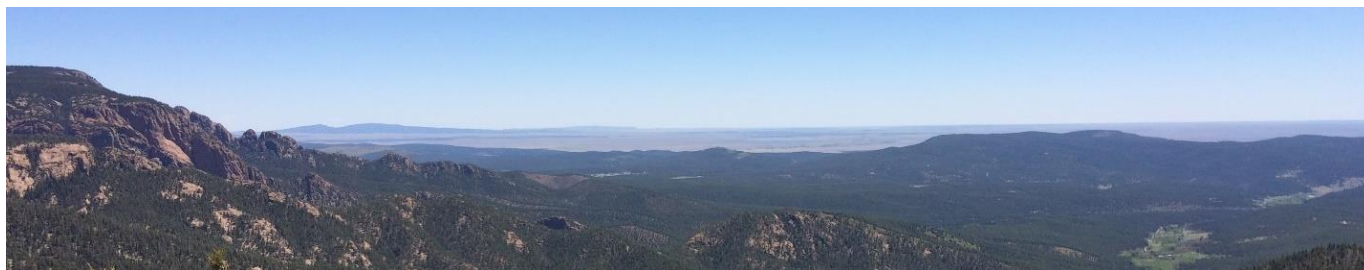
In order to meet the intent of the Executive Order and to further alleviate climate impacts, a myriad of strategies will be implemented to reduce greenhouse gas emissions. Several of the strategies presented in this plan focus on the reduction of CO<sub>2</sub> from the atmosphere via science-based forest management practices. There are two main components to this strategy: a) reduction of CO<sub>2</sub> emissions associated with wildfires by properly reducing fuels and managing forest densities (Strategies 1, 2, & 8) and b) sequestration of CO<sub>2</sub> through reforestation efforts on severely disturbed forest lands (Strategy 6) and tree management in urban areas (Strategy 7).

The *2020 New Mexico Forest Action Plan* also supports the Energy, Minerals, and Natural Resources Department's Strategic Plan. Other documents that guide New Mexico Forestry Division programs that are referenced in this plan include the *New Mexico Rare Plant Conservation Strategy* (2017) and the *Urban and Community Forestry Program Strategic Plan* (2016 NMFD and NM Urban Forest Council). The Forestry Division also has



IWC crew burning at Blue Hole Cienega © Daniela Roth/NMFD





Mountains and forest near Santa Fe © Carmen Austin/NMFD

annually updated guiding documents such as the *Fire Policy* and the *New Mexico Resource Mobilization Plan*. In addition, the Plan works within the context of other state plans. The Division reached out to sister agencies to make sure that action items in this plan conform with or complement existing plans. Examples of relevant state plans include: the *New Mexico State Wildlife Action Plan* (Department of Game and Fish, 2016), *State Water Plan* (Office of the State Engineer, 2019), *New Mexico Nonpoint Source Management Plan* (Environment Department, 2019), and the *New Mexico Comprehensive Outdoor Recreation Plan* (State Parks, in development). The Division also coordinated with Office of Outdoor Recreation (Economic Development Department), and Healthy Soil Act Program (New Mexico Department of Agriculture).

The collaborative processes called for in the NMFAP are designed to help the Division avoid actions that conflict with plans guiding federal agencies. The NMFAP recognizes local land planning undertaken by counties, municipalities, and soil and water conservation districts, including Community Wildfire Protections Plans (CWPPs) developed through a critical planning process at the county or local community level. CWPPs both inform and are informed by the NMFAP. This plan also lays out strategies that implement the collaborative policies of and the three tenets of the National Cohesive Wildland Fire Management Strategy: building resilient landscapes; fire adapted communities; and safe and effective wildland fire response. Concepts from these documents provide foundational underpinnings for this Plan.

The audience for this Plan is presumed to be primarily resource managers and partners engaged

in the day to day work of stewarding forests and watersheds. However, the Background Chapter contains a more thorough description of the state's resources as they relate to forests and some of the underlying processes that define our forest ecosystems and various challenges to resiliency. This Chapter may be the starting point for individuals who are new to the state or forest management.

In addition to the simple wisdom of utilizing planning to guide implementation, there are a few expectations that guide this planning process. The 2008 Farm Bill requires State Forestry agencies to develop Forest Action Plans on a recurring 10-year plan cycle, with the first plans developed in 2010. The *2005 New Mexico Forest and Watershed Health Plan* identified the need for an in-depth assessment and plan for watershed management in the state. In combining these planning needs, New Mexico has taken a broad landscape/watershed approach to natural resource planning within the Forest Action Plan.

The Forest Service's State and Private Forestry guidelines require Forest Action Plans to address these priorities: 1) conserve and manage working forests for multiple values and uses, 2) protect forest from threats, and 3) enhance public benefits from trees and forests. As in 2010, with a nod to the interrelatedness of New Mexico ecosystems, the modified national priorities for this plan are: 1) conserve and manage working landscapes, 2) protect natural resources from threats, and 3) enhance public benefits from natural resources.

In 2010, the process was divided in three parts: Assessment, Strategy, and Action Plan. The Assessment was a wall-to-wall, all-jurisdictions

approach while the Strategy and Action Plans were targeted specifically on the actions of the Forestry Division. With a decade of increased collaboration and partnerships, the 2020 plan takes the same wall-to-wall approach, but extends the combined Strategy/Action plan to include collaborative actions that can be undertaken by the Division and the Division’s partners.

In both 2010 and 2020, the Forestry Division contracted The Nature Conservancy (TNC) to assist in assessment and plan development. Similarly, both plans have been developed with stakeholder and partner participation. A core Forest Action Plan team (the Core Team) consisted of staff of the Forestry Division and The Nature Conservancy.

The *2005 New Mexico Forest and Watershed Health Plan* called for the development of a Forest and Watershed Health Coordinating Group made up of natural resource agencies and other interested parties in the state. This Coordinating Group is an active body with wide representation that meets quarterly and has guided collaborative watershed restoration within the state since 2005. The Division elected to use this body, which is already established and open to anyone, as the vehicle for stakeholder engagement and involvement (see Table 1). In addition, the New Mexico Forest Stewardship Committee and the State Technical Committee (hosted by the Natural Resources Conservation Service) have been engaged in the development of this plan.

Table 1. Organizations participating in the stakeholder process.

2-3-2 Cohesive Strategy Partnership	NM Department of Game and Fish
Albuquerque Bernalillo County Water Authority	NM Department of Health
Audubon New Mexico	NM Department of Homeland Security and Emergency Management
Boss Reclamation	NM Department of Transportation
Bureau of Indian Affairs	NM Economic Development Department, Outdoor Recreation Division
Bureau of Land Management	NM Environment Department, Drinking Water Bureau
Bureau of Reclamation	NM Environment Department, Surface Water Quality Bureau
Cañon de Carnuel Land Grant Merced	NM Office of the State Engineer
Center for Biological Diversity	NM State Land Office
Cerro Negro Forest Council	NMSU Cooperative Extension Service
Chama Peak Land Alliance	NMSU Forestry Research Center
City of Santa Fe Fire Department	Otero County Electric Cooperative
City of Santa Fe Water Division	Public Service Company of NM
Colorado Forest Restoration Institute	Pueblo of Acoma
Conservation Voters New Mexico	Pueblo of Isleta
Defenders of Wildlife	Pueblo of Jemez
Ecotone Landscape Planning	Pueblo of Laguna
Edgewood SWCD	Pueblo of Nambe
EMNRD Forestry Division	Pueblo of Sandia
EMNRD Mining and Minerals Division	Pueblo of Santa Ana
EMNRD Youth Conservation Corps	Pueblo of Santa Clara
Forest Stewards Guild	Pueblo of Tesuque
General public/non-affiliated	Rio Puerco Management Committee
Holly von Winkel Cut and Dry Lumber	Rocky Mountain Youth Corps
Mescalero Apache Tribe	SAKAK Natural Resource Consulting
METI - USFS	San Juan-Chama Watershed Partnership
Mountain Studies Institute	Sierra Club
National Wildlife Federation	South Central Mountain RC&D
Native Plant Society of NM	SWCA
Natural Heritage New Mexico	Taos County
Natural Resources Conservation Service	The Nature Conservancy
New Mexico Association of Conservation Districts	Tree Recycling
New Mexico Coalition of Conservation Districts	Trout Unlimited
New Mexico Farm and Livestock Bureau	University of New Mexico, Department of Biology
New Mexico Forest and Watershed Restoration Institute	US Forest Service, SW Region <sup>1</sup>
New Mexico Forest Industry Association	USFS Cibola National Forest
New Mexico Land Grant Council	USFS Lincoln National Forest
New Mexico Rural Water Association	USFS Santa Fe National Forest
New Mexico Wildlife Federation	US Geological Survey
NM <sup>2</sup> Department of Agriculture	

<sup>1</sup>USFS Regional teams involved: BAER, Botany, Coop Forestry, CFRP, Fire-Fuels-Aviation, Fisheries, Forest Health, Forest Products Modernization, GIS, Range, Recreation, Regional Partnerships Program, Restoration Partnerships, Soils, Watershed, Planning

<sup>2</sup>State government agencies are noted in this list using the abbreviated NM, while organizations with names that begin with New Mexico are spelled out.





Forest and Watershed Coordinating Group working on strategies. © Mary Stuever/NMFD

*The Forest and Watershed Health Coordination Group spent nearly a year providing input to the New Mexico Forest Action Plan.*

For more than a decade, natural resource management agencies participating in the Coordinating Group have been rethinking and retooling the approach to forest and watershed management in New Mexico. This approach recognizes the inseparability of ecological, social and economic sustainability. It strives to be collaborative, to base decisions on best available science, and to coordinate plans and actions at the landscape scale. This approach requires trust and up-front investment of time and energy, but it also brings to bear broader experience and knowledge. Utilizing the Coordinating Group as the foundation for stakeholder outreach in developing this plan continues this important process.

State officials invited any interested stakeholders to join the Coordinating Group throughout the review process. Specific outreach targeted natural resource management agencies, land grants, tribal communities, and environmental, sportsmen, and land conservation organizations. This outreach brought in many tribal representatives, expanded participation from local, state, and federal agencies, and attracted additional non-profit organizations and individuals.

Throughout New Mexico, collaborative groups are working on specific landscapes and or issues. Many of these groups have developed or come together in the last decade such as the Greater Santa Fe Fished Coalition or the San Juan Chama Watershed Partnership. Much coordination and cooperation also exist with many long-established groups such as the state's 47 Soil and Water Conservation Districts and the eight Resource Conservation and Development Councils. Some groups span state lines such as the Malpai Borderlands Group in the New Mexico bootheel and adjacent parts of Arizona or the 2-3-2 Cohesive Strategy Partnership in the San Juan Mountains of New Mexico and Colorado. More than 50 community-based collaborative organizations and watershed groups exist in New Mexico locally and regionally working to improve their communities and natural environments<sup>1</sup>.

Funding programs and opportunities for collaborative projects is also expanding. Programs tend to target specific jurisdictions, locations, or treatments. Some programs such as Restore New Mexico and the Collaborative Forest Restoration Program provide federal funding uniquely designated for New Mexico. Many federal programs, such as the Joint Chiefs' Landscape Restoration

<sup>1</sup> Visit [nmfwri.org/collaboration/new-mexico-collaborations](http://nmfwri.org/collaboration/new-mexico-collaborations) for more information about these collaboratives.

Partnership, the Regional Conservation Partnership Program, and the Collaborative Forest Landscape Restoration Program, provide competitive national funding opportunities requiring significant proposal preparation ensuring broad collaborative input. State initiatives include Water Trust Board grants and funding through the Forest and Watershed Restoration Act of 2019. One common goal of project managers is to pair federal grants with state or private funds to provide match and leverage greater accomplishments for all partners and funders.

Comprehensive assessment and planning are essential to successfully securing grant funding. This Plan should not only help those requesting funds justify the priority and need for their projects, but also help funders target money to high priority landscapes. As funders have varied and specific objectives, this plan has been developed to identify priority areas by various themes, objectives, and strategies. This complexity is necessary to help funders put money into projects that match the desired objectives.

In November 2019, the USDA Forest Service and State of New Mexico signed an Agreement for Shared Stewardship (Appendix C). The agreement strengthens an already solid partnership between the two entities and establishes a framework to allow state and federal governments to co-manage wildfire and other forest health risks across the land more efficiently. Prior to signing the agreement, state officials reached out to the Pueblos, Tribes and Nations in New Mexico and to the New Mexico Land Grant Council for input. The agreement identifies the need and process for land grant and tribal engagement in the collaboration. Under this agreement, Forest Service managers and researchers actively participated in the development of this plan.

The Forest Service Rocky Mountain Research Station utilized an emerging analysis tool, the Scenario Investment Planning Platform, to help the Forestry Division develop priority maps that consider risk of wildfire to communities, water supply, and biodiversity. The resulting report will be

available as a USDA General Technical Report (Appendix D). The scenario planning analysis was used not only to create the Shared Stewardship Priority map (Map 46) but also the Forest Stewardship map for private lands (Map 49), the Forest Legacy and the Land Conservation priority maps (Map 51).

This Assessment and Strategy benefit from recent advances in science, tools, and data. Many of the high-priority data gaps that were identified in the 2010 Forest Action Plan have been filled. Priority data gaps that were resolved in the past decade include high resolution soils data, improved habitat connectivity models, water-provisioning ecosystem service models, recent and complete Forest Inventory Analysis data, improved riparian corridor maps, high-resolution urban tree canopy maps, improved erosion hazard models, consistent wildfire hazard data, a comprehensive vegetation treatment database, and statewide values at risk maps.

Besides the new and improved data available for natural resources planning, there are advances in the science used to model the resources and threats assessed in the Forest Action Plan. Stochastic fire simulation tools simulate thousands of possible fire seasons, whereas a decade ago, single problem fire scenarios were the best available tool for modeling fire hazard. Ecosystem service models have advanced, allowing this assessment and plan to use high resolution models of the sources and beneficiaries of water resources. Satellite imagery used for remote sensing and the tools available to process that imagery have evolved to allow rapid monitoring of forest conditions and trends.

The quantitative risk assessment framework and resulting data atlas underlying the Forest Action Plan set the stage for a leap forward in science-based priority setting. This framework enables NMFDF and its collaborative partners to set priorities with transparent rationale. The tools and data used to set priorities are open and accessible.

The wall-to-wall, all-jurisdiction approach to this Forest Action Plan is ideal for developing and promoting cross boundary projects within New Mexico. The Plan outlines a framework for achieving a vision of forest and watershed health that incorporates ecological, social and economic considerations. It requires working across agency jurisdictions, ownership boundaries, cultural divides, and ecosystem types; applying best science in ecological restoration methods; and using collaboration, teamwork, persistence and continual learning. The Core Team shared methodology with Colorado's Forest Action Plan team in hopes that plans from both states can be useful in cross state boundary projects as well. Colorado contains important headwaters for the Rio Chama (including watersheds that feed the San Juan-Chama Diversion), San Juan River, and the Rio Grande. New Mexico is engaged in collaborations focused in these watersheds.

The knowledge that the climate is changing and will most likely be hotter—and possibly have unusual precipitation patterns different from the past—permeates this plan. With this knowledge comes an urgency to act, as healthy trees and forests are better positioned to withstand the changing climate. In addition to looking towards the future, the legacy of past fire exclusion within our forests also underlies the urgency to act and is the driver of many of the strategies within this plan. A description of the causes and impacts of fire exclusion is included in the Background Chapter of this plan.

Likewise, the Plan recognizes the necessity of protecting New Mexico's rivers and streams through responsible upland management protective of water quality. Water supply is intrinsically linked to water quality; degraded streams and aquifers cannot fulfill communities' need for clean, safe water. Water security in the future is a key concern of an arid state.

Both climate change and fire exclusion have created fuel conditions and fire behavior that is unprecedented, creating large burn scars on the landscape. In a pattern that started in the late 1990's, wildfires continue to grow larger, burn hotter, and leave vast areas denuded of trees and vulnerable to debris flow. When exposed soil is washed away by monsoon rainstorms, often the result is unrestorable—and thus transitioning—ecosystems.

Although this plan is deeply grounded in Western science, data, and analysis, there is also an acknowledgement of non-western alternatives to knowledge bases. Through stakeholder involvement, and hours of review and conversations, this Plan also represents professional expertise, traditional knowledge, and common sense encapsulating the spirit of New Mexico and the deeply rooted traditions of land and natural resource management.



A dry mixed conifer meadow in the Manzano Mountains © Susan Rich/NMFD



# II. Natural Resources Assessment

The Natural Resources Assessment section of the Forest Action Plan provides a geospatial analysis of the conditions and trends of forests and other natural resources in New Mexico as well as threats to forested lands, natural and cultural resources, life and property.

The Assessment gathers and considers known information to provide the best science available for developing Strategies (Chapter 3) and other decision making. The Assessment identifies high risk areas where hazards pose the greatest threat to resources, and priority areas where strategies can be implemented to protect and enhance public benefit from natural resources. Summaries of each resource and threat are provided in this chapter. See the Data Atlas for detailed metadata documenting this Assessment.

## Resource Assessment Framework

This assessment is structured as a spatial risk assessment, mapping the resources and assets that are valued and the hazards that threaten them. A framework developed for wildfire risk assessments (*Scott, Thompson, and Calkin 2013*) has been adapted for reference across a broad range of hazards. A spatial risk assessment framework requires mapping both valued resources and assets and the hazards that threaten them. Additionally, the susceptibility of each resource to each threat must be characterized.

New Mexicans have a strong connection to the land and natural resources of the state. Resources and assets valued by New Mexicans vary widely, from homes to watersheds and ski slopes to forage production. This Assessment maps the spatial distribution of valued resources and assets across the landscape. The value of some resources like

homes, habitat, or timber is directly mappable, while a modeling approach must be used for compound resource values (like runoff for irrigation) where value is derived both from the source of the resource and the beneficiary of the resource.

At the start of the Forest Action Plan development process, the Division extended an open call for spatial data to partners, scientists, and other subject matter experts. This yielded hundreds of datasets mapping many resources and assets. The Forestry Division convened panels of technical experts to select the datasets and methods best suited for mapping the value of a broad category of resources, referred to as a “Theme.” Resources and assets were grouped into eight themes by common beneficiaries or resource mapping similarity (Table 2). Full theme descriptions and summaries are provided in the Resources and Assets section of this chapter.

Table 2. Themes used to organize the resources and assets data.

<b>Wildland Communities</b>	Structures, infrastructure, and other life and property values are mapped in this theme.
<b>Recreation and Cultural Use</b>	The resources and infrastructure relied on for hunting, fishing, trapping, and recreation like hiking, mountain biking, and camping are mapped in this theme. New Mexicans benefit directly from these resources and from the outdoor industries that they sustain.
<b>Biodiversity</b>	Habitat for terrestrial, aerial, and aquatic animals, and plants are valued for the biodiversity they sustain. This model maps the value provided by our forests to plants, animals and biodiversity.
<b>Water Quality and Supply</b>	Watersheds provide water for irrigation and public water supplies; additionally, water supplied through river networks is essential to meet the obligations outlined in interstate compacts and to support aquatic life designated uses.
<b>Urban Forests and Communities</b>	Trees and urban forests provide many benefits to the people that live, work, study, and recreate near them.
<b>Indigenous and Traditional Communities</b>	The communities that are most directly tied to New Mexico’s cultural ancestry are valued for the traditional practices and cultural heritage that they sustain.
<b>Carbon and Soils</b>	New Mexico’s natural and working lands hold tremendous pools of carbon, in the living trees and plants, in down woody debris, and in the soil. Stabilizing and building those pools of carbon in the face of wildfire and climate change will mitigating carbon emissions.
<b>Timber and Grazing</b>	The timber and forage resources are critical to New Mexico’s Timber and Grazing industries.

Our valued resources and assets are threatened by many hazards. Wildfire is the clearest example of a hazard. Wildfires that burn under extreme conditions threaten most resources in the state. The 2011 Las Conchas Fire burned more than 150,000 acres in the Jemez Mountains, destroyed 112 structures including 63 homes and devastated wildlife habitat and critical watersheds. Downstream communities are still dealing with the lingering impacts of that catastrophic wildfire.

Other hazards that threaten natural resources in this state include post-fire hazards like flooding and debris flow, outbreaks of forest pests, climate change, and habitat fragmentation. This assessment examines the expected likelihood and intensity of these hazards. The threat posed by these hazards is typically greatest where likelihood and intensity of disturbance are highest. Different resources are threatened by different hazards (Table 3).

Table 3. Matrix of threats themes and the threats for which risk was mapped. Data has been assembled so that risk can be mapped for all combinations of resources and hazards. Technical panels advised which hazards are the largest threats to the resources included in each theme. The hazards that pose the largest threat are indicated with a hollow or filled square (□, ■). Risk has been mapped for at least one resource within each theme where marked with a filled square (■).

	Hazards							
	Wildfire	Post-fire Debris Flow	Post-Fire Erosion	Post-fire Flooding	Climate Change	Disease and Insects	Development	Use and Activity
Wildland Communities	■	■		■				
Recreation and Cultural Use	■	■						
Biodiversity	■	■	■		■		■	□
Water Quality and Supply	■	■	■					
Urban Forests and Communities					□	□		
Indigenous and Traditional Communities	□	□	□	□	□	□	□	□
Carbon and Soils	■		■					
Timber and Grazing	■					■		

Natural resources respond to disturbances in different ways. For example, low-intensity wildfire is beneficial to ponderosa pine forests and rangelands, while low-intensity fire in a residential neighborhood has the potential to be destructive. Some resources that are damaged by wildfire bounce back relatively quickly following disturbance while others can take a long time or never recover to their pre-disturbance value. In the modified risk assessment approach used for this assessment, only negative impacts of these events are characterized as hazards. Although some disturbances could increase the value of resources and assets and enhance public benefit from natural resources, this risk framework is utilized primarily to identify opportunities to protect resources from harm and provide resiliency to identified threats.

Resources are most at risk to threats where resource value is high, the likelihood and intensity of the

threat are high, and the susceptibility of the resource to the threat is high. To identify the places where resources are most at risk, each resource value map was overlaid with the mapped hazard for each threat to which it is susceptible, the resulting models identify high-risk areas for each resource to help prioritize investments in protecting resources against threats.

Risk to multiple resource can be synthesized using the relative value of each resource to produce an overall risk map showing areas where there are high concentrations of resource exposure to threats. A survey was conducted to elicit the relative importance of New Mexico’s valued assets and natural resources. This information could be used to develop a single risk to resources map. Several alternative weighting schemes were implemented to identify priority sites for implementing resource protection strategies.



## Collaborative Approach and Stakeholder Engagement

The team convened eight technical panels to guide mapping of resources and characterizing their susceptibility to hazards. Over 100 subject matter experts contributed their expertise on these technical panels. Experts were drawn from tribal, federal, state, and local government agencies, academic institutions, non-profit organizations, industry associations, and the general public (Table 4). To maximize equity and inclusion, technical panel meetings were conducted via videoconference. All interested parties were encouraged to join the technical panels.

Table 4. Organizations represented on each technical panel.

<p><b><u>Wildland Communities</u></b>                      NMFD                      Timmons Group                      NM Rural Water Users Assoc.                      Forest Stewards Guild                      NMDHSEM                      USFS R3                      City of Santa Fe                      BLM                      Edgewood SWCD</p>	<p><b><u>Recreation and Cultural Use</u></b>                      NM Department of Game &amp; Fish                      NM Tourism Department                      US Forest Service R3                      NM State Parks                      NM Outdoor Rec. Division                      NM Dept. of Transportation                      Pueblo of Laguna                      Jemez Pueblo                      The Nature Conservancy</p>	<p><b><u>Biodiversity</u></b>                      USFS R3                      The Nature Conservancy                      Audubon                      National Wildlife Federation                      Defenders of Wildlife                      NMDGF                      NMFD                      BLM                      Natural Heritage NM</p>
<p><b><u>Water Quality and Supply</u></b>                      NM Environment Dept.                      Mountain Studies Institute                      US Bureau of Reclamation                      NM Office of the State Engineer                      NM Dept. of Agriculture                      New Mexico State University                      NM Institute of Mining and Technology                      NM Water Resources Institute                      NM Rural Water Users Assoc.                      NMFD                      NM Acequia Association                      USFS R3                      The Nature Conservancy                      USDA NRCS</p>	<p><b><u>Urban Forests and Communities</u></b>                      NM Dept. of Health                      USFS R3                      NMFD Urban Forestry                      The Nature Conservancy                      University of New Mexico</p> <p><b><u>Indigenous and Traditional Communities</u></b>                      NM Land Grant Council                      Nambe Pueblo                      Jemez Pueblo                      Tesuque Pueblo                      USFS R3                      NMFD                      Pueblo of Santa Clara                      Edgewood SWCD</p>	<p><b><u>Soil and Carbon</u></b>                      UNM                      NMFD                      Sustainable Soil Systems, LLC                      NRCS                      USFS R3</p> <p><b><u>Timber and Grazing</u></b>                      NMFD                      NM Forest Industry Association                      USFS R3                      USDA NRCS                      NM Dept. of Agriculture                      Bureau of Land Management                      NM Cattle Growers Association                      Western Landowners Alliance                      The Nature Conservancy                      New Mexico State University                      Bureau of Indian Affairs</p>

The New Mexico Forest and Watershed Health Coordinating Group (FWHCG) guided the approach employed during the development of the assessment. The FWHCG also reviewed and guided the integration of resource and threat data. At the July 26, 2019 meeting, the group suggested the broad resource themes and threats to resources to be included in the assessment. At the October 25, 2019 meeting, members reviewed and critiqued draft maps of each resource and relevant threats. The January 17, 2020 meeting was cancelled due to inclement weather, so a webinar was held on January 29, 2020 to present the second draft of resource maps and risk models. The Core Team drafted a set of strategies built around the natural resource concerns and issues identified in the Assessment, with goals of mitigating risk,

protecting valued assets and enhancing the benefits of the resources. On February 7, 2020, the Division presented the strategies to the FWHCG and collected feedback during breakout groups for each strategy. The strategies were revised based on stakeholder input and presented for further feedback at the final stakeholder workshop, held on May 8, 2020 via Zoom teleconference to comply with COVID-19 meeting restrictions. Over 120 people from the state participated in this virtual workshop and provided input during the five breakout sessions. The draft Plan and strategies were posted to the Division's FAP website prior to the May 8<sup>th</sup> workshop and a form for written comments was made available for the duration of the public comment period from April 22 through May 29, 2020.

## Threats to Resources

Numerous disturbances threaten the resources and assets valued by New Mexicans. Prolonged drought threatens our water supplies, development and fragmentation threaten wildlife habitat, and wildfire threatens all the above. In the risk assessment framework used in this assessment, these disturbances are called hazards. Hazards are defined as “a physical situation with potential for harm to persons or damage to resources and assets” (Scott et al. 2013).

Many of the phenomena that pose a threat to resources and assets are natural. The reason natural resource managers map these hazards is because they could damage the things people care about. It is the presence of resources or assets, or an anthropogenically altered intensity or recurrence regime, that turns these hazards into threats and make these threats worth mapping. For example, seasonal flooding has shaped the canyons and valleys of New Mexico, but development in floodplains and post-fire flooding exacerbated by unhealthy forest conditions transform the natural phenomena of flooding into a hazard worth

planning for and mitigating. This section describes how the threats to resources were assessed. The set of threats considered have widespread impact in the state, and threats with narrower effects, such as registered and abandoned mines, were not included in this assessment. The following Resources and Assets section explains how the expected impacts of these hazards on valued resources and assets were evaluated.

### Wildfire

Wildfires pose a threat to communities, water supplies, and many other resources and assets. Fuel accumulation caused by a “fire deficit” has created large homogeneous landscapes where fires burn at high intensities over unusually large areas. Interannual variation in the area burned by wildfire (Figure 1) is driven by climate, and the combination of unprecedented fuel loads and climate change are expected to extend and exacerbate the intensity of fire season in New Mexico. Fires burn in nearly every ecosystem and in all parts of the state (Map 1).

**Annual Area Burned 2000–2019**

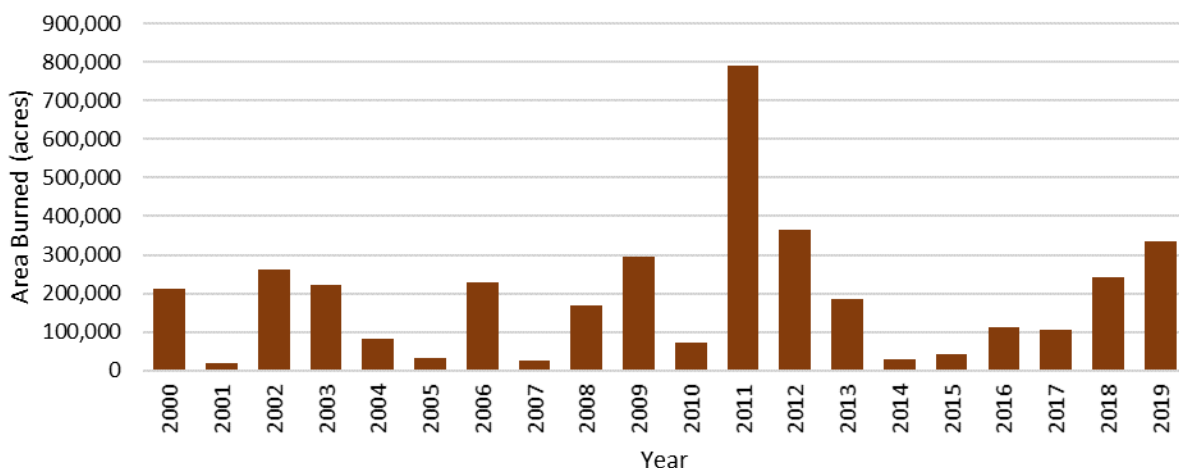
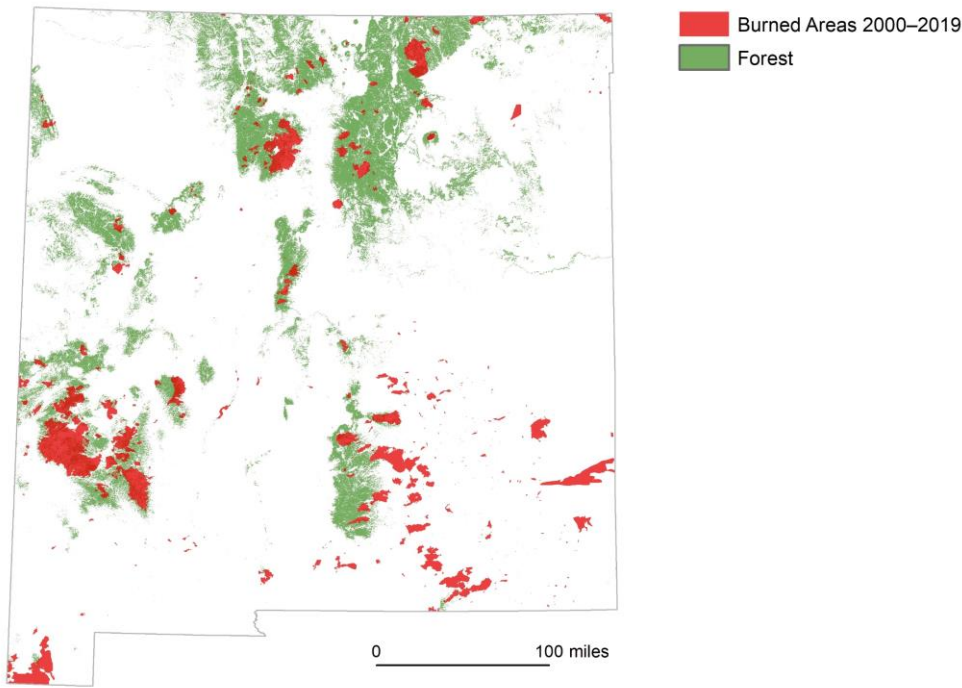


Figure 1. Annual areas burned in New Mexico 2000–2019 (NIFC 2020)



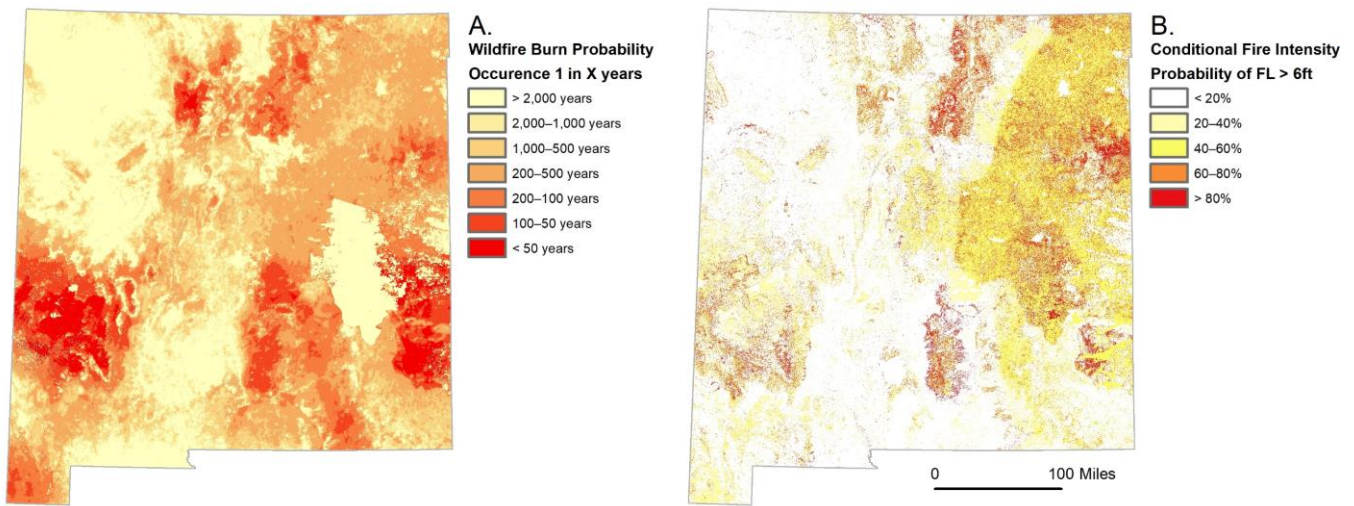
Map 1. Areas burned by wildfire 2000–2019 (NIFC 2020)

Historically, wildfire was much more common in New Mexico. Our forests and grasslands have evolved with wildfire. Fire can maintain grasslands that are encroached upon by shrubs and trees. Fire releases ponderosa pine forests that are overly dense and of uniform age are released to grow in open stands that support a diversity of age classes—as well as grasses and forbs—when burned at the historical fire frequency. Fire suppression and other anthropogenic alteration of fuel conditions have decreased the average return period for wildfires. An analysis of the fire return interval for forestlands indicates a fire deficit of between 14,000 acres and 260,000 acres annually in New Mexico forests.<sup>2</sup> Reintroduction of fire is both one of the most promising and most challenging tools for remedying this fire deficit. The presence of infrastructure, homes, and other fire-intolerant resources and assets—and forests that have diverged from their historically fire-resilient structure—limit the extent that fire can be introduced today. Until the fire deficit is reduced, uncharacteristic wildfire will continue to threaten our resources and assets.

Wildfire hazard is a function of the probability of a wildfire burning a given location and the intensity of a wildfire if it were to burn that location (Scott et al. 2013). Burn probability of a location is a function of the connectivity of fuels surrounding the location, patterns in wind direction during fire season, and likelihood of a fire ignition in a place that can spread to the location. Fire intensity is a function of fuel loading, weather conditions and topography (Andrews 2018).

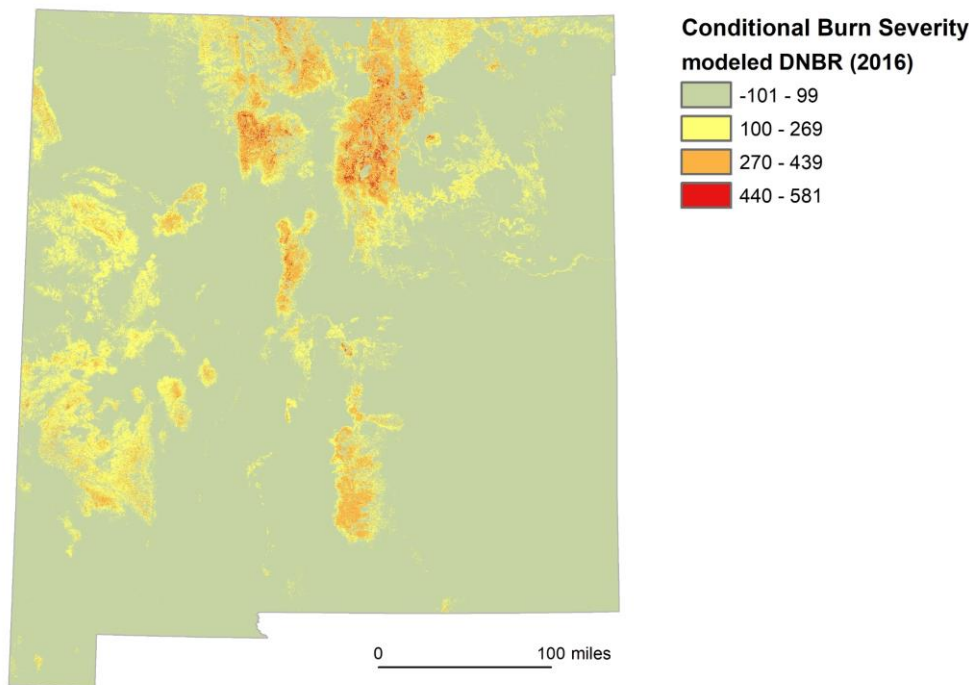
Both burn probability (Map 2A) and fire intensity (Map 2B) have been modeled for New Mexico using advanced fire simulation software (USFS 2016). These fire simulation tools simulate thousands of stochastically generated fire seasons using spatial fuelscapes (fuel loading data, canopy structure metrics, and topography), historical fire ignition locations and weather records. In New Mexico, the best statewide fuels data is from the LANDFIRE program (Reeves, Kost, and Ryan 2006).

<sup>2</sup> Historical mean fire return intervals (MFRI) documented in New Mexico's forests range from two years in ponderosa pine stands to over 400 years in wetter forest types like aspen and spruce fir. The Average fire return interval for all forests in New Mexico is somewhere between 10 and 100 years (Schussman, Enquist, and List 2006), and with 2.7 million acres of forest, the annual average burned area would be between 27,000 and 270,000 acres. Between 2000 and 2019, about 13,000 acres of forest burned on average each year in the state.



Map 2. Wildfire hazard is a function of burn probability (A) and conditional fire intensity (B) (USFS 2015). Burn probability is the likelihood a fire will start or spread into each pixel. Conditional fire intensity is the probability of a fire burning at a given intensity when the pixel burns.

Wildfires directly threaten many resources, and damage can persist for many years. Historical fire regimes produced wildfires that burned at low intensities through New Mexico’s dry forests, producing burn scars that rebounded quickly from the disturbance. With infrequent fires, fuel accumulates to levels that produce high-severity burn scars that do not recover as quickly. Burn severity has been modeled for the state to allow for pre-fire planning for burned areas. Burn severity is function of fire intensity and fuel characteristics, but has been approximated as a function of canopy cover (Bassett and Lopez 2020) (Map 3).



Map 3. Conditional burn severity showing differenced Normalized Burn Ratio (dNBR) modeled representing burn severity if a fire burned every pixel. Actual burn severity will depend on the conditions under which the fire burns. This model was developed using burn severity mapped by the Monitoring Trends in Burn Severity program (Eidenshink et al. 2007), and canopy cover modeled by the USFS (Bender et al. 2019).



## Post-wildfire Hazards

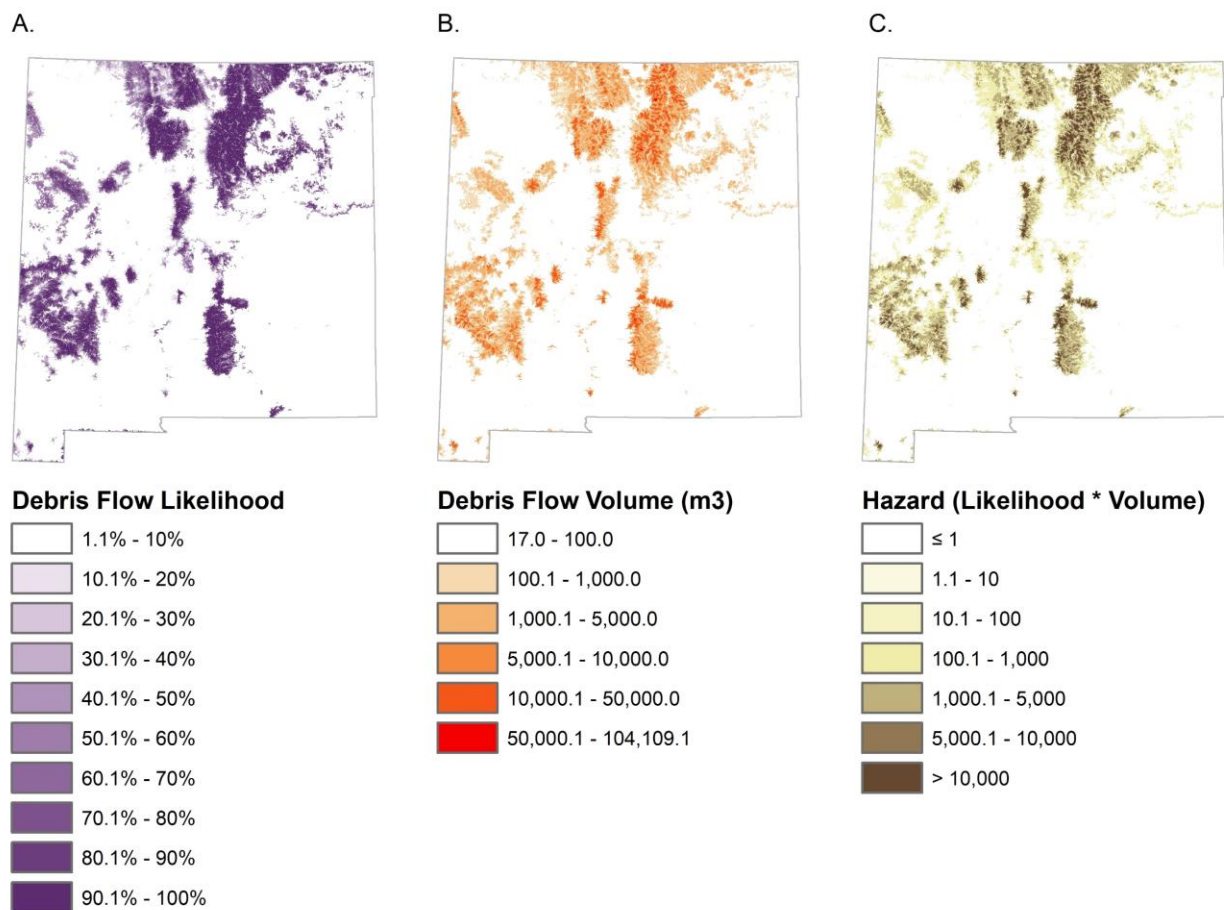
Floods and debris flows can be unleashed when rain falls on high-severity burn scars (Cannon and Gartner 2005). Sediment mobilized following a fire can affect downstream resources and assets even if the initial runoff of the event doesn't reach them. Throughout the west, recent fires have created burned areas that produced post-fire floods and debris flows that were much more damaging than the fire itself (Kean et al. 2019). The Assessment maps communities and water supplies across New Mexico that are threatened by post-fire hazards.

Following the 2011 Las Conchas Fire, a sediment plug blocked the Rio Grande below Cochiti Dam, halting deliveries of water to downstream communities and irrigators. Water deliveries were also halted below Caballo Dam on the Rio Grande

when the outlet works were clogged with sediment and debris from the 2013 Silver Fire burn scar runoff. Communities are also threatened by post-fire hazards. Debris flows following the 2018 Ute Park Fire buried roads and damaged several homes and outbuildings.

### Post-wildfire Debris Flow Hazard

Debris flows are sediment-laden flows that behave like a flood but carry high volumes of debris. Post-fire debris flow hazard has been mapped for New Mexico using models developed by the United States Geological Survey (USGS) (Gartner, Cannon, and Santi 2014; Staley et al. 2016), and parameterized using local precipitation, topography and soils data (Bassett and Lopez 2020) (Map 4).

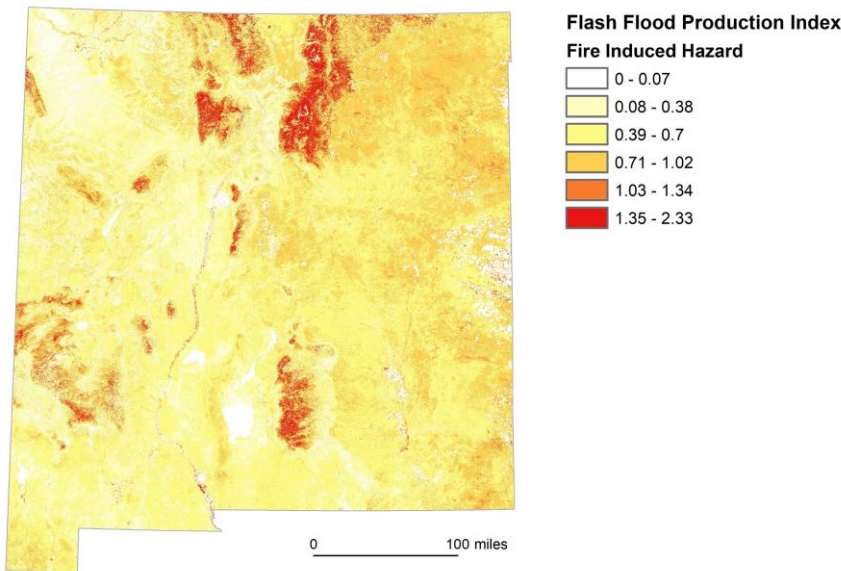


Map 4. Debris flow hazard modeled for New Mexico. Conditional hazard of post-fire debris flow is shown in (C) which is the combination of the conditional likelihood (A) and conditional intensity (volume, B). Conditional hazard is contingent on a fire occurring. To map annual risk of post-fire debris flow, the probability of fire occurring within each basin is multiplied by the conditional risk.



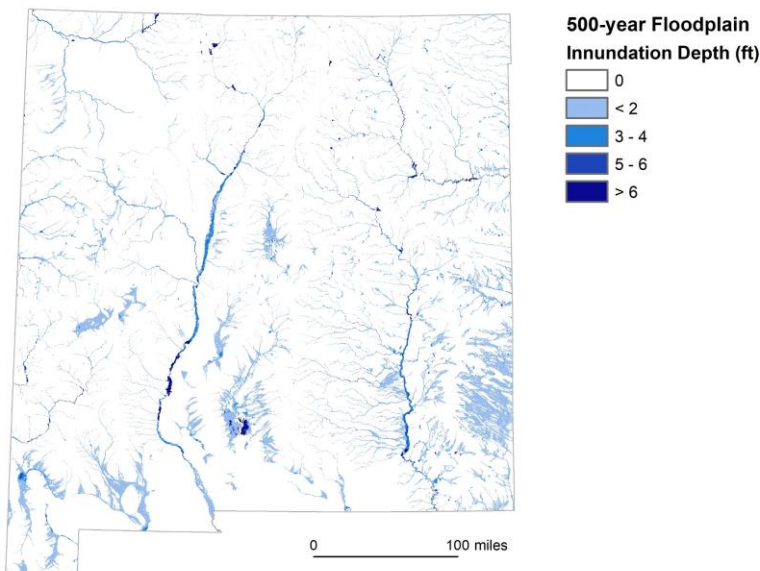
### Post-wildfire Flooding Hazard

Flash floods are the deadliest precipitation-driven hazard (Zogg and Deitsch 2013), and burned areas are known to produce damaging floods that are significantly more intense than floods produced during comparable pre-fire precipitation events. Relative flash flood production has been modeled by the National Weather Service (NWS) based on basin characteristics (Zogg and Deitsch 2013). In New Mexico, post-fire flood hazard has been predicted with the same approach applied to current and post-fire scenarios (Bassett 2020) (Map 5).



Map 5. Flash flood production hazard modeled with the NWS Flash Flood Production Index (FFPI) model.

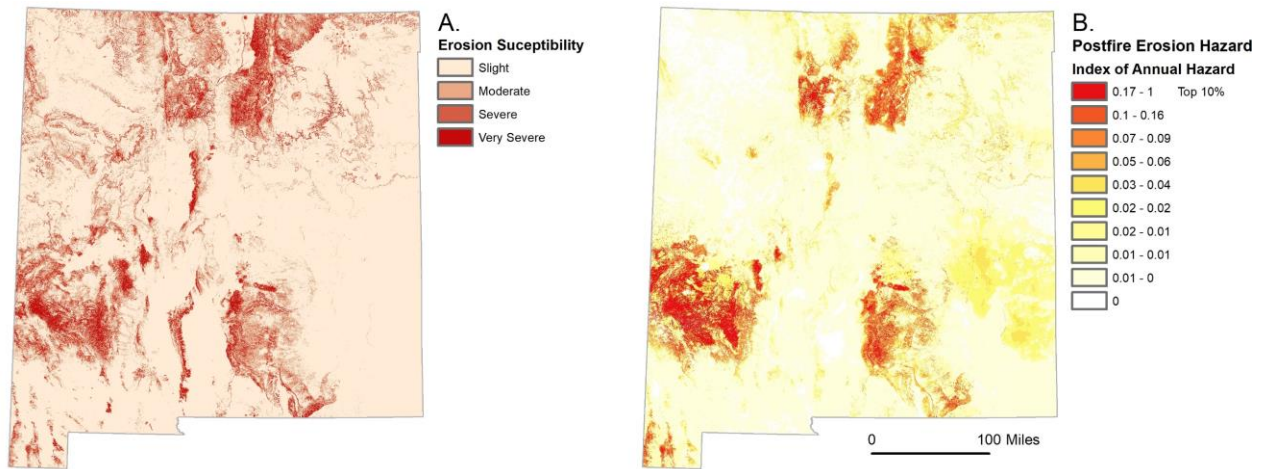
Burned areas produce floods, but most impacts occur downstream. Flash flood production models can be related to flood hazard zones to enable characterization of the sources of flood hazard to individual floodplains. Floodplains have been mapped for portions of New Mexico at varying levels of detail. The best statewide map of floodplains was produced during a national assessment of flood hazard (Wing et al. 2017) (Map 6).



Map 6. Flood inundation hazard zones (Wing et al. 2017). Pre-fire 500-year flood zones are exceeded much more frequently when upstream areas are burned by wildfire.

### Post-wildfire Erosion Hazard

Severe wildfire disturbance creates bare and damaged soils that are then susceptible to erosion. The Kf-factor determines the relative susceptibility to erosion. The Kf-factor ranges from 0.02 for the least erodible soils to 0.64 for the most erodible. A simple model combining slope and Kf-factor can create a classification of erosion hazard (USDA 1998) (Map 7A). When combined with fire hazard, the resulting model depicts the areas where post-fire erosion is most likely to occur (Map 7B).



Map 7. A) Erosion susceptibility classification based on slope and soil erodibility. B) Post-fire erosion hazard integrates burn probability and erosion hazard data to show where post-fire erosion is most likely to be a hazard.

### Disease and Insects

Trees are susceptible to diseases and insects. Most of the diseases and insects that affect trees in New Mexico are native to the state and our forests are historically resilient to them. As forest density increases, resilience to these pests decreases. Higher forest densities coupled with climate change lead to increased tree stress and mortality over much larger areas. Mortality increases when drought conditions coincide with pest outbreaks (Figure 2).

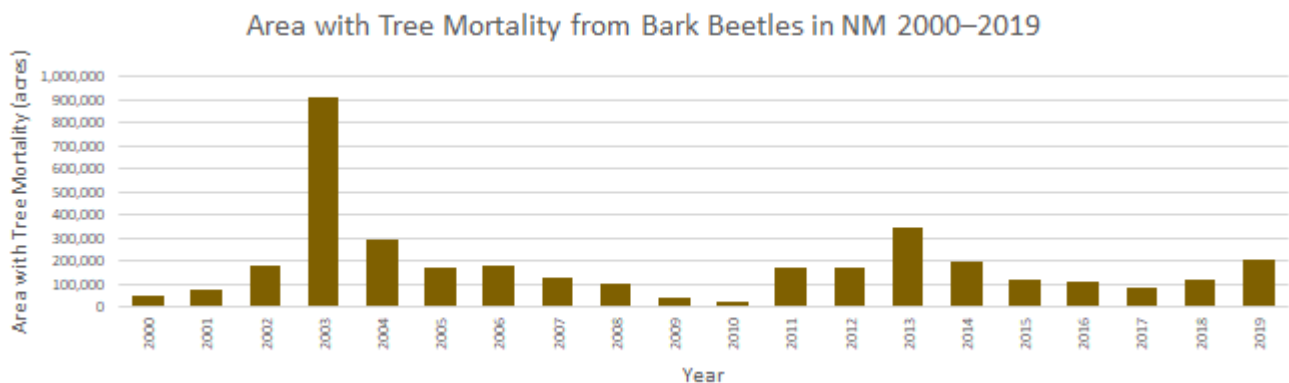
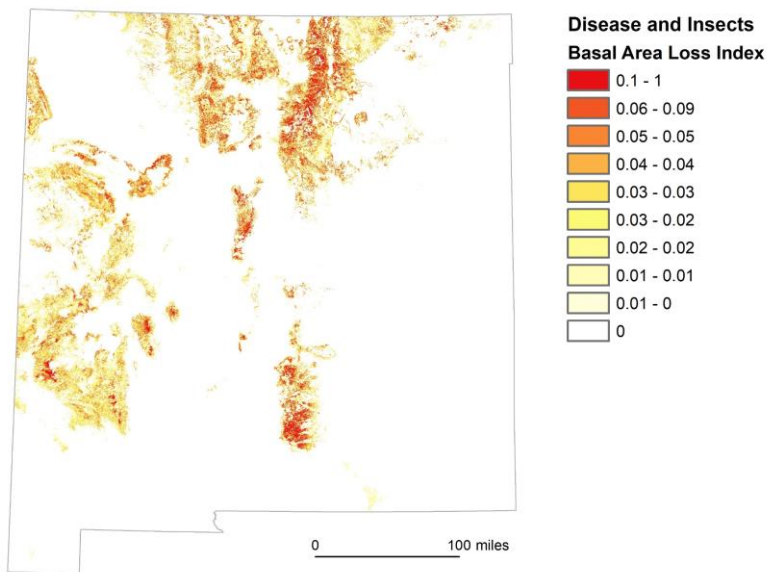


Figure 2. Annual area with tree mortality in New Mexico from the National Insect & Disease Survey database (Paschke 2020). Increased survey intensity is partially responsible for the high mortality observed in 2003.

Expected tree mortality by 2027 has been modeled for New Mexico as a function of basal area loss (Krist et al. 2014). Basal area loss is expected to be greatest in the Sacramento, Sandia and Manzano Mountains and the Sangre De Cristo range, though pest-driven tree mortality is expected to occur to some degree in all forests and woodlands in the state (Map 8).



Map 8. Disease and insect risk from the National Insect and Disease Risk Map (NIDRM) (Krist et al. 2014). The basal area loss index highlights forested areas where disease and insects are expected to have the largest impact on forest resources.

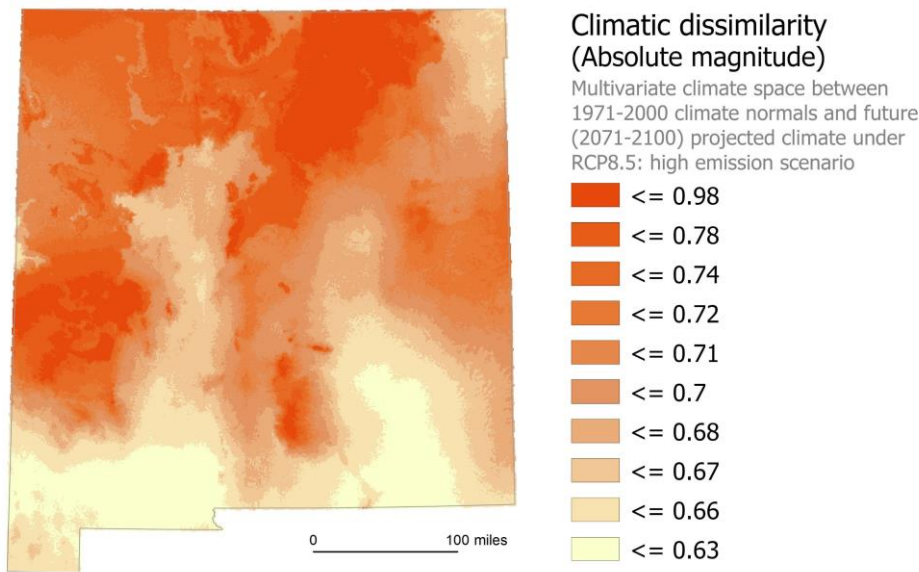
## Climate Change

Climate change is expected to disrupt many natural and social systems in New Mexico (UCS 2016). Our climate is trending to be hotter and drier, with less reliable snowpack and runoff and prolonged droughts. Fragile habitats and scarce water resources will in turn be stressed by climate change. These climate change impacts will also compound other hazards by exacerbating fire seasons and forest pest outbreaks. Heat-related illness and deaths are also expected to increase (Woods, Kelley, and Fristachi 2019).

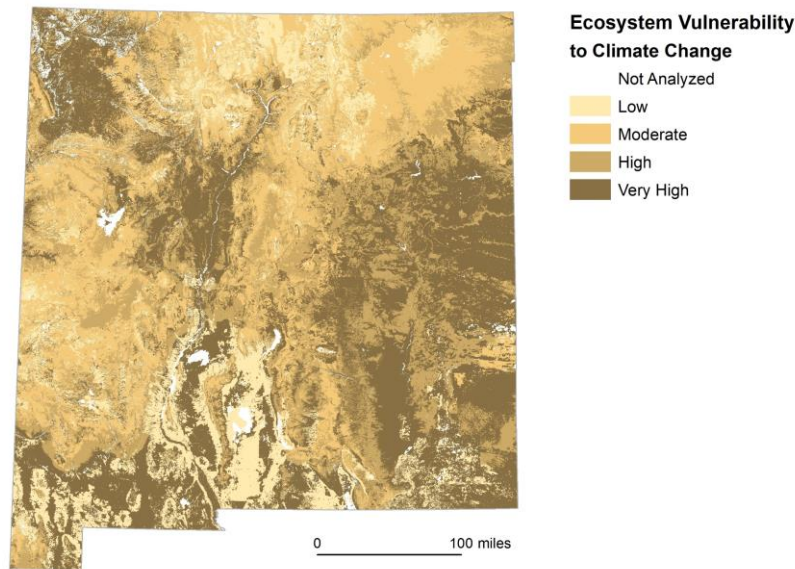
Climate change is expected to alter many phenomena which can be quantified as discrete metrics, such as average annual maximum temperature, daily maximum temperature, winter precipitation and nighttime temperature. Natural resources and species will be affected differently by climate changes impacts. Changes in winter precipitation will have a large impact on water

resources, while precious urban tree canopies are more sensitive to maximum temperatures.

Resource-specific climate change hazard analyses are not available statewide for all resources, so a compound “climate dissimilarity index” (Map 9) and an “ecosystem vulnerability” classification (Map 10) are used to map where climate change poses the greatest hazard. The climate dissimilarity index is derived from changes in eleven temperature and precipitation variables that have the greatest impact on biological organisms (AdaptWest 2018). Climate dissimilarity is projected out to the year 2055 using an ensemble mean projection from 15 CMIP5 climate models (Carroll 2018). The ecosystem vulnerability classifications are derived from five climate variables from three CMIP3 climate models, which are highly correlated with existing vegetation patterns (Triepke, Muldavin, and Wahlberg 2019). The ecosystem vulnerability classifications are also represented in the priority project acres of Map 46.



Map 9. Climate dissimilarity—absolute magnitude (Carroll 2018).



Map 10. Ecosystem vulnerability to climate change (Triepke et al. 2019)

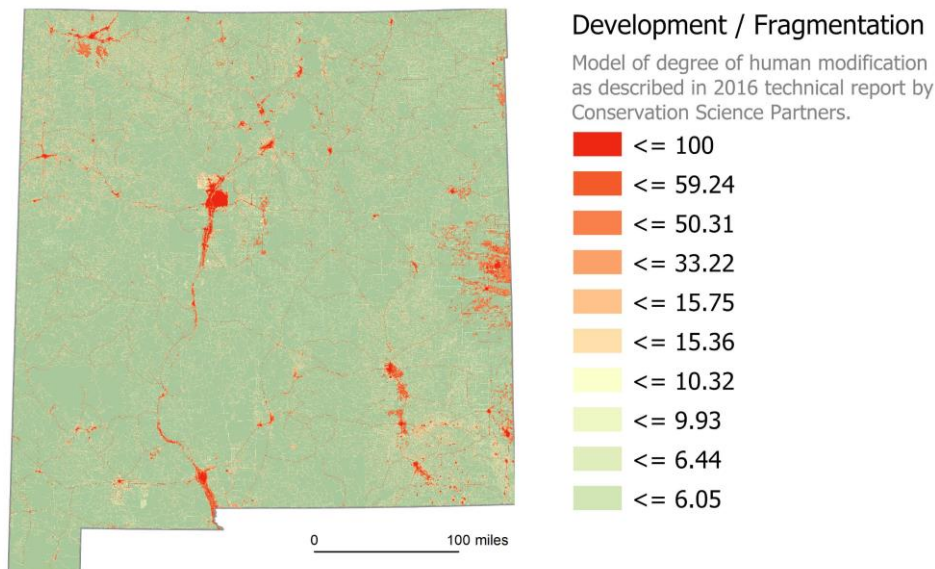
Climate change must be considered when developing strategies to protect and enhance the value of resources. Determining whether a strategy should prioritize investments in high climate vulnerability areas or not depends on the expected success of the investment. For example, a water resource investment in an area with high climate vulnerability may not persist as long as an investment in a low-vulnerability area. On the other hand, an investment in an area with a high climate vulnerability rating may have much greater benefit to resources than if it were to occur in a low-hazard area.

### Development and Fragmentation

Development into natural areas disrupts natural resources like wildlife habitat and watershed function. It also decreases the ability of resource managers to use natural processes like wildfire to maintain the landscape. In New Mexico, development hazard is difficult to predict consistently statewide because many different local constraints and political factors control where development occurs. Several models have



been developed to predict development in the region, though they have not successfully predicted actual development. In the past decade, new development has primarily been concentrated near existing development, either in resource extraction areas like the Permian and San Juan Basins, near active mines, or near existing cities. Development is most frequently seen in intensification of existing development or marginal sprawl into adjacent areas. In this assessment we model development hazard as a function of proximity to existing development (Map 11).



Map 11. Development and fragmentation index depicting relative intensity of human modification (Theobald et al. 2016). Most future development is expected to occur within or adjacent to existing development.

## Use and Forest Management Activities

Intentional, ecologically-based human activities including forest management have little negative impact on resources and assets (Allen et al. 2002). Increased active management of New Mexico's landscapes may be necessary to mitigate and counteract the effects other human-caused hazards including climate change (Fargione et al. 2018; NM Interagency Climate Change Task Force 2019), increased fuel loading (Allen et al. 2002), habitat degradation (Albert et al. 2004), and forest pest outbreaks (NMF 2016). However, since active management may also have negative effects on some resources or assets, it is included as a hazard so tradeoffs encountered when mitigating other hazards may be analyzed.

## Resources and Assets

In the context of this assessment, resources and assets are the things people care about that can be protected from threats or have their value enhanced through management. As mentioned earlier, the resources and assets valued by New Mexicans are varied and provide a wide range of economic, social, cultural and ecological benefits. This assessment mapped the spatial distribution of valued resources and assets across the landscape.

With stakeholder input, the Forestry Division developed thematic groupings of resources and assets, clustered by common beneficiaries or resource similarity. Eight resource "themes" were identified. The FWHCG reviewed the themes and drafted a list of the resources and assets and recommended subject matter experts. The Division then assembled technical teams who further refined the scope of each theme and selected datasets and methods best suited for mapping the distribution of value of the theme across New Mexico (Table 2).

Every dataset that was submitted or gathered was evaluated for inclusion in the Assessment. Data included in the Assessment had to meet several requirements. Each dataset was required to:

- Have a statewide extent so all areas of the state are equally represented with the same quality of data.
- Include data for all lands so all ownerships are equally represented with the same quality data.
- Be based on the best available science so the data can be relied upon to present a factual characterization of the distribution of each phenomenon.
- Exist or be relatively easy to derive from existing data to allow the Assessment to be completed within the required timeline.

### Theme: Water Quality and Supply

The importance of water to New Mexico cannot be overstated. The water that flows from our forested headwaters irrigates our fields and sustains our communities. Our communities have grown from settlements and villages built near reliable water sources. Maintaining this connection to a clean and dependable water supply is vital to the future of all New Mexicans. Water security provides a buffer from outside economic forces and allows self-determinism for New Mexico.

Climate change and other hazards threaten our water resources. Rising temperatures increase demand and prolong droughts, while wildfires threaten the water quality and supply, and post-fire debris flows threaten diversions and other water infrastructure.

Water users in New Mexico divert or withdraw more than three million acre feet (AF) of water annually (Magnuson et al. 2019). The *2015 Water Use by Category* report from the New Mexico Office of the State Engineer (OSE) provides statistics on the diversion or withdrawal of water in New Mexico (Magnuson et al. 2019):

Data that did not meet these requirements was incorporated into the Assessment only where additional data was available to compliment, supplement, or correct deficiencies in the data.

The objective of each technical panel was to produce a map of resource value for that theme, and to characterize the susceptibility of each resource and asset to hazards. These themes are presented in the following sections.

- Surface water is the source of slightly over 50 percent of water withdrawals.
- Public water systems divert about 280,000 AF annually with 87,000 AF (roughly 30 percent) coming from surface water sources and 197,000 AF (roughly 70 percent) coming from groundwater.
- Self-supplied domestic users withdraw 28,000 AF annually, all from ground water sources.
- About 2.4 million AF are diverted annually for irrigation with slightly more than half coming from surface water sources (52.84%).
- Water is also relied upon by livestock growers (roughly 1.2 percent of total withdrawals), direct commercial users (2 percent), mining and other industrial users (1.6 percent), and power generating stations (1.6 percent).
- Evaporation from reservoirs accounts for over seven percent of total withdrawals (231,000 AF).

Irrigation supports New Mexico's communities and its economy. Crop production accounted for \$823 million of New Mexico's gross domestic

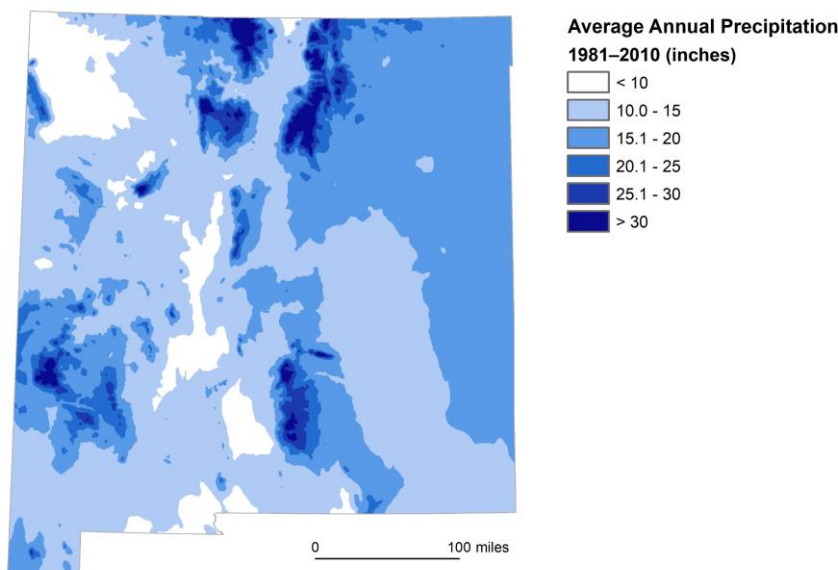
product (GDP) in 2012 (Diemer, Crawford, and Patrick 2012). Hay (\$172.3 million), pecans (\$110.5 million), chile (\$65.4 million), and onions (\$56.1 million) were the largest irrigated crops by revenue in 2012 (Diemer et al. 2012). While New Mexico's water resources are used to irrigate crops that contributes to the state's GDP, water also supports small scale agriculture that keeps communities alive. Acequias that historically sustained communities through subsistence farming are still vital for many rural communities that rely on small market and kitchen gardens (Adams 2017).

### Sources and Beneficiaries of Water

New Mexico's water originates as precipitation falling as rain or snow. Precipitation is highest in mountainous areas where orographic lift forces water from the atmosphere (Map 12). Late summer monsoons make July and August the wettest months throughout the state, though winter precipitation that adds to snowpack is critical for sustained river flows. Precipitation that is not returned to the atmosphere either flows away as surface runoff or infiltrates through the soil and ground until it reaches an aquifer.

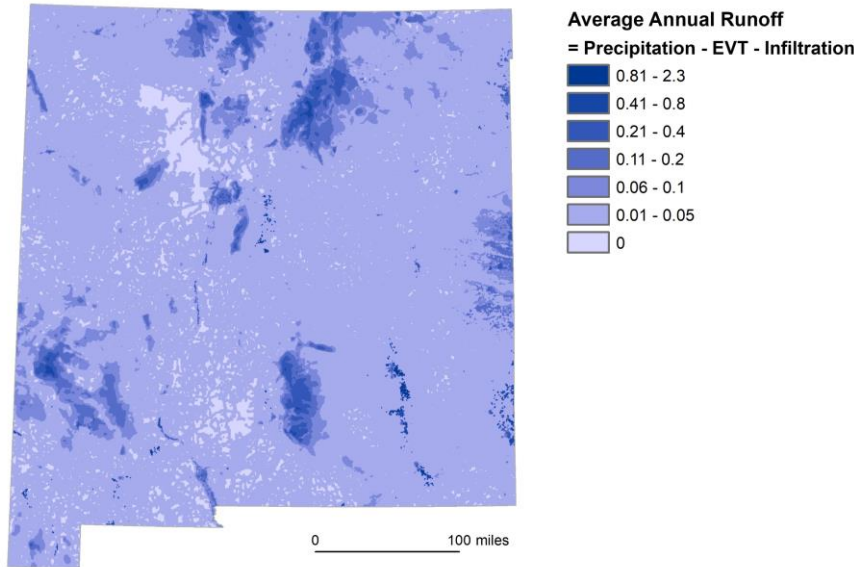
Irrigators, municipalities, and domestic water users divert or pump these streams and aquifers that sustain their families, livelihoods and communities.

Water is most valued where it is "used" for benefit. In this assessment "use" is defined broadly as any benefit of a resource. Aquatic habitat that requires a certain base flow "uses" a stream. This assessment assigns the highest value to water where there is a high level of benefit per unit of water. For example, if two identical watersheds produce identical volumes of runoff each year, the watershed that is relied on by 100 irrigators would be valued more than the other if it was relied on by only 10 irrigators. In much of New Mexico, demand for water exceeds supply, so there is a high ratio of benefit per unit of water. In alignment with state water quality standards, "use" corresponds to "designated uses" in New Mexico's Water Quality Standards (NMAC 2020), including domestic water supply, irrigation and irrigation storage, recreation (primary and secondary contact), livestock watering, wildlife habitat and aquatic life uses.



Map 12. Average annual precipitation is highest in high elevation areas (PRISM Climate Group 2016)

The connection between land management, recharge, and aquifer beneficiaries has not yet been mapped with the detail required for inclusion in this assessment. On the other hand, surface water supply, transmission and beneficiaries have been thoroughly mapped. Runoff from watersheds that are relied on by irrigators, municipalities and other beneficiaries can be quantified using runoff models (Reitz et al. 2017) (Map 13).



Map 13. Average annual runoff used to estimate surface water supply (Reitz et al. 2017). Playa lakes and other areas with low infiltration have artificially elevated estimated runoff. These mapping errors have limited impact on the assessment because there are no beneficiaries downstream from these closed basins.

### Threats to Water Quality and Supply

This assessment identified wildfire, post-wildfire debris flow and climate change as the primary threats to water supply. Post-wildfire erosion and wildfire-driven loss of riparian tree canopy were identified as the primary threats to water quality.

#### Wildfire

Wildfire alters vegetation and soil properties that alter watershed function. Soils in severely burned areas often have different hydrologic properties that negatively impact infrastructure relied on by water users. Hydrophobic soils are subject to extreme erosion, producing large quantities of sediment and increasing the potential for post-fire debris flows.

#### Post-wildfire Debris Flow and Erosion

Post-fire debris flows and erosion increase sediment loads that can obstruct stream channels

and water diversion and conveyance structures, disrupting transmission and use of surface water.

#### Climate Change

Climate change is expected to decrease New Mexico's water supply by about one third through loss of winter snowpack and increased evapotranspiration (Llewellyn et al. 2013). Higher elevation watersheds will experience less decrease in water supply, though even there a decrease of approximately 25% is expected (Llewellyn et al. 2013). Summer monsoon precipitation may increase in New Mexico (Asmerom et al. 2013). However, most reservoirs are upstream from the areas where that increase will be most pronounced. The Rio Grande watershed has been identified as "the best example of how climate-change-induced flow declines might sink a major system into permanent drought" (Dettinger, Udall, and



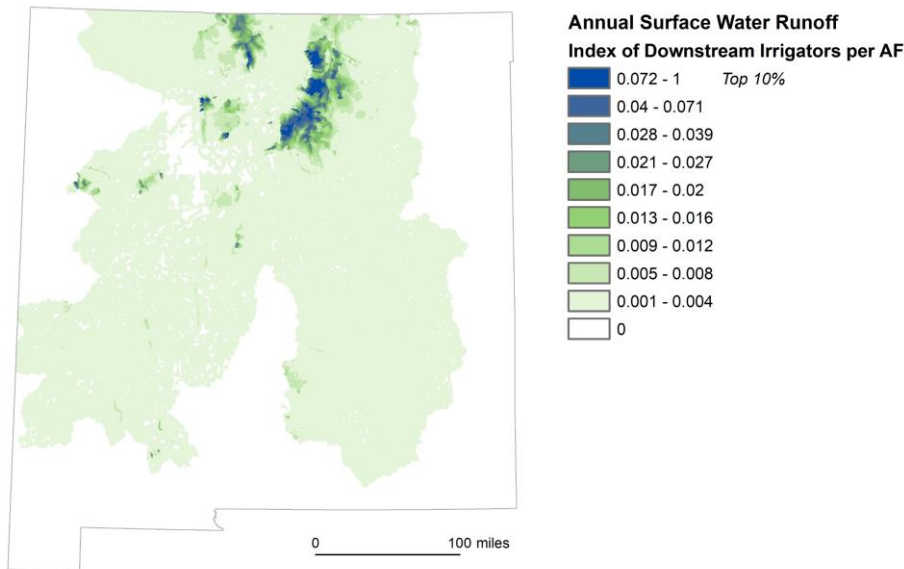
Georgakakos 2015). Cascading impacts of climate change are anticipated as other threats are exacerbated. For example, drought stricken forests are much more susceptible to disease outbreaks, insect infestations and high-severity wildfire (Loehman et al. 2017). Climate change has already increased wildfire activity, and that trend is expected to continue (Abatzoglou and Williams 2016).

data characterizing those changes is not available at high enough resolution for use in mapping future impacts to water quality and supply. In general, the relative distribution of risk is expected to remain approximately the same – the highest risk watersheds will still be highest risk in the future – though the absolute risk will increase the threats to all watersheds across the state.

While climate change is expected to have a large impact on New Mexico’s water resources, spatial

**Resource: Surface Water Runoff for Irrigation**

Irrigation beneficiaries were mapped from a directory of irrigation organizations from the 1980s (Saavedra 1987). Irrigated acres and number of *parciantes* or irrigators were mapped to diversion points and then aggregated to their source watersheds to model relative benefit per acre feet of runoff from each basin in the state (Map 14). In New Mexico, the benefit of irrigation water is not proportional to obvious geospatial metrics such as irrigated acres or miles of ditch. Consider, for example, the prevalence of small market and kitchen gardens that provide food security to families and help sustain communities and culture. This assessment therefore uses number of irrigators as the metric of benefit provided by surface water for irrigation.



Map 14. Index of surface runoff weighted by number of downstream irrigators. The number of irrigators is from a NMOSE report (Saavedra 1987). The points of diversion for each organization were georeferenced using mapped points of diversion (NMOSE 2020b), conveyances (NMOSE 2020a), and the geographic names information system (GNIS) (BGN 2020). Runoff is from Reitz et al. (2017).

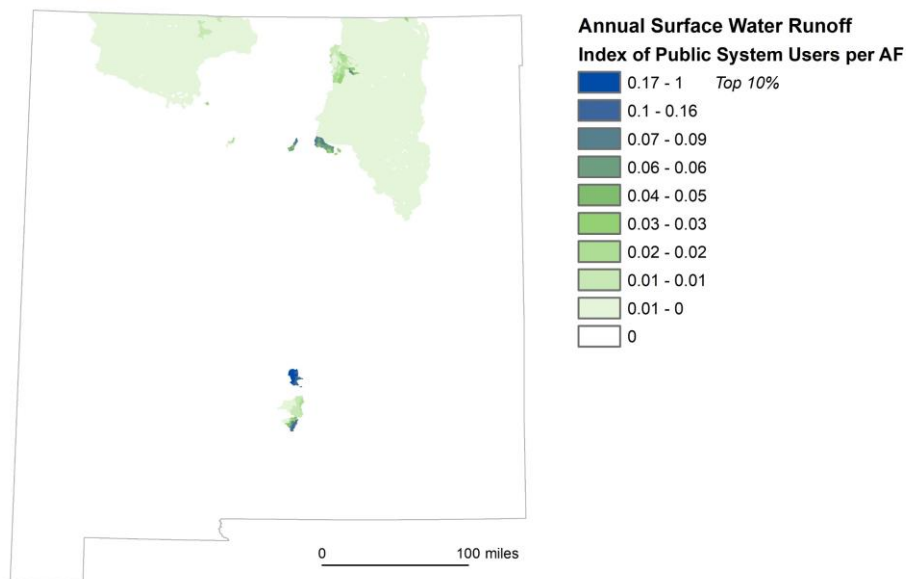
Some of the most critical watersheds for water provisioning for irrigation in New Mexico are outside of the state. Those include the Navajo, Blanco, and Little Navajo watersheds that are the source watersheds for the San Juan-Chama inter-basin diversion project; the Animas and La Plata watersheds in the San Juan Basin; and the headwaters of the Rio Grande. In the Animas River watershed, some points of diversion for

irrigation in New Mexico are across the border in Colorado. This assessment only includes irrigation beneficiaries located in New Mexico in the weighting of available water per downstream beneficiary. The analysis does not consider beneficiaries located in Colorado because planning and managing for water delivered to them from the Rio Grande headwaters is beyond the scope of this assessment.

The water that originates in New Mexico is also valued by downstream beneficiaries in Texas, Utah, Arizona, Nevada, California, and Mexico. Interstate and national compacts govern the flow of water out of New Mexico, so those downstream beneficiaries are not included in this beneficiary map.

**Resource: Surface Water Runoff for Public Water Systems**

Public water systems include municipal water utilities and mutual domestic water consumers associations. Nearly one third of public water systems rely on surface water. Technical panelists identified springs, infiltration galleries, and surface diversions as dependent on the runoff in their source watersheds. Public water systems data including points of diversion, percent of each system’s supply that originates as surface water, and number of people served by each system were accessed from the New Mexico Environment Department (NMED 2019c, 2019b). As with surface water supply for irrigation, this analysis mapped the beneficiaries per volume of water (Map 15).



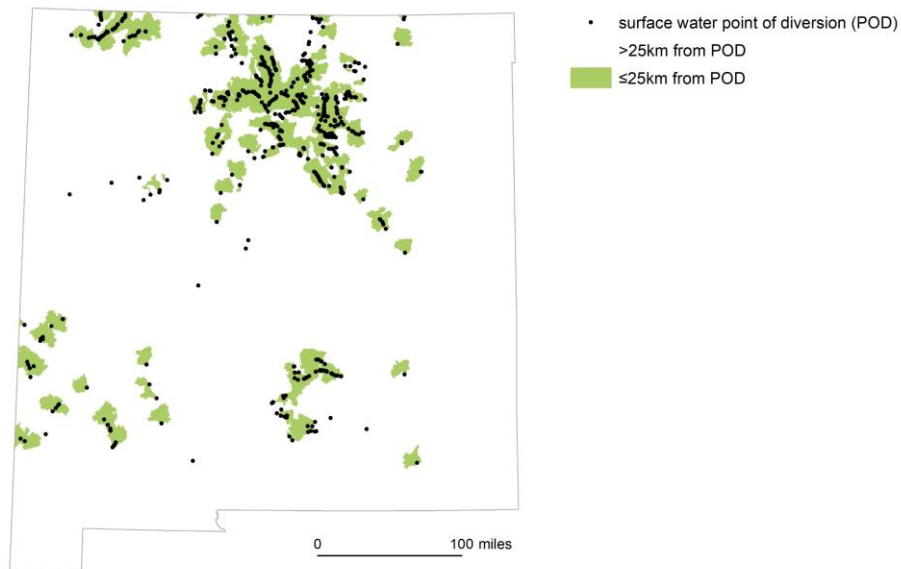
Map 15. Average annual runoff weighted by number of downstream public water system users.

Many public water systems in New Mexico rely on surface water that originates in Colorado. The San Juan-Chama Project transfers water across the continental divide from the San Juan basin in Colorado to the Rio Grande basin, where it is utilized by many public water systems. Even though this water supplies more beneficiaries than water from any watershed inside New Mexico, the source watersheds for the San Juan Chama project are in Colorado and so do not appear on these resource value maps.

**Resource: Surface Water Quality at Points of Diversion**

For nearly all uses, the value of water is as highly dependent on water quality as on quantity. Surface water diverted for agricultural and public water system use is especially susceptible to post-fire degradation by increases in sediment and turbidity. Potential impacts include increased water treatment costs, increased maintenance cost or precluded diversion. Because the intensity of impacts decays spatially, areas immediately upstream from points of diversion – mapped using a maximum flow distance of 25 kilometers

after Weidner and Todd (2011) – have been identified as the source areas that contribute post-fire hazard to water quality at points of diversion. While sources of watershed impacts are not limited to 25 kilometers, for this model only these close source areas are mapped (Map 16).



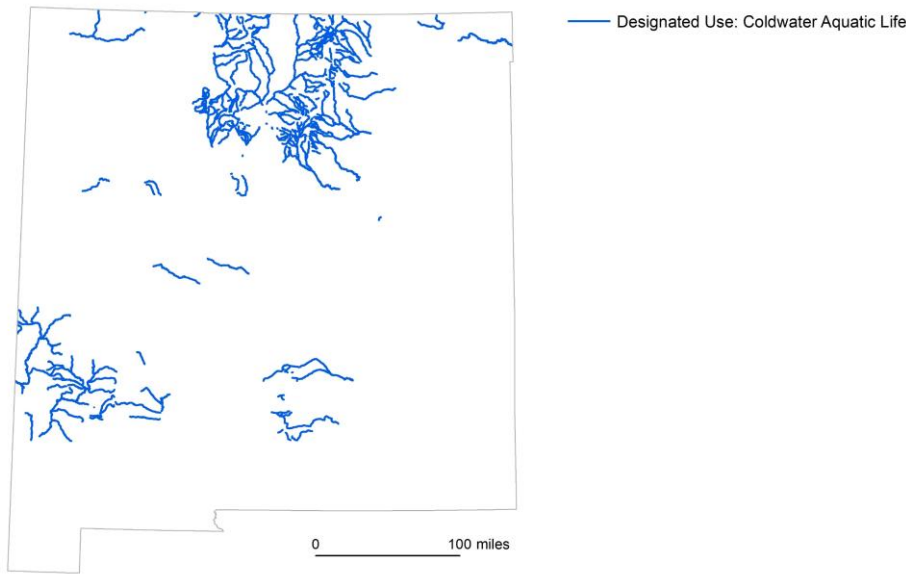
Map 16. Critical source watershed that contribute the greatest risk to points of diversion. Points of diversion and the source areas immediately upstream from them as mapped by a 25-kilometer maximum flow distance.

#### **Resource: Surface Water Quality to meet State Water Quality Standards**

Streams with “coldwater aquatic life” designated uses are vulnerable to sedimentation and turbidity (water quality parameters most directly affected by forest management). These streams were mapped from the current Water Quality Standards for Interstate and Intrastate Waters (NMAC 2020) (Map 17). Tributary watersheds directly upstream from these waters are mapped as potential vulnerabilities and sources of sediment to these waters.

For the purposes of forest management, preserving and protecting waters that support their designated uses are just as important as improving and restoring impaired waters. As such, Map 17 and the resulting prioritization depicted in Map 46 and Map 51 below do not distinguish between impaired and unimpaired waters. Further, protecting the watersheds of the streams depicted in Map 17 generally also protects springs and lakes that may be similarly vulnerable to sedimentation and turbidity.

Note that State Surface Water Quality Standards establish water quality characteristics necessary to support several other designated uses, such as irrigation and domestic water supply. Those uses are addressed in other resource areas.



Map 17. Streams with water quality standards to sustain the “coldwater aquatic life” designated use (NMED 2019a) .

**Resource: Water Transmission**

Much of the surface water used in New Mexico originates far from where it is diverted. This assessment therefore considered water transmission—efficient delivery or conveyance of water through the river systems—as an asset valued by New Mexicans. Water conveyance through rivers is also valued for its utility in meeting interstate compacts and agreements. New Mexico is party to interstate agreement or compacts for all the river systems that flow out of the state. Water provisioning for these interstate obligations is also valued but is not included in this assessment.

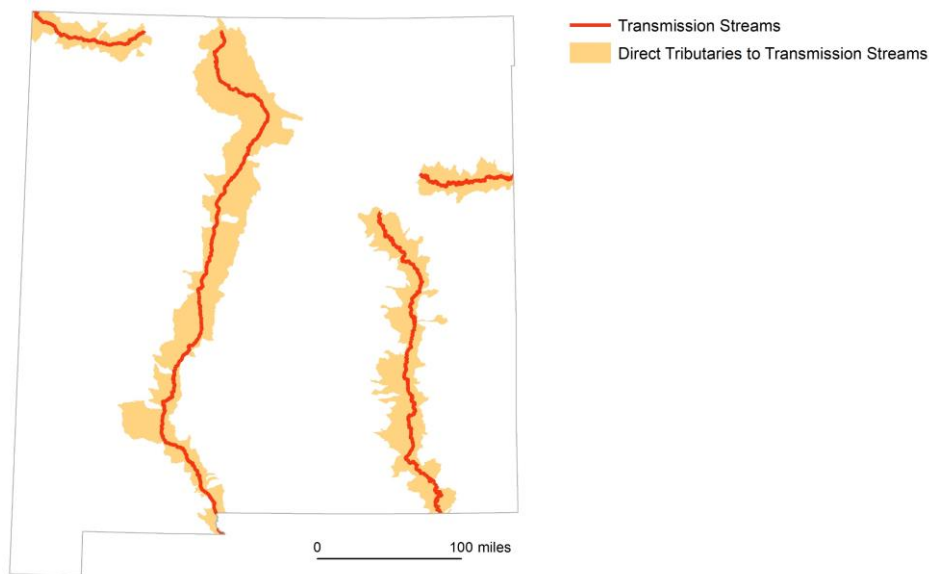
This assessment assigns the highest water transmission value to river reaches between reservoirs and the places where water is used. Threats to water transmission include direct obstruction of conveyances and outlet works as well as sediment plugs upstream of such infrastructure. Sediment plugs require that releases from upstream reservoirs be curtailed until the plug can be mitigated. The sediment plug that formed in the Rio Grande at the confluence of the Peralta Arroyo following the Las Conchas fire illustrates the threat

that uncharacteristically large and intense wildfire in tributary watersheds poses to water supplies by limiting water conveyance (AuBuchon and Bui 2014; Wolfe et al. 2014).

Water transmission is valued anywhere that any surface water flows but is most valued in perennial rivers. This assessment maps only perennial streams below reservoirs as having water transmission value because water conveyance can only be curtailed below reservoirs.

Water conveyance is also threatened by post-fire debris flow and sedimentation (Miller et al. 2011; Sankey et al. 2017). All 6<sup>th</sup>-order (HUC12) watersheds that are tributaries to streams relied on for water transmission were mapped as sources of hazard to water conveyance (Map 18). Dams control the downstream transmission of sediment, so tributary watersheds are modeled to the lowest dams or other sediment control structure, or to the top of the watershed if there is no dam or sediment control structure.





Map 18. Water transmission streams critical for water ensuring interstate and intrastate water deliveries can be made.

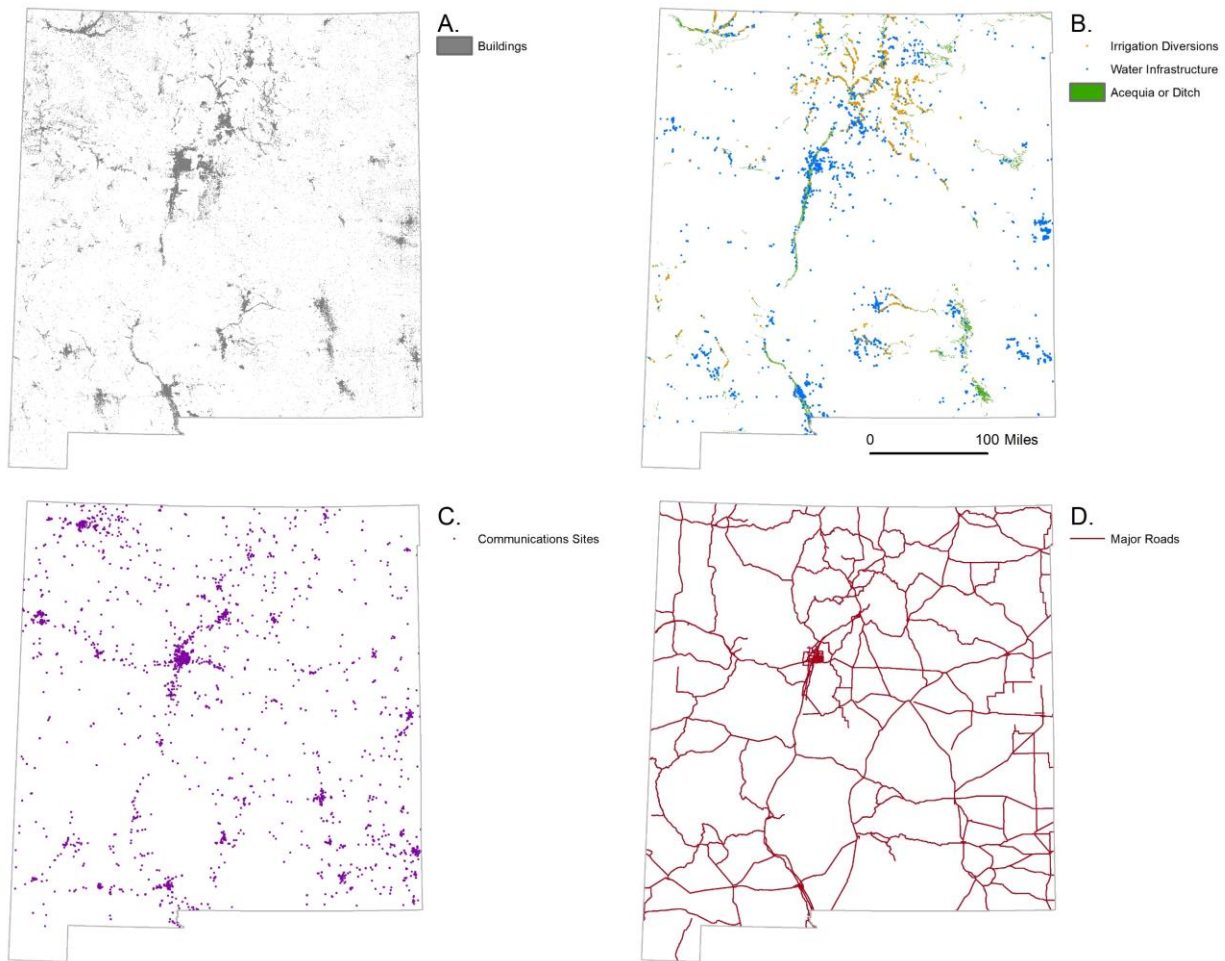
## Theme: Wildland Communities

Communities that are located in or adjacent to natural areas pose a challenge to natural resource managers and community members. In these places where development and wildlands overlap, hazards easily transmit across boundaries. Nearly every community in New Mexico is a wildland community that could be impacted by hazards common in wildlands. A 2019 assessment of wildfire risk to communities identified 669 New Mexico communities (82%) with moderate or high wildfire risk (NMF 2019). Post-fire hazards like flooding and debris flow also threaten many wildland communities.

Technical panelists identified four resources and assets that model the spatial distribution and concentrations of community value: buildings, communications sites, water infrastructure, and major roads. Value is relatively straightforward to map for these resources because they are either

present or absent from the landscape. Other resources such as water supply are of critical importance to wildland communities but are not mapped as part of this theme because they are captured elsewhere in the assessment.

Other assessments have mapped wildland community value based on census data (Radeloff et al. 2018) or stakeholder-drawn polygons (e.g. Gardiner 2016). The four types of resources and assets used to map value in this assessment are a more spatially discrete representation of where community value is concentrated on the landscape. All resources of each type were assigned the same value because technical panelists viewed all instances of resources as having equal value. For example, even if property or structure value data were available, they would not have been used to differentiate importance of structures to communities.



Map 19. Resource and assets used to model the distribution and concentrations of value to wildland communities (FCC 2013; FHWA 2019; Microsoft 2018; NMED 2019b; USGS 2019b, 2019a).

Buildings were mapped from a national building footprint dataset (Microsoft 2018) that was modified to remove false-positive building detections. Water infrastructure was mapped from conveyances (NMOSE 2020a), diversions (NMOSE 2020b), and water facility data (NMED 2019b). Communications sites were mapped from a Federal Communications Commission database (FCC 2013). Major roads were accessed from the national highway planning network (FHWA 2019) (Map 19).

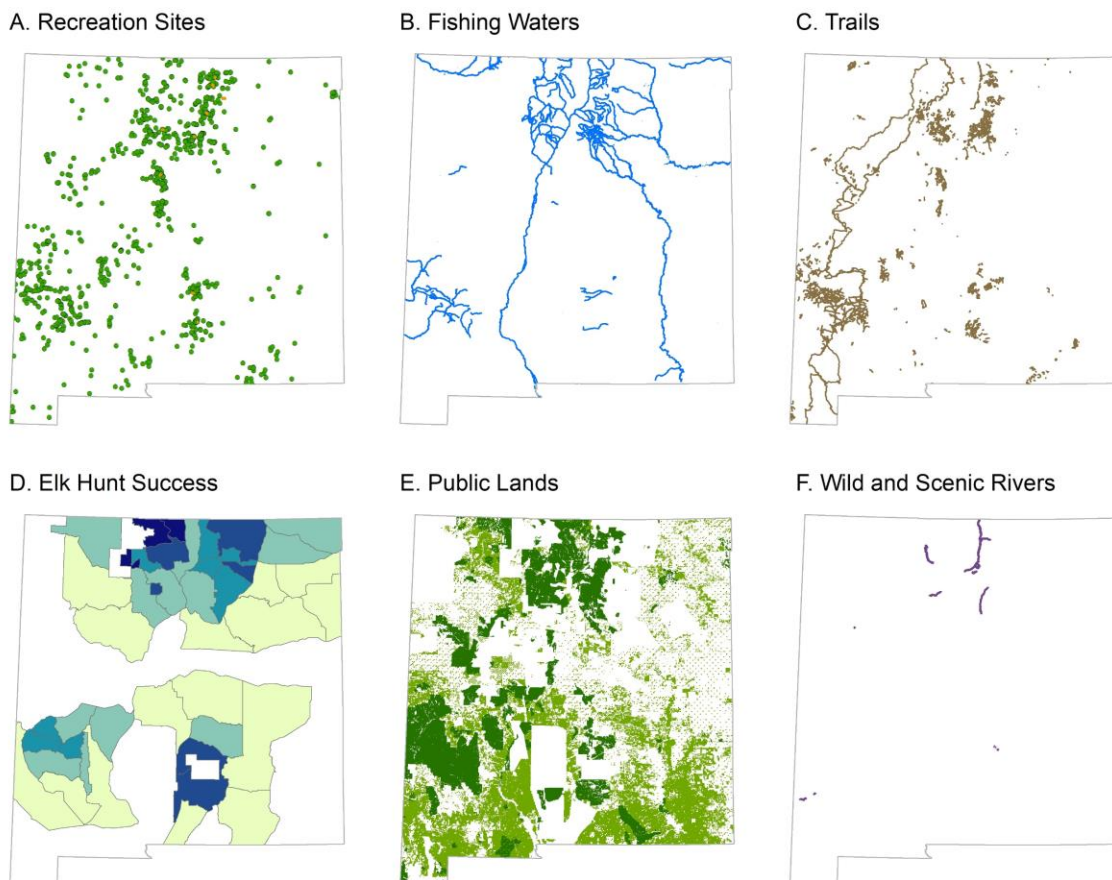
Wildfire threatens buildings, water infrastructure and communications sites. These resources are characterized as being susceptible to wildfire when flame lengths exceed six feet. Post-fire debris flow threatens major roads. This assessment mapped all debris flows that flow through drainages that intersect major roads as threats, though local mitigation measures may decrease actual risk posed by debris flow to the road. Post-fire flooding threatens buildings. For this analysis, flood inundation depths over six inches were characterized as damaging to buildings.

## Theme: Recreation and Cultural Use

New Mexicans place a high value on outdoor recreation and cultural use of the land. This assessment defines cultural use as resource use to sustain a way of life and recreation as activities practiced for enjoyment rather than to sustain a way of life. The constituency that relies on natural resource for cultural use is different from the constituency that relies on natural resources for recreation benefit, but they are group together as a single theme because many resources and assets are valued by both constituencies. Data for each resource and asset included in this theme are available separately so individual constituencies can make use of the data that aligns with their interests. Use of these resources and assets provide direct personal benefits, and communities benefit from the industries supported by both recreation and cultural use.

Visitors to state and national parks and wildlife refuges contribute to the economic wellbeing of the state. For example, visitors to Bosque Del Apache National Wildlife Refuge generated \$13.9 million in economic impact in 2017 (Huber and Sexton 2019). Visitors to Bandelier National Monument and White Sands National Monument respectively generated \$16 million and \$37 million in 2018 (Cullinane Thomas, Koontz, and Cornachione 2019). Across all lands in the state, hunting, fishing, and trapping contributed \$453 million to the gross domestic product of New Mexico in 2013 (NMDGF 2014).

The resources and assets mapped in this theme capture a wide range of activities (Map 20). They include developed recreation sites, trails, ski areas, state fishing waters and hunting areas, as well as lands managed for public recreation and designated and eligible wild and scenic rivers.



Map 20. Resources used to model the distribution and concentration of recreation and cultural use value (CDTC 2019; IWSRC 2019; NMDGF 2018, 2019; USFS GTAC 2019; USGS 2019b; USGS GAP 2018)



Wildfire is a threat to recreation sites, trails, ski areas, lands managed for recreation, designated wilderness, and hunting areas. Post-fire hazards threaten fishing waters and wild and scenic rivers. For this analysis, recreation site points were buffered by 300 meters and trail centerlines were buffered by 100 meters. Immediate source water areas for wild and scenic rivers and fishing waters were mapped as potential sources of post-fire hazards. Game management units are a relatively coarse geographic unit to map hunting value; in future assessments, this data could be further refined by including additional game species and limiting density calculations to only preferred habitats.

### Theme: Timber and Grazing

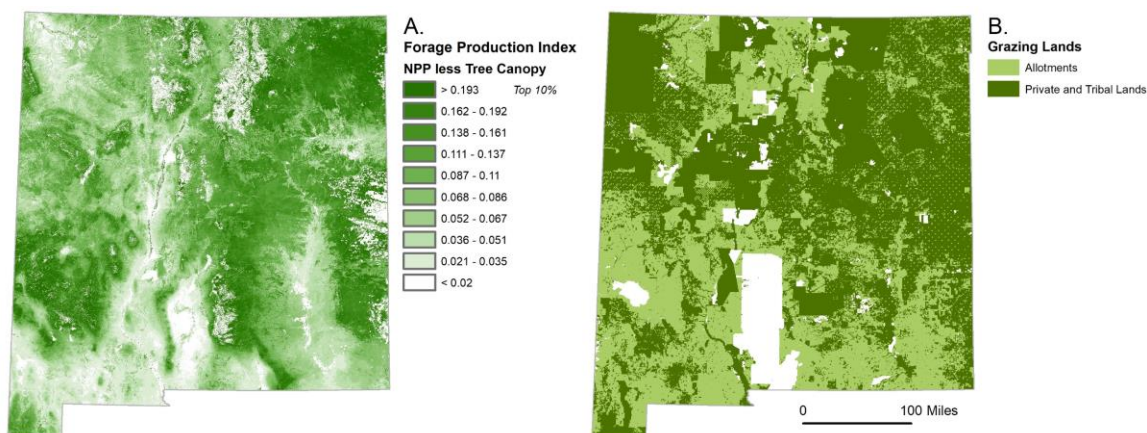
Timber and grazing are grouped together in this theme because the resource value models are similar. For timber, tree inventory and production are assigned value. For grazing, value is assigned to forage production. Both rely on the growth and regeneration of biomass. Both are valued most where the resource is accessible, either on private land or lands where grazing or timber harvest are allowed.

Fire can be both a threat and a benefit to timber and forage. High-intensity fire that produces high-severity burned areas that recover slowly are detrimental to both resources. Low-intensity fire can enhance these resources by stimulating growth of forage and timber. Climate change may alter the distribution of each of these resources. Forest pests also pose a threat to timber. Post-fire erosion is the biggest threat to grasslands. Other resources and assets of value to timber and grazing include grazing infrastructure like fences and waterers, and mills and other forest product processing facilities. However, neither were included in this assessment because data for grazing infrastructure is incomplete and the complex analysis required to utilize haul distance to mills has not yet been done.

#### Forage Production

Forage production was modeled as a function of primary productivity and canopy cover. Forage production has a negative correlation with canopy cover, so as canopy cover increases, forage production decreases. Maximum net primary productivity was modeled for 2016 with LANDSAT imagery using Google Earth Engine. Canopy cover estimates from 2016 ensured recently burned areas were not erroneously predicted as low productivity sites (Homer et al. 2015). Irrigated agricultural lands are some the highest productivity areas in the state, so were masked using a recent cropland dataset (USDA 2018).

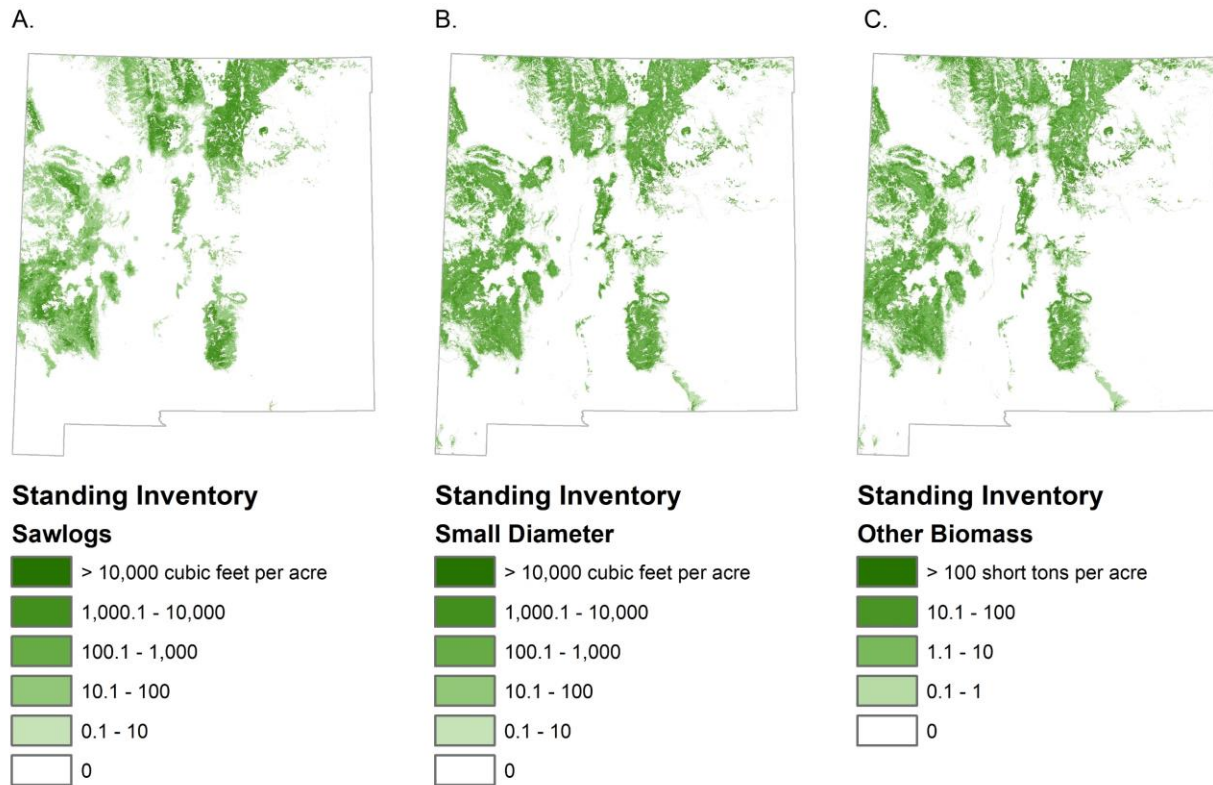
Forage production is most valuable on private lands and allotments where grazing occurs. Higher grazing intensities are possible in higher productivity sites, but even in relatively low-productivity sites, the forage produced has tremendous value to the landowner.



Map 21. Forage production productivity was modeled as a function of net primary productivity (NPP) less irrigated cropland, decreasing as canopy cover increases. Forage production is most valuable on private lands and allotments where grazing value to beneficiaries is highest.

### Timber Inventory

Estimates for standing timber inventory were derived from Forest Inventory and Analysis (FIA) Program county-level estimates (USFS 2019), downscaled using maps of forest vegetation type group (USFS 2006) and continuous estimates of basal area (Krist et al. 2014).

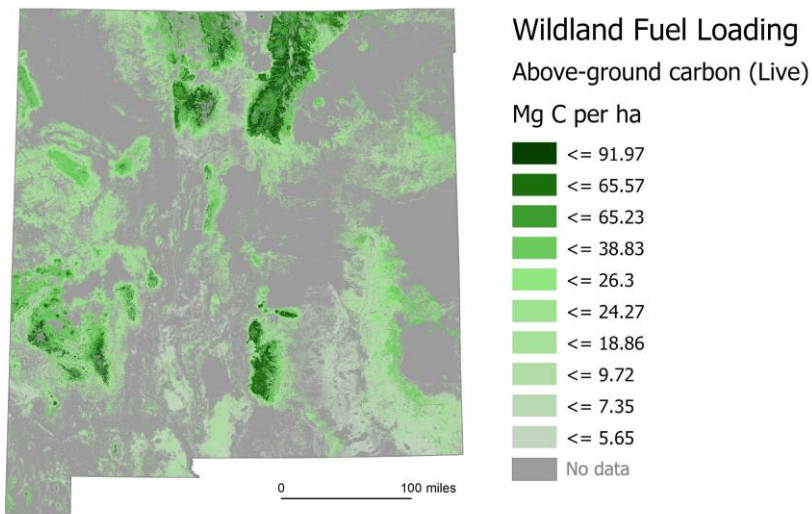


Map 22. Standing inventory of sawlogs based on Forest Inventory and Analysis (FIA) Program county-level estimates, downscaled using maps of forest vegetation type and continuous estimates of basal area. B) This small diameter product is exclusive of sawlogs. C) This 'other biomass' inventory estimate is exclusive of sawlogs and small diameter timber.

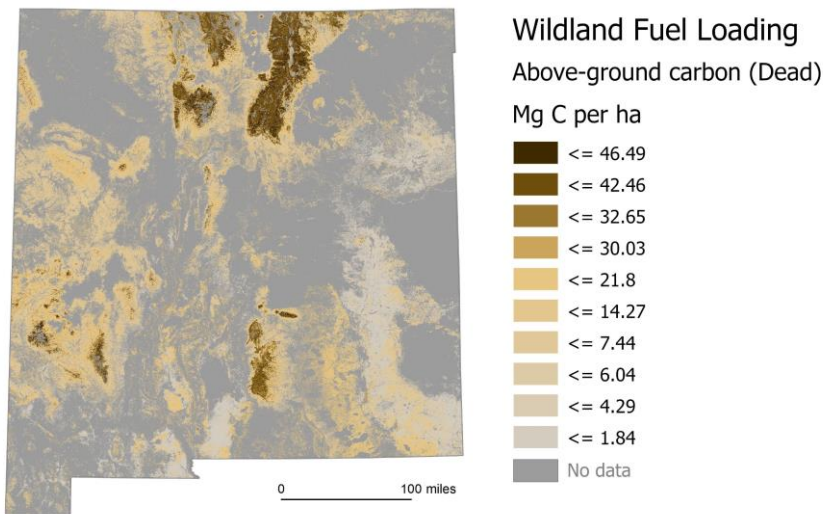
### Theme: Carbon and Soils

The carbon stored in New Mexico's natural and working lands accumulates slowly through annual growth but can be released rapidly during a wildfire. Carbon stored in aboveground fuels is very susceptible to loss, while carbon stored in the soil is more resilient to wildfire but also vulnerable to erosion. In this theme, the distribution of carbon is mapped in three pools: aboveground live, aboveground dead, and soil carbon. Belowground live carbon was not mapped because it is least susceptible to disturbance. Because New Mexico's forests are overstocked, high carbon storage rates are not sustainable. Instead of valuing the highest concentrations of carbon on the landscape, this assessment assigns the highest value to resilient levels of carbon storage.

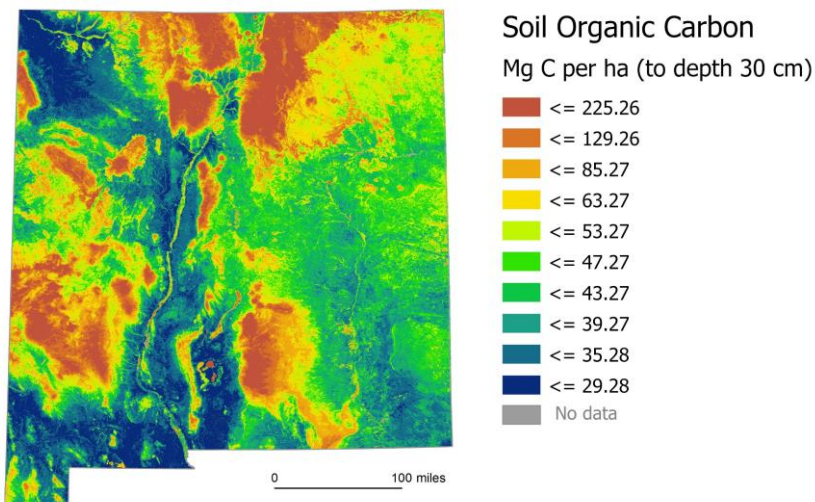
The aboveground live carbon pool (Map 23) and aboveground dead carbon pool (Map 24) were summarized from national fuels models (Prichard et al. 2019). Soil organic carbon (Map 25) was mapped from nationally continuous soils data (Ramcharan et al. 2018).



Map 23. Above-ground live carbon pool (Prichard et al. 2019)



Map 24. Above-ground dead carbon pool (Prichard et al. 2019)



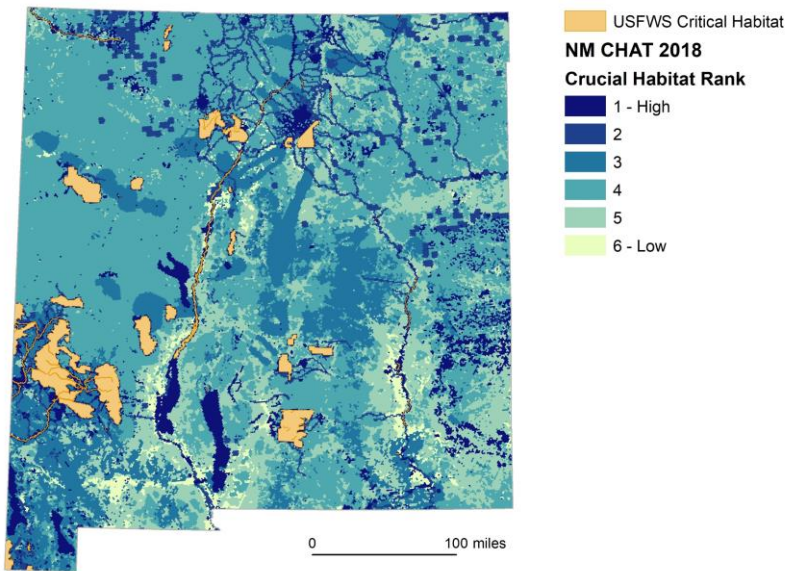
Map 25. Soil carbon pool. Soil organic carbon (SOC) was modeled from 0 - 30 cm (Prichard et al. 2019). SOC at depths greater than 30 cm is unlikely to be lost to the hazards included in this assessment.



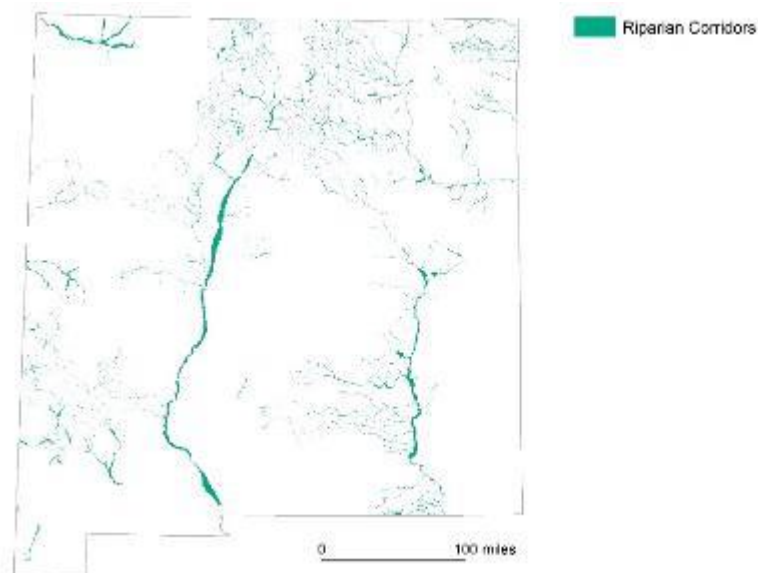
## Theme: Biodiversity

New Mexicans recognize both the intrinsic value and external values derived from biodiversity and ecological function. This assessment assigns innate value to biodiversity itself, though people also benefit from biodiversity. For example, it contributes to the economic wellbeing of the state by attracting visitors who spend money on outdoor recreation in areas valued for their biodiversity. The technical panel for this theme decided to map the spatial distribution and concentrations of biodiversity and characterize the susceptibility of resources to applicable threats.

Existing analyses like the *2016 State Wildlife Action Plan* (NMDGF 2016) and the *Crucial Habitat Assessment Tool* (CHAT) (NMDGF and NHNM 2013) provide the foundation for this theme. The assessment mapped terrestrial and aquatic habitat (Map 26), riparian corridors (Map 27), landscape connectivity (Map 28), important bird areas (Map 29), important plant areas (Map 30), and naturalness (Map 31).

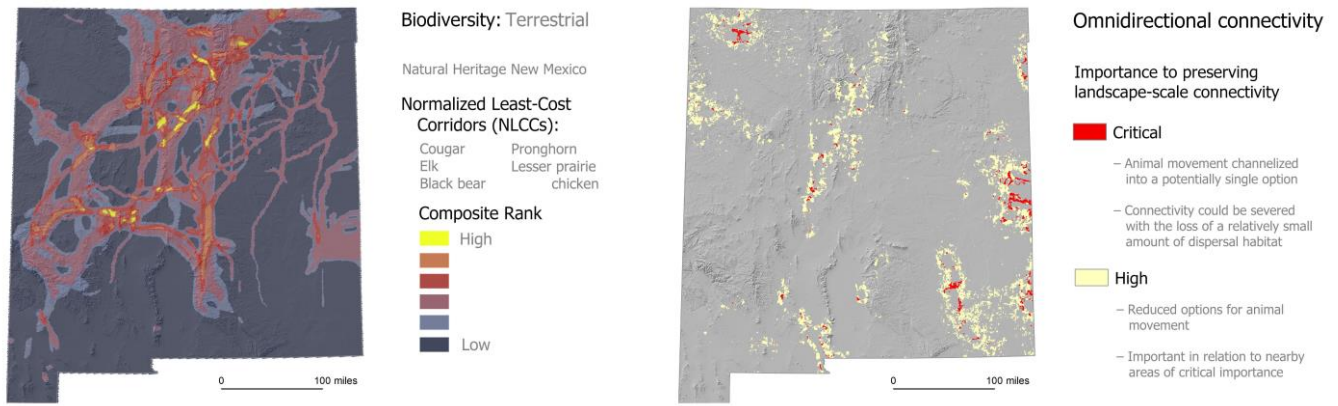


Map 26. Habitat value components (NMDGF and NHNM 2013)

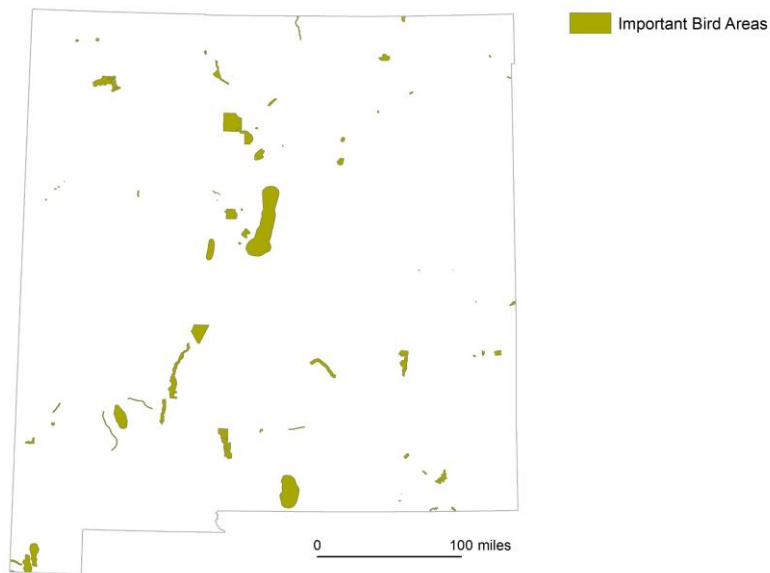


Map 27. Riparian corridors (Muldavin et al. 2020).

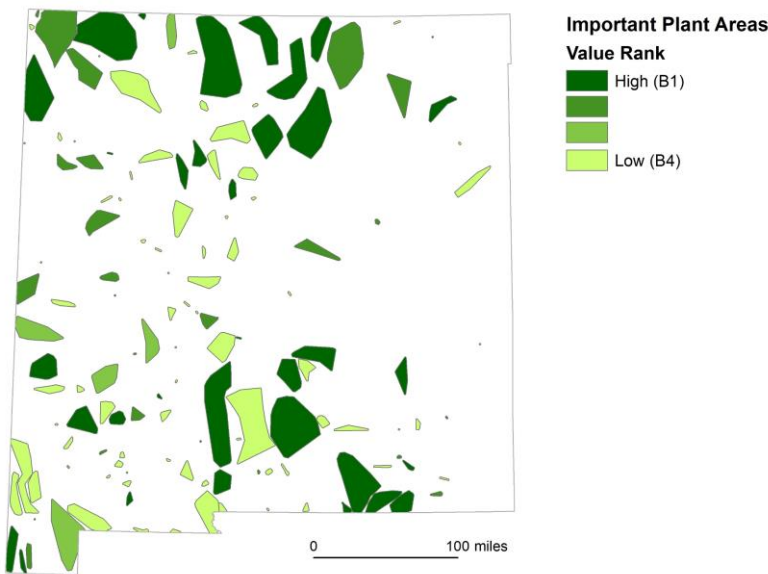




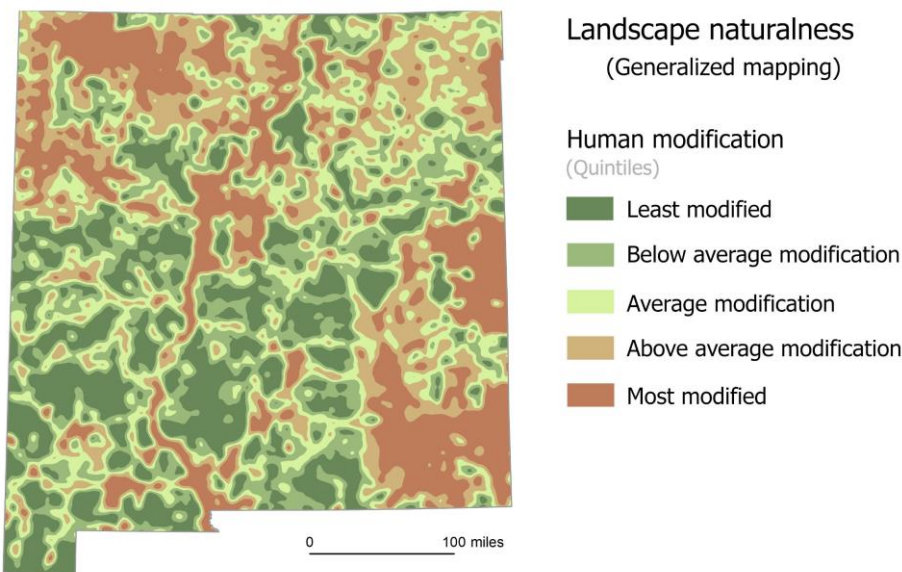
Map 28. Two approaches to connectivity are included in this assessment. (a) Habitat connectivity for five focal species was modeled as set of least-cost corridors calculated using kernel density estimation on factorial least-cost paths. Shown is a composite map of maximum values taken from all five species (Wan, Cushman, and Landguth 2018). (b) Landscape connectivity was modeled omnidirectionally using Omniscape (Landau 2020), a moving-window implementation of Circuitscape (McRae et al. 2008), applied over an index of human modification (Theobald et al. 2016). Shown are the areas where flow (representing multi-species movement potential) is most constricted.



Map 29. Important bird areas (Wells, Niven, and Cecil 2005).



Map 30. Important plant areas (EMNRD 2017).



Map 31. Naturalness modeled as the inverse of human modification as mapped from a broad range of development indicators (Theobald et al. 2016).

The resources analyzed for the biodiversity theme are less consistent in their response to hazards than resources analyzed for the other themes. Widespread, uncharacteristically high-intensity wildfire and associated post-fire hazards threaten most of these resources, as do climate change, development and landscape fragmentation. Some resources may be sensitive to forest management activities. Those resources require that practitioners take extra care to protect them when mitigating threats to, and enhancing the benefits of, other resources.

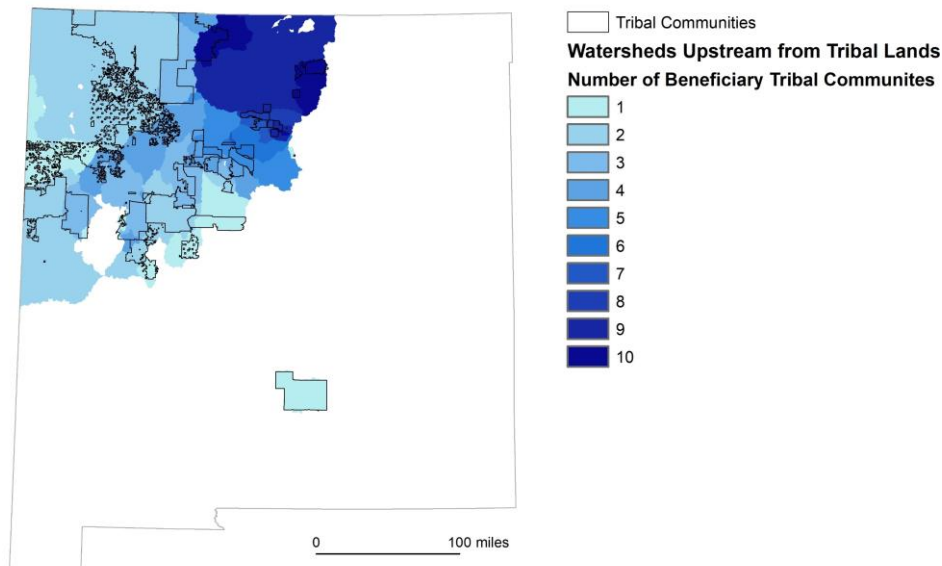
## Theme: Indigenous and Traditional Communities

New Mexico’s indigenous and traditional communities are inextricably tied to the land. Indigenous communities have persisted in our landscape since time immemorial, and land grant communities have survived for hundreds of years. Traditional land management practices shape the land we see today, and traditional knowledge still guides land management in New Mexico. This technical panel was convened as an intentional space for the communities that practice a traditional land-based lifestyle to identify resources and assets that provide benefits to their communities and that they wish to see protected from threats.

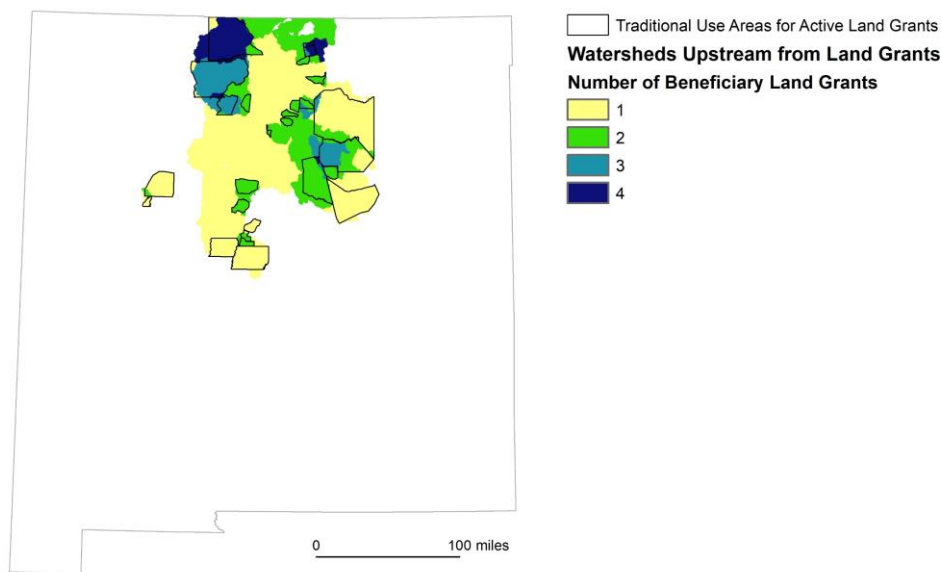
During technical panel meetings, panelists identified a broad range of important places, resources, and assets. Many of them were already mapped in other themes. Others were unmappable because doing so would reveal traditional knowledge that is inappropriate to share. Instead of mapping the value brought by the resources relied on by the community, the panel suggested mapping these communities as special beneficiaries of the other themes. If these communities are to persist, the resources and assets they rely on must persist as well.

One option—mapping ancestral lands where these communities historically practiced their way of life— was too broad to delineate special beneficiary areas. Technical panelists pointed out that the entire state is ancestral land, so the entire state should receive added importance, which would negate the added importance. The panel selected an alternative approach that assigns additional importance to the systems, resources and assets that support indigenous and traditional communities.

This approach gives elevated beneficiary value to the current extent of the indigenous and traditional communities and the watersheds above them in the statewide value and risk analyses. There are twenty-three sovereign tribal nations in New Mexico and twenty-seven land grant communities recognized as political subdivisions of the state. This assessment assigns additional importance to resources and assets anywhere within or upstream from their boundaries. The technical panel considered weighting those areas proportionally to the number of communities that depend on an area but decided to assign the same weighting to all those areas regardless of the number of beneficiary communities.



Map 32. There are twenty-three sovereign tribal nations within New Mexico. Source watersheds provide water for up to ten downstream tribal communities.



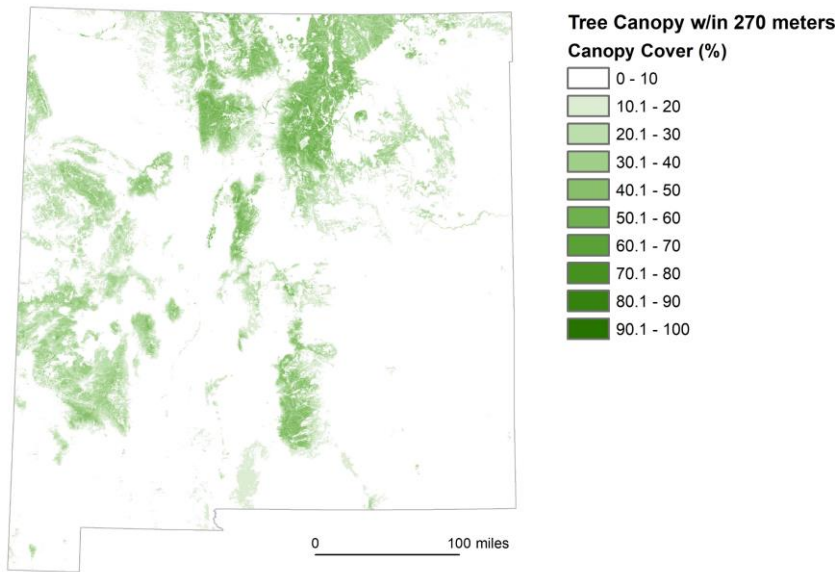
Map 33. Traditional use areas for active land grants recognized as political subdivisions of New Mexico. The traditional use areas and the watersheds that serve them sustain these traditional land grant communities.

## Theme: Urban Forests and Communities

Urban forests cool cities, filter air, and have demonstrated benefits to human wellbeing and quality of life. For this theme, the assessment maps the value of existing urban forests along with tree canopy deficit locations where additional tree canopy would have the greatest benefit. Tree canopy was mapped at sub-meter resolution in developed areas, providing an unprecedentedly detailed view of the urban forest canopy in communities across the state.

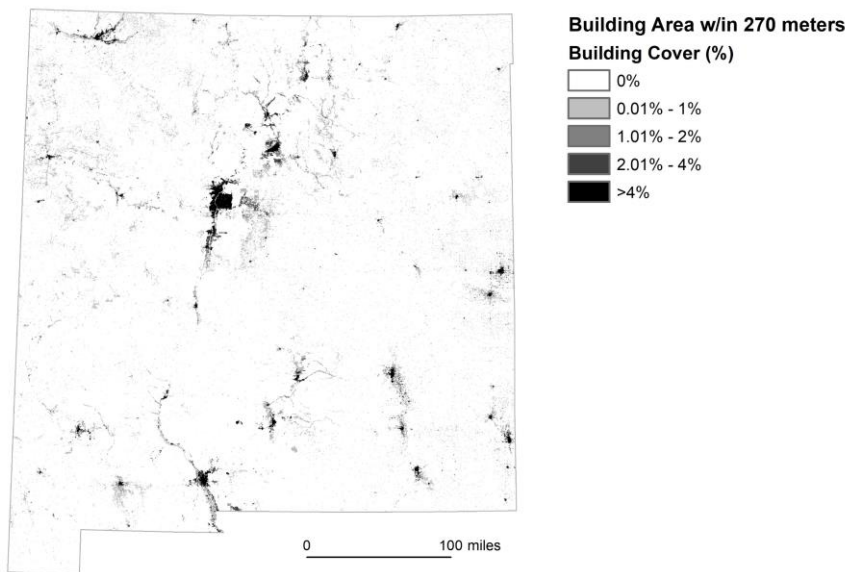
National Agricultural Imagery Program (NAIP) imagery collected in 2018 was classified into a binary canopy dataset based on unsupervised classification (Jones 2020). This dataset was aggregated to 30-meter canopy cover estimates to quantify the current density of urban canopy across all developed areas identified by the U.S. Census Bureau in New Mexico. Canopy cover estimates from the National Landcover Dataset (NLCD) (MRLC Consortium 2019), were used to fill gaps adjacent to the delineated developed areas. Because value is received from tree canopy even when not directly under the canopy and typically decays outward from the canopy to around 300 meters (McDonald et al. 2016), a 270-meter focal filter was used to calculate the average canopy cover within 270 meters of every point in the developed areas. This average canopy cover within 270 meters is the current 'supply' of urban forest value (Map 34).





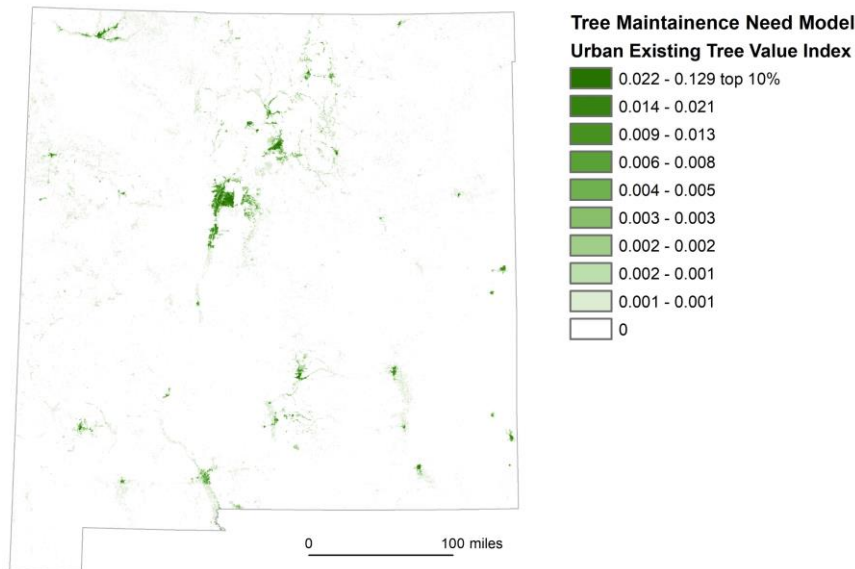
Map 34. The value of canopy to urban beneficiaries is modeled with this 270-meter average canopy cover dataset. Urban forest value was mapped statewide, so any areas where there are clusters of beneficiaries, the tree canopy supply value could be determined.

Beneficiaries of the urban forest canopy can be mapped in several ways. Census data is frequently used to map population density, but this accounts for only the residents that live within a census reporting unit. Because urban forests provide benefits to all people within 270 meters, not just residents, an alternative beneficiary index was sought. The building footprint dataset used in the wildland communities theme also has utility for mapping urban forest beneficiaries. The building dataset includes schools, industrial parks, and office complexes as well as residential structures (Microsoft 2018). The analysis assumed that beneficiaries of urban forests have approximately the same distribution and concentration as these structures because they represent the types of buildings where people spend most of their time. The analysis correlates high building density to a high density of beneficiaries of urban forests (Map 35).



Map 35. Building density serves as an approximation of urban forest beneficiary density (Microsoft 2018).

The technical panel wanted a model showing where urban tree maintenance need is high. Current urban canopy value was mapped by multiplying an index of the current canopy cover within 270 meters by an index of the building cover within 270 meters. Areas where canopy density is high and beneficiary density is high have values near 1. Areas where there is no tree canopy or no beneficiaries have a value of zero. This current canopy value map can be used to identify places where loss of tree canopy would have the largest negative impacts (Map 36).

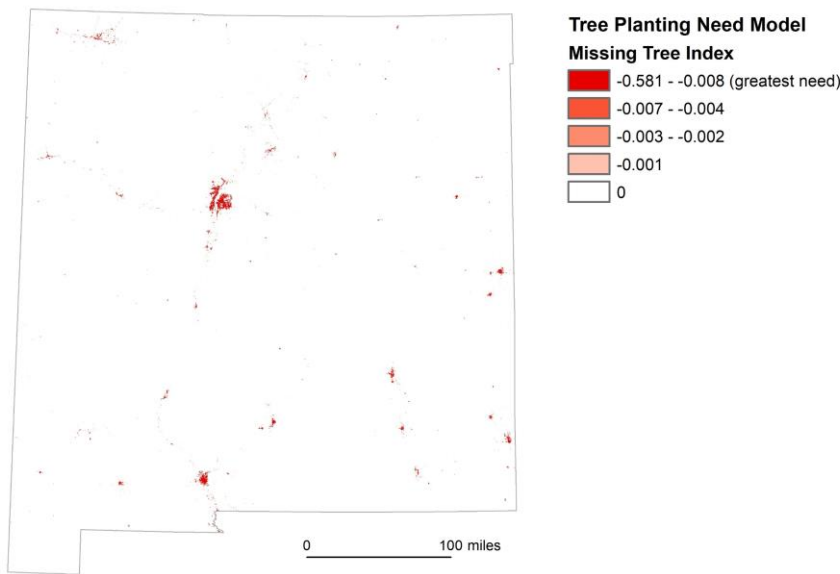


Map 36. Current canopy value is a function of the current tree canopy cover and the density of beneficiaries modeled with building density (Jones 2020; Microsoft 2018; MRLC Consortium 2019).

Technical panelists for this theme were also interested in mapping areas where additional tree cover would have the greatest benefit. The resulting Tree Planting Need Model was created using similar input datasets. Tree canopy deficit was calculated where average canopy cover within 270 meters was below 15%. This deficit was converted to an index, where the largest deficit was equal to 1, and no deficit was equal to 0. Impervious surface was used as a secondary indicator of canopy need. High density of impervious surface is correlated with air pollution and elevated air temperatures, both of which are mitigated by increased tree canopy. An index was produced where high densities of impervious surface have a value of 1 and low densities a value of 0. The canopy deficit index and impervious surface index were multiplied by the beneficiary index (measured by building density) to identify places where additional tree canopy would mitigate air quality and temperature impacts for the greatest number of people (Map 37).

Additional factors must be considered when using these models to guide strategies and actions, for example, physical constraints on tree planting (like extreme density of impervious surface) or incompatible land uses like sports fields.

Hazards threaten urban forest resources in similar ways to other resources and assets. Development, disease and insects, and climate change are persistent threats to urban tree canopy. Wildfire is somewhat less of a concern. While wildfire can damage urban forests, impacts to other resources and assets like homes and other structures are typically much more significant, and if buildings are destroyed the value of the canopy decreases due to decreases in benefit. Hazards also threaten urban residents, where additional urban canopy cover may mitigate those impacts. Climate change poses a threat to the health of urban residents (Woods et al. 2019). Additional research is needed to model the value of canopy cover for mitigation of heat related illness.



Map 37. The tree planting need model identifies areas where additional tree canopy would have the greatest benefit. It is a function of tree canopy, impervious surface, and beneficiary density (Jones 2020; Microsoft 2018; MRLC Consortium 2019).

## Relative Importance of Resources and Assets

The Division conducted a survey to inform the relative importance weighting of the resources and assets mapped in this assessment. The survey used two instruments: an online form distributed via email, websites, and during webinars, and a paper form distributed during the February 2020 Forest and Watershed Health Coordinating Group/FAP Stakeholder Workshop. Eighty-seven responses were received with 32 completed using the paper form and 55 completed online. Respondents were asked to score their perceived importance of 39 resources and assets on a scale from 0 to 10 with 5 representing average importance, 0 representing low importance and 10 representing high importance. Most respondents had previously seen a presentation about these resources and assets, though consistent definitions of each resource cannot be assumed.

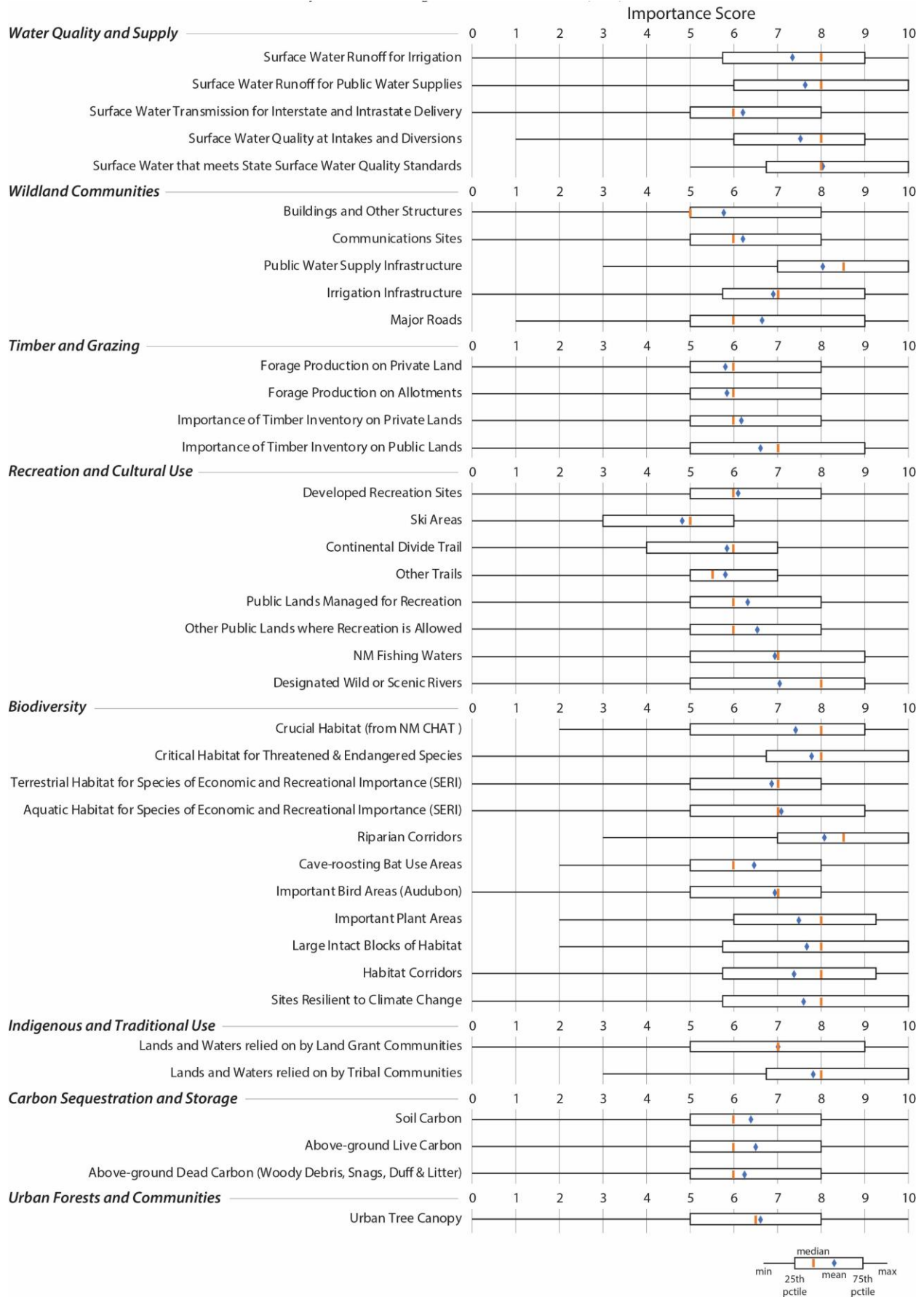
The resources and assets with the highest mean importance are “Riparian Corridors,” “Public Water Supply Infrastructure” and “Water that meets State Surface Water Quality Standards” (Figure 3). Every resource or asset was scored by at least one participant as being of the highest importance, and over three quarters of resources were scored as

having the lowest possible value by at least one respondent. Voluntary self-selected participation may bias the results towards stronger opinions about relative importance of certain values.

The results of this survey were used to ensure high-importance resources and asset were mapped. For instance, identification of “Surface Water Quality to meet State Water Quality Standards” as a consensus high-importance resource led the GIS team to conduct additional analysis to ensure risk to this resource was adequately mapped. The Division sought out new spatial data for river corridors and drafted a sub-strategy for riparian restoration, given the high ranking of “Riparian Corridors” in the survey.

The relative importance values produced by this survey are one possible valuation. Every person, organization, and agency will bring different perspectives to the question of relative importance. One single definitive scoring of importance is unnecessary and counterproductive for a diverse stakeholder driven process. Instead, flexibility is granted, allowing each strategy prioritization process to specify relative importance to accurately reflect the intended impact of the intervention.

Figure 3. Relative importance of resources and assets as rated by 87 resource managers in January and February 2020 (n=87).

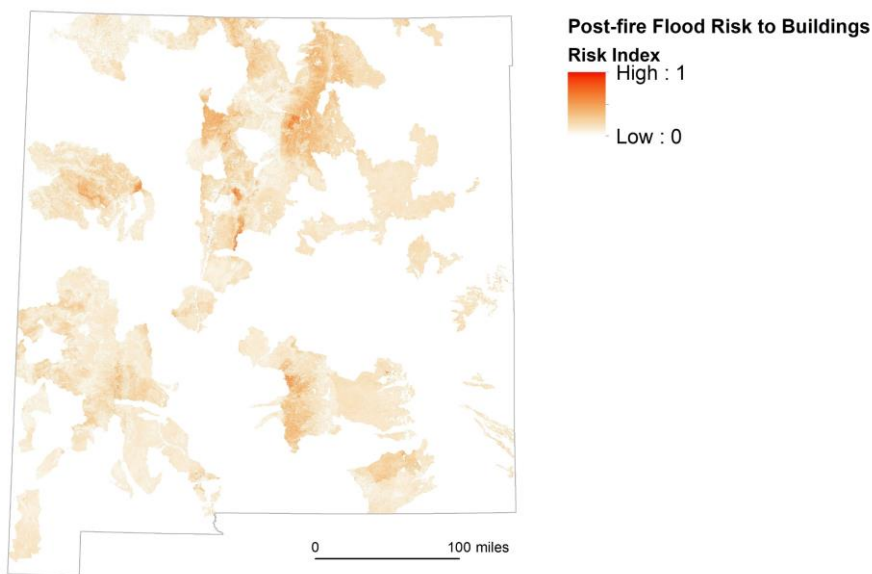




## Risk Assessment

The maps of resource and asset value developed by the technical panels were combined with the maps of hazards using the susceptibility characterization process to produce single resource risk maps for each relevant hazard. The risk assessment framework that was adapted for use in this assessment was originally developed for wildfire risk assessment only. New Mexico’s analysis adapted the framework, extending it to other hazards and modifying it to simplify mapping of risk. One way in which the analyses differ is in mapping where resources have a positive response to disturbances. Whereas the original framework can identify areas where the expected net value change from each hazard is positive, the adapted framework does not. That type of analysis requires consistent and detailed response functions. It was not feasible to develop detailed response functions for each combination of valued resource and relevant threat, so for this analysis susceptibility was instead characterized by the threshold where significant damage would occur to resources.

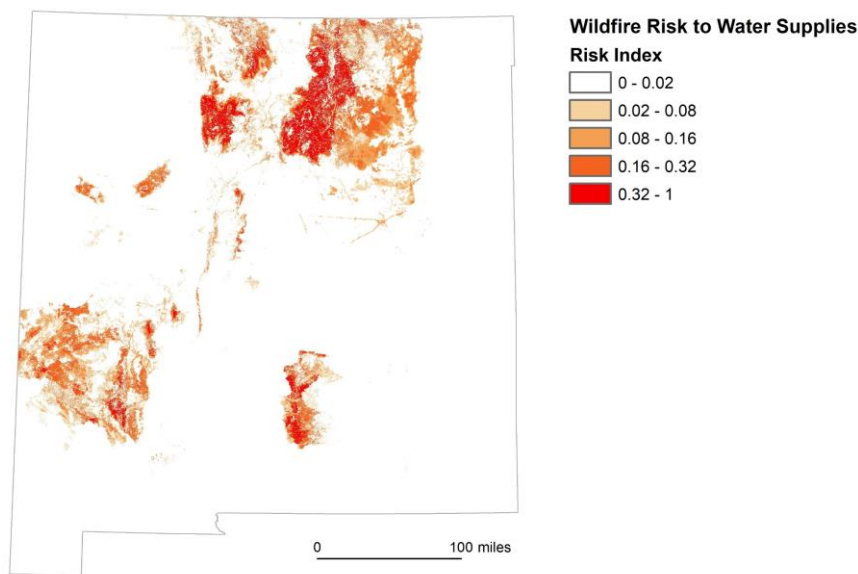
The assessment produced risk maps for specific resources, which can then be combined to produce models to inform strategies. One example of a resource-specific risk map is the map depicting relative risk of post-fire flooding to buildings (Map 38). Structures in floodplains were identified, and the watersheds upstream from those structures were mapped and then analyzed for likelihood of burning in a wildfire and likelihood of spawning a flash flood after the fire has burned.



Map 38. Post-fire flood risk to buildings. Dark orange areas have a higher likelihood of burning in a wildfire and producing a flood that will impact structures in downstream flood hazard zones.

The Division also used the resources and hazards data to produce strategy-specific risk assessments. For example, wildfire risk to multiple water resources and assets was mapped to enable the Division and its partners to more effectively prioritize investments in protecting water supplies from wildfire (Map 39).

As new needs arise, the Division or its partners can create additional syntheses of several resource-specific risk maps to identify areas where a specific strategy or activity can mitigate risk. Once high-risk areas are identified, managers and decision makers consider further information such as physical or legal constraints on mitigation actions and mitigation costs when prioritizing landscapes and developing projects.



Map 39. Combined risk posed by wildfire to surface water for irrigation, surface water for public water systems, water quality, and water transmission.

## Data Gaps

The Assessment was completed using the best available data and stands as the best currently available product for prioritizing forest management activities in New Mexico. During development of the assessment, subject matter experts identified gaps in the available data that would have improved the Forest Action Plan if they were available. In order to improve future planning initiatives, including revisions to this plan, the Division has documented these data gaps and, with input from its partners, prioritized them for resolution (Table 5).

Identification and documentation of data gaps proved to be a critical component of the 2010 Assessment. It guided subsequent efforts to acquire needed data and supported successful requests for

funding to do so. This list provides perspective on the completeness and accuracy of the Assessment and prioritizes new data to be acquired.

Despite these data gaps, this assessment reflects the current understanding of values, threats and risk. These data gaps should be filled as opportunities arise but waiting for perfect information before taking action increases risk to resources and assets. The Division and its partners can identify appropriate actions based on the priorities and strategies that were developed with the currently available information. As additional data becomes available, these priorities and strategies can be reconsidered or adapted.

Table 5. Data gaps identified during development of the Assessment.

<b>High Priority Data Gaps</b>	<b>Description</b>
Wildfire Hazard	Wildfire hazard data will improve as wildfire simulations are re-run to incorporate improved fuel loading and canopy structure data. Inconsistent fuels mapping across ecoregion boundaries produces artifacts that complicate statewide comparison of wildfire hazard.
Fire Behavior Fuel Models	Inconsistencies across ecoregion boundaries in the currently best available fuels data introduce errors to fire hazard models. A consistent statewide surface fuel model dataset would enable consistent mapping of fire hazard statewide.
Canopy Fuel Characteristics	Improved spatially continuous data characterizing canopy base height, canopy bulk density, canopy cover, and canopy height would substantially improve fire hazard models. Statewide LiDAR data is now available and may be useful for developing these new canopy datasets.
Electricity Distribution Lines	Electricity distribution lines are both an asset/resource and a source of ignition for wildfire. Currently available datasets are incomplete and where available are inconsistent between utility service areas.
Points of Diversion Attributed with Acres Irrigated and Number of Irrigators	The best available data is from a 1987 OSE report on acequias and irrigation associations. A second edition of that report would improve water provisioning models.
Public Water System withdrawal locations with population served	Public water supply system datasets have low-precision intake points, causing source watersheds to be delineated with less certainty. Improving the spatial precision and accuracy of intake point locations will improve water provisioning models.
Response functions for value change following disturbance	The simplified risk assessment approach employed in this assessment didn't require detailed response functions characterizing susceptibility to each threat. Comprehensive and detailed response functions would support tradeoff analysis between treatment types.
<b>Other Data Gaps</b>	<b>Description</b>
Groundwater Source Areas	Analytical product mapping the surface catchments that recharge aquifers weighted by beneficiaries and recharge volume.
Projections of Runoff, accounting for Climate Change	The ecosystem service models in this assessment are based on observed weather. Models based on projections of future climate would ensure planning is based on realistic future scenarios.
Pre-fire Burn Severity Model	Current pre-fire burn severity models do not account for varied burning conditions. Improving burn severity models would improve post-fire hazard modeling.
Opportunity and cost models for strategies	Additional spatial filters mapping where strategies can be applied, where they are likely to be most effective, and the cost of implanting the strategy in each location would allow managers to optimize investments based on the expected return on investment from each implementation project.
Forest product industry map	Mill and processing facility locations, product demand and, haul distances for each facility, and gaps between supply of forest products and demand will allow spatial mapping to support strategy #8.
Habitat value maps for non-game species	Mapping high-use or high-importance areas, along with susceptibility of this use to hazards will allow a more robust assessment of risk to biodiversity. In particular, the maps of high value bat and bird use areas in New Mexico are incomplete
Game species habitat value maps, including additional species and revising mapping methodology.	Elk are the only terrestrial game species mapped in this assessment. To enable further optimization of investments in habitat protection and enhancement, habitat value for additional species must be mapped. Additionally, the game management unit (GMU) approach employed in this assessment should be further refined to value only the areas within a GMU that are habitat for the species of interest.

## References

- Abatzoglou, John T. and A. Park Williams. 2016. "Impact of Anthropogenic Climate Change on Wildfire across Western US Forests." *Proceedings of the National Academy of Sciences* 113(42):11770–75.
- Adams, Alexis Marie. 2017. "Can New Mexico's Ancient Irrigation Canals Survive a Changing Climate?" *Food & Environment Reporting Network*, December 21, 1–13.
- AdaptWest. 2018. "Climatic Dissimilarity for North America." Retrieved (<https://adaptwest.databasin.org/pages/climatic-dissimilarity>).
- Albert, Steven, Nelson Luna, Roger Jensen, and Larry Livingston. 2004. "Restoring Biodiversity to Piñon-Juniper Woodlands." *Ecological Restoration* 22(1):18–23.
- Allen, Craig D., Melissa Savage, Donald A. Falk, Kieran F. Suckling, Thomas W. Swetnam, Todd Schulke, Peter B. Stacey, Penelope Morgan, Martos Hoffman, and Jon T. Klingel. 2002. "Ecological Restoration of Southwestern Ponderosa Pine Ecosystems: A Broad Perspective." *Ecological Applications* 12(5):1418–33.
- Andrews, Patricia L. 2018. "The Rothermel Surface Fire Spread Model and Associated Developments: A Comprehensive Explanation. RMRS-GTR-371."
- Asmerom, Yemane, Victor J. Polyak, Jessica B. T. Rasmussen, Stephen J. Burns, and Matthew Lachniet. 2013. "Multidecadal to Multicentury Scale Collapses of Northern Hemisphere Monsoons over the Past Millennium." *Proceedings of the National Academy of Sciences of the United States of America* 110(24):9651–56.
- AuBuchon, Jonathan and Chi Bui. 2014. "Stream Restoration Within A Confined Space: A Case Study on the Middle Rio Grande." 2014(June):1–2.
- Bassett, Steven. 2020. *Pre-Fire Estimates of Post-Fire Flood Production for New Mexico*.
- Bassett, Steven and Manuel K. Lopez. 2020. *Assessing Post-Fire Debris-Flow Hazard Prior to Wildfire to Enable Pre-Fire Planning and Investments in Risk Mitigation across Colorado and New Mexico*.
- Bender, Stacie, Wendy Goetz, Mark Finco, Bonnie Ruefenacht, Vicky Johnson, Josh Reynolds, Jan Johnson, Greg Liknes, Zhiqiang Yang, and Kevin Megown. 2019. "2016 Tree Canopy Cover for the National Land Cover Database: Production Data, Methods, Uses, and a Tour Through American Landscapes."
- BGN. 2020. "Geographic Names Information System."
- Cannon, S. H. and J. E. Gartner. 2005. "Wildfire-Related Debris Flow from a Hazards Perspective." *Debris-Flow Hazards and Related Phenomena* 363–85.
- Carroll, Carlos. 2018. *Climatic Dissimilarity Data for North America at 1 Km Resolution*. (Version 1.0) [Data set].
- CDTC. 2019. "Continental Divide Trail." Retrieved November 5, 2019 (<https://continentaldividetrail.org/cdt-data/>).
- Cullinane Thomas, Catherine, Lynne Koontz, and Egan Cornachione. 2019. "2018 National Park Visitor Spending Effects."
- Dettinger, Michael, Bradley Udall, and Aris Georgakakos. 2015. "Western Water and Climate Change." *Ecological Applications* 25(8):2069–93.
- Diemer, Joel, Terry Crawford, and Michael Patrick. 2012. "Agriculture's Contribution to New Mexico's Economy: Circular 675." 1–8.
- Eidenshink, Jeff, Brian Schwind, Ken Brewer, Zhi-Liang Zhu, Brad Quayle, and Stephen Howard. 2007. "A Project for Monitoring Trends in Burn Severity." *Fire Ecology* 3(1):3–21.
- EMNRD. 2017. *New Mexico Rare Plant Conservation Strategy*.
- Fargione, Joseph E., Steven Bassett, Timothy Boucher, Scott D. Bridgman, Richard T. Conant, Susan C. Cook-patton, Peter W. Ellis, Alessandra Falcucci, James W. Fourqurean, Trisha Gopalakrishna, Huan Gu, Benjamin Henderson, Matthew D. Hurteau, Kevin D. Kroeger, Timm Kroeger, Tyler J. Lark, Sara M. Leavitt, Guy Lomax, Robert I. McDonald, J. Patrick Megonigal, Daniela A. Miteva, Curtis J. Richardson, Jonathan Sanderman, David Shoch, Seth A. Spawn, Joseph W. Veldman, Christopher A. Williams, Peter B. Woodbury, Chris Zganjar, Marci Baranski, Patricia Elias, Richard A. Houghton, Emily Landis, Emily McGlynn, William H. Schlesinger, Juha V. Siikamaki, Ariana E. Sutton-Grier, and Bronson W. Griscom. 2018. "Natural Climate Solutions for the United States." *Science Advances* 4(11):1–15.
- FCC. 2013. "Communications Sites." Accessed via WFDSS. Retrieved November 21, 2019 ([https://wfdss.usgs.gov/wfdss/WFDSS\\_Data\\_Downloads.shtml](https://wfdss.usgs.gov/wfdss/WFDSS_Data_Downloads.shtml)).
- FHWA. 2019. "National Highway Planning Network (NHPN)."
- Gardiner, Ron. 2016. "2016 Taos County CWPP Update." 1–95.
- Gartner, Joseph E., Susan H. Cannon, and Paul M. Santi. 2014. "Empirical Models for Predicting Volumes of Sediment Deposited by Debris Flows and Sediment-Laden Floods in the Transverse Ranges of Southern California." *Engineering Geology* 176:45–56.
- Homer, Collin, Jon Dewitz, Limin Yang, Suming Jin, Patrick Danielson, George Xian, John Coulston, Nathaniel Herold, James Wickham, and Kevin Megown. 2015. "Completion of the 2011 National Land Cover Database for the Conterminous United States – Representing a Decade of Land Cover Change Information." *Photogrammetric Engineering and Remote Sensing* 81(5):345–54.
- Huber, Christopher and Natalie Sexton. 2019. "Value of Migratory Bird Recreation at the Bosque Del Apache National Wildlife Refuge in New Mexico." *Western Economics Forum* 17(2):52–63.
- IWSRC. 2019. "National Wild and Scenic River Line."
- Jones, Aaron. 2020. "New Mexico Urban Forest Canopy, 2018."
- Kean, J. W., D. M. Staley, J. T. Lancaster, F. K. Rengers, B. J. Swanson, J. A. Coe, J. L. Hernandez, A. J. Sigman, K. E. Allstadt, and D. N. Lindsay. 2019. "Inundation, Flow Dynamics, and Damage in the 9 January 2018 Montecito Debris-Flow Event, California, USA: Opportunities and Challenges for Post-Wildfire Risk Assessment." *Geosphere* 15(4):1140–63.
- Krist, Frank J. Jr, James R. Ellenwood, Meghan E. Woods, Andrew J. McMahan, John P. Cowardin, Daniel E. Ryerson, Frank J. Sapio, Mark O. Zweifler, and Sheryl A. Romero. 2014. "National Insect and Disease Forest Risk Assessment." *United States Forest Service* (January):209.
- Landau, V. A. 2020. "Omniscape.Jl: An Efficient and Scalable Implementation of the Omniscape Algorithm in the Julia Scientific Computing Language, vX.Y.Z."



- Llewellyn, Dagmar, Seshu Vaddey, Jesse D. Roach, and Ariane Pinson. 2013. "West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment." *US Department of Interior, Bureau of Reclamation, Upper Colorado Regions, Albuquerque Area Office, New Mexico*. December (December):138.
- Loehman, Rachel A., Robert E. Keane, Lisa M. Holsinger, and Zhiwei Wu. 2017. "Interactions of Landscape Disturbances and Climate Change Dictate Ecological Pattern and Process: Spatial Modeling of Wildfire, Insect, and Disease Dynamics under Future Climates." *Landscape Ecology* 32(7):1447–59.
- Magnuson, Molly L., Julie M. Valdez, Charles R. Lawler, Matt Nelson, and Laura Petronis. 2019. *New Mexico Water Use By Categories 2015: Technical Report 55*. Santa Fe, NM.
- McDonald, Rob, Timm Kroeger, Tim Boucher, Wang Longzhu, and Rolla Salem. 2016. *Planting Healthy Air*. Arlington, VA.
- McRae, B. H., B. G. Dickson, T. H. Keitt, and V. B. Shah. 2008. "Using Circuit Theory to Model Connectivity in Ecology, Evolution, and Conservation." *Ecology* 89:2712–24.
- Microsoft. 2018. "Microsoft/USBuildingFootprints: Computer Generated Building Footprints for the United States." Retrieved March 24, 2019 (<https://github.com/Microsoft/USBuildingFootprints>).
- Miller, Mary Ellen, Lee H. MacDonald, Peter R. Robichaud, and William J. Elliot. 2011. "Predicting Post-Fire Hillslope Erosion in Forest Lands of the Western United States." *International Journal of Wildland Fire* 20(8):982–99.
- MRLC Consortium. 2019. "National Land Cover Dataset 2016." Retrieved February 6, 2020 (<https://www.mrlc.gov/>).
- Muldavin, E., E. Milford, J. Leonard, J. Triepke, L. Elliot, P. Hanberry, D. Diamond, J. Smith, C. Reasner, Y. Chauvin, and A. Urbanovsky. 2020. "New Mexico Riparian Habitat Map (NMRipMap)."
- NIFC. 2020. "US Historical Fire Perimeters 2000-2019."
- NM Interagency Climate Change Task Force. 2019. *New Mexico Climate Strategy: Initial Recommendations and Status Update*. Santa Fe, NM.
- NMAC. 2020. "Title 20 Environmental Protection, Chapter 6 Water Quality, Part 4 Standards For Interstate And Intrastate Surface Waters."
- NMDGF. 2014. *The Economic Contributions of Fishing, Hunting, and Trapping in New Mexico in 2013*. Santa Fe, NM.
- NMDGF. 2016. *State Wildlife Action Plan for New Mexico*. Santa Fe, NM: New Mexico Department of Game and Fish (NMDGF).
- NMDGF. 2018. "Game Management Units (GMUs) – Elk."
- NMDGF. 2019. "2019-2020 New Mexico Fishing Rules & Info."
- NMDGF and NHNM. 2013. "New Mexico Crucial Habitat Data Set. New Mexico Crucial Habitat Assessment Tool: Mapping Fish and Wildlife Habitat in New Mexico."
- NMED. 2019a. "Assessed Waters 2018."
- NMED. 2019b. "OpenEnviroMap."
- NMED. 2019c. "SDWIS."
- NMFD. 2016. *New Mexico Forest Health Conditions Report, 2016*. Santa Fe, NM.
- NMFD. 2019. "New Mexico Communities At Risk Assessment Plan." (December).
- NMOSE. 2020a. "OSE Conveyances."
- NMOSE. 2020b. "OSE Points of Diversion."
- Paschke, Jeanine. 2020. *Areas with Tree Mortality from Bark Beetles*. Fort Collins, CO.
- Prichard, S. J., M. C. Kennedy, A. G. Andreu, P. C. Eagle, N. H. French, and M. Billmire. 2019. "Next-generation Biomass Mapping for Regional Emissions and Carbon Inventories: Incorporating Uncertainty in Wildland Fuel Characterization." *Journal of Geophysical Research: Biogeosciences*.
- PRISM Climate Group. 2016. "30-Year Normals."
- Radeloff, Volker C., David P. Helmers, H. Anu Kramer, Miranda H. Mockrin, Patricia M. Alexandre, Avi Bar-Massada, Van Butsic, Todd J. Hawbaker, Sebastián Martinuzzi, Alexandra D. Syphard, and Susan I. Stewart. 2018. "Rapid Growth of the US Wildland-Urban Interface Raises Wildfire Risk." *Proceedings of the National Academy of Sciences of the United States of America* 115(13):3314–19.
- Ramcharan, Amanda, Tomislav Hengl, Travis Nauman, Colby Brungard, Sharon Waltman, Skye Wills, and James Thompson. 2018. "Soil Property and Class Maps of the Conterminous United States at 100-Meter Spatial Resolution." *Soil Science Society of America Journal* 82(1):186–201.
- Reeves, Matthew C., Jay R. Kost, and Kevin C. Ryan. 2006. "Fuels Products of the LANDFIRE Project." Pp. 239–52 in *Fuels Management-How to Measure Success: Conference Proceedings. RMRS-P-41*, edited by P. L. Andrews and B. W. Butler. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Reitz, M., W. E. Sanford, G. B. Senay, and J. Cazenias. 2017. "Annual Estimates of Recharge, Quick-Flow Runoff, and Evapotranspiration for the Contiguous U.S. Using Empirical Regression Equations." *Journal of the American Water Resources Association* 53(4):961–83.
- Saavedra, Paul. 1987. *Surface Water Irrigation Organization in New Mexico: Report TDDC-87-2*. Santa Fe, NM.
- Sankey, Joel B., Jason Kreitler, Todd J. Hawbaker, Jason L. McVay, Mary Ellen Miller, Erich R. Mueller, Nicole M. Vaillant, Scott E. Lowe, and Temuulen T. Sankey. 2017. "Climate, Wildfire, and Erosion Ensemble Foretells More Sediment in Western USA Watersheds." *Geophysical Research Letters* 44(17):8884–92.
- Schussman, Heather, Carolyn Enquist, and Michael List. 2006. *Historical Fire Return Intervals for Arizona and New Mexico: A Regional Perspective for Southwestern Land Managers*. Tucson, AZ: The Nature Conservancy in Arizona.
- Scott, Joe H., Matthew P. Thompson, and David E. Calkin. 2013. "A Wildfire Risk Assessment Framework for Land and Resource Management. RMRS-GTR-315."
- Staley, Dennis M., Jacquelyn A. Negri, Jason W. Kean, Jayme L. Laber, Anne C. Tillery, and Ann M. Youberg. 2016. *Updated Logistic Regression Equations for the Calculation of Post-Fire Debris-Flow Likelihood in the Western United States*.
- Theobald, David M., Luke J. Zachmann, Brett G. Dickson, Miranda E. Gray, Christine M. Albano, Vincent Landau, and Dylan Harrison-Atlas. 2016. "The Disappearing West: Description of the Approach, Data, and Analytical Methods Used to Estimate Natural Land Loss in the Western U.S." 23.
- Triepke, F. Jack, Esteban H. Muldavin, and Maximillian M. Wahlberg. 2019. "Using Climate Projections to Assess Ecosystem Vulnerability at Scales Relevant to Managers." *Ecosphere* 10(9).
- UCS. 2016. *Confronting Climate Change in New Mexico*. Cambridge, MA: Union of Concerned Scientists.

- USDA. 2018. "USDA, National Agricultural Statistics Service, 2017 Cultivated Layer." *2017 Cultivated Layer*.
- USDA, NRCS. 1998. "National Forestry Manual." 200.
- USFS. 2006. "National Forest Type Dataset."
- USFS. 2015. *Southwestern Wildfire Risk Assessment: Detailed Initial Regional Wildfire Risk Assessment Results*.
- USFS. 2016. *Southwestern Wildfire Risk Assessment: Detailed Initial Regional Wildfire Risk Assessment Results for the Cibola National Forest and Grasslands*.
- USFS. 2019. "EVALIDator Version 1.8.0.01."
- USFS GTAC. 2019. "FSTopo RecFacility PT."
- USGS. 2019a. "USGS National Hydrography Dataset (NHD)."
- USGS. 2019b. "USGS National Transportation Dataset (NTD)."
- USGS GAP. 2018. "Protected Areas Database of the United States (PAD-US) Version 2.0."
- Wan, Ho Yi, Samuel A. Cushman, and Erin Landguth. 2018. *Final Report New Mexico Wildlife Habitat Linkage Assessment*.
- Weidner, Emily and Al Todd. 2011. *From the Forest to the Faucet. Methods Paper*. Washington, D.C.: USDA Forest Service, Ecosystem Services & Markets Program Area, State and Private Forestry.
- Wells, Jeffrey V, Daniel K. Niven, and John Cecil. 2005. "The Important Bird Areas Program in the United States: Building a Network of Sites for Conservation, State by State." *Middle East* 1265–69.
- Wing, Oliver E. J., Paul D. Bates, Christopher C. Sampson, Andrew M. Smith, Kris A. Johnson, and Tyler A. Erickson. 2017. "Validation of a 30 m Resolution Flood Hazard Model of the Conterminous United States." *Water Resources Research* 53(9):7968–86.
- Wolfe, Dick, Scott A. Verhines, Patrick R. Gordon, and Hal Simpson. 2014. *Calendar Year 2013 Report to the Rio Grande Compact Commission*. Albuquerque, NM.
- Woods, Brian, Garry Kelley, and Tony Fristachi. 2019. "Heat Related Illness in New Mexico: 2013-2017." *New Mexico Epidemiology* 2019(6):1–4.
- Zogg, Jeffrey and Kevin Deitsch. 2013. *The Flash Flood Potential Index at WFO Des Moines, Iowa*.



The Ute Park Fire, 2018, from Highway 64. © Michael Gonzales/NMFD

# III. Strategies

Setting a strategy for the 2020s is a complex undertaking. The Assessment portion of the 2020 Forest Action Plan depicts natural resource conditions, values and threats spatially throughout the state, and the Strategy Chapter guides what work should be done, often based on the Assessment. The next chapter, Priority Setting Concepts and Map Products, uses information developed in the Assessment to identify priority area delineations based on the varied programmatic areas. Although forest management activities are expected to occur throughout the state, ideally most projects are implemented within priority areas to ensure the best use of resources.

This introduction discusses the development of ten strategies and associated sub-strategies, measures, and action items, and some of the conditions and barriers that pertain to each of the ten strategies. The remainder of the chapter presents the strategies, sub-strategies, measurable goals, and action items.

Ten years ago, State and Private Forestry (USDA Forest Service) required all state forest action plans to align state strategies with the national themes of State and Private Forestry Redesign. They are Conserve Working Forest Landscapes, Protect Forests from Harm, and Enhance Public Benefits from Trees and Forests. Since the New Mexico plan focused on all jurisdictions, these priority headings were adjusted to incorporate a watershed, multi-resource approach. Since strategy development

within these themes - is now optional, this 2020 plan is organized within ten programmatic strategies that focus on desired outcomes. The table in Appendix B shows how the 2020 plan programmatic strategies align with the New Mexico-adapted national themes.

Another departure from the 2010 Forest Action Plan stems from ten years of growth and development in the Division's collaborative partnerships. Whereas, in 2010 the Strategy only addressed actions to be taken by the Division, this 2020 Strategy includes work of the Division's collaborative partners where that work is closely integrated and important to achieving success. This approach demonstrates how interrelated the Division's work is with its partners and should be construed as recommendations for possible collaborative actions.



Managing fire on the Canjilon Ranger District © Angie Krall



Recognizing the importance of partners and stakeholders, public engagement initiated during the assessment was extended to development of the strategy. The Forest and Watershed Health Coordinating Group (FWHCG) met via webinar on January 29, 2020 and in person on February 7 in Albuquerque. Stakeholders provided input on values that helped establish statewide priorities and informed strategy development. The meetings replaced a full day stakeholders' workshop originally scheduled for January 17 which was postponed due to a statewide snow event. The Division proposed eight draft strategies, and participants broke into small groups to discuss these eight, plus an additional group to develop a ninth strategy around rare plants, and a final group to identify the need for any additional strategies. As a result of this effort, ten strategies were finalized by Division staff, often in close communication with partners.

Each thematic strategy has actionable sub-strategies with defined outcomes and measures. In the case of three strategies—Fire Management, Reforestation, and Urban Community Forestry—sub-strategies are grouped under headings. Action items identified by staff and stakeholders lay out a path to achieve the desired outcome and address the sub-strategy. Each action item includes a description of what needs to be done, by whom, when and where. If the answer to when is 'ongoing' or the answer to where is 'statewide,' these lines were not included. This format provides critical information to facilitate tracking and accountability throughout the life of the FAP.

An intentional omission for each action is that the plan does not address the specifics of "how." Most natural resource goals have multiple solutions and approaches to solve problems. As this plan will potentially be used by hundreds of dedicated professionals over the next ten years, the intention here is to describe the outcome and goals, but leave the direct specifics of how to implement the action to the imaginations and efforts of all of the plan's users.

Several barriers affect many of the strategies. One issue common to several strategies is the need for public outreach and education. The action items that address public outreach and education are consolidated in sub-strategy 1.7 under Restore Forests and Watersheds. An informed public is essential to support implementation of the work outlined in these strategies. There is also a connection between this shared sub-strategy and the sub-strategy discussed next addressing the shortage of workers—educational outreach is the first step in recruiting the workforce needed to implement these strategies. Another sub-strategy that addresses a shared concern for several strategies is the shortage of trained workers. This theme arose in discussions on restoring forests, managing fires, reforestation, restoration economy, and urban forestry. These workforce and training needs are addressed in sub-strategy 8.3 under Restoration Economy yet apply to all these strategies.

Related to staffing are additional capacity issues (for example equipment availability, businesses, and partners) to achieve the work that needs to be done. Finally, and not unexpectedly, is the need for greater access to funds to achieve the work called for in these strategies. An implied action item underlying all the sub-strategies is to secure necessary funding, staffing, and facilities.

Integrated throughout each of the strategies is science, technology, and complex geospatial analyses. Part of the process in identifying what is known, is identifying what *isn't* known. These data gaps are discussed in the Assessment and Data Atlas portion of this document. However, these gaps were also considered as the strategies were developed.

The first strategy, tagged **Restore Forests and Watersheds**, addresses what is arguably the most expensive issue facing forest management today—the legacy of fire exclusion and current land conditions. In the absence of naturally occurring wildfires, forests have generated excessive fuels which has, in the past two decades, resulted in



catastrophic wildfires burning much hotter than previously experienced. These “mega-fires” are happening every year around the West and threaten water supply, lives and property. Experience has demonstrated that forest management treatments such as thinning, burning, and especially a combination of thinning and burning, can moderate fire behavior. The Restore Forests strategy and sub-strategies outline a plan for addressing these fuel conditions and restoring forest stand densities to healthier conditions.

Closely related to the restoration of forests is the second strategy, **Fire Management**. The sub-strategies here fall under four headings: Restore the ecological role of fire to foster resilient landscapes and watershed health; Wildfire response on state and private lands; Support regional, state, and national wildfire response on all jurisdictions, and Collaborate across programs and jurisdictions on post-fire response. The first area moves New Mexico toward managing fire as a beneficial force and natural part of the environment under the right conditions. The next two strategy areas address the Division’s traditional and jurisdictional fire suppression roles, while increasing capacity to support the first area. The last strategy acknowledges and guides the relatively recent need to manage lands that have experienced impacts from high severity wildfire.

Recognizing that wildfire threats generally apply throughout New Mexico communities, rather than on the edges of communities, this plan does not utilize the term “Wildland Urban Interface” to geographically define areas threatened; however the term, or the acronym WUI is quite ubiquitous throughout natural resource management programs and certainly New Mexico communities qualify for available WUI grants and WUI funding.

The Division’s key recipient of services are New Mexico’s private landowners. As a group, private landowners also own the largest amount of forest lands in the state, and thus are critical to achieving landscape scale restoration. The third strategy, **Private Land Stewardship**, discusses what is needed

to improve and support private land stewardship. Good private land management starts with an informed and motivated landowner. Many partners engage in providing services to assist landowners, including both government agencies and non-governmental organizations (NGOs). In the past decade, the number of NGOs supporting private landowners has increased. The Division strives to create and foster a culture in New Mexico where private landowners recognize the responsibility to be good stewards of resources that provide substantial public benefit to everyone.

Powerlines have been sources of ignition for several severe wildfires in the State of New Mexico in the last decade. Additionally, catastrophic fires can cause expensive damage to above ground powerlines. Therefore, the **Utility Rights of Way** strategy specifically addresses ways to increase vegetation management along powerline rights of way to reduce the risk of fire ignitions and the damage to utility infrastructure. This work requires planning and implementation that can benefit from the Division’s involvement. Adequate mitigation goes beyond typical powerline easements, which requires collaborative efforts with adjacent land managers and landowners.

Changing climate and increased human activity impact habitats which lead to the endangerment of various plants and animals. The Division has statutory responsibility for conserving the state’s rare plants. The **Rare Plant** strategy addresses the programmatic side of ensuring protection of the biodiversity this state offers. Meanwhile, action items are also integrated with several other strategies to insure implementation of the Division’s *Rare Plant Conservation Strategy*.

The increase in high-intensity fires on the landscape triggers the need to plant trees to replace the forests that are lost and not likely to regenerate naturally in the near term. The **Reforestation** strategy addresses a few barriers including the low levels of available tree seeds compared to the needs generated by recent fires and the limited capacity to grow needed seedlings. A long-term perspective is

essential when planning reforestation of large burned areas. For example, without tree planting, it may take thousands of years for the forest to naturally regenerate, while the strategy of planting seed trees may speed that process to hundreds of years instead.

Approximately 80% of New Mexicans live in an urban forest, and for many people this is the primary forest they will access. Urban forests provide essential benefits such as cooling shade, cleaning the air, increasing rainfall infiltration, reducing stormwater runoff reduction, and producing oxygen. Healthy urban forests can help solve many community problems. They create safer, healthier, and more sociable communities. The **Urban Forests and Communities** strategy addresses many of the current barriers impacting our ability to steward robust urban forests. For example, most urban forest management efforts in New Mexico are largely limited to municipal parks departments and commercial landscaping companies. Yet a variety of advocates across landownerships are needed to advocate for the urban forest. Another barrier is the lack of research and knowledge specific to urban forestry in the arid southwest, and the related issue of little access to professional training opportunities for communities throughout the state. Perhaps one of the greatest challenges is to increase public awareness of the role of trees in water conservation where a common misconception is that trees are incompatible with water conservation goals.

Whether cutting trees or planting them, the driving force behind forest management activities is the contractors who do the work. Likewise, excess biomass from restorative fuel reduction provides opportunities for businesses to generate energy and create products and jobs in rural communities. The cyclical nature of forest industries, and various unfavorable forest policies in the recent past, requires the forest industry in New Mexico to rebuild and retool in order to be able to address restoration needs, thus the **Restoration Economy** strategy. Rural communities were historically

dependent on forestry work; however, multiple factors contributed to closure of the hundreds of family-owned mills throughout the state. In the absence of healthy rural economies, populations have been reduced and workers are no longer readily available. The primary condition to create businesses is to provide consistent opportunities, yet this is challenging for a variety of reasons including inconsistent wood supply, short-duration thinning contracts, and long-haul distances for raw material. The foundation to rebuild this economy is the partnership between public land management agencies, the industry, and the public, based upon shared goals of long-term restoration and managing forests for resilience in changing climate conditions.

The **Land Conservation** strategy offers specific actions to address various conservation efforts in the state. New Mexico does not have a statewide blueprint for land conservation to guide the investment of state and federal funds to provide tax credits for conservation easements or purchase land or easements. Several issues regarding equitable access to conservation easements are addressed. In New Mexico, many landowners are property rich and cash poor. The strategy also calls for increased collaboration among local government agencies, non-governmental organizations, and land trusts.

Given that outdoor recreation is positioned to become a major economic driver in the state, the **Outdoor Recreation** strategy identifies the importance of sound forest management's role in outdoor recreation, particularly the roles of both public and privately owned lands.

These strategies are purposefully challenging. For many of them, overcoming barriers will require creativity and perseverance. For most of these strategies, resources such as staffing and funding are not necessarily pinned down. These diverse, complex strategies mirror an equally diverse, complex Division committed to fostering healthy forests and watersheds in New Mexico.

## Strategy #1 — Restore Forests and Watersheds

Identify and treat priority areas for forest and watershed restoration at large scale and across ownership boundaries to maximize ecosystem services and resilience to climate change and other identified threats.



Treated stand on Carson National Forest near Canjilon © Mary Stuever/NMFD

**Sub-strategy 1.1** - Conduct appropriate treatments in large-scale priority areas identified collaboratively using best available tools including the FAP risk assessment models.

**Outcomes:**

- High priority landscapes at risk are treated by NMFD and partners sharing resources and leveraged funding in a manner appropriate to site constraints.
- Treatments occur at a large scale to provide landscape scale resilience.
- Treated landscapes are maintained.

**Measures:**

- High-priority acres treated (including maintenance treatments) each year by all parties on all jurisdictions.
- High-priority acres treated (including maintenance treatments) each year on private, tribal, state and local agency lands.
- Percentage of total acres treated and in restoration status over the number of total acres needed to be in forest restoration status to achieve landscape resilience.

**Actions:**

**1.1.A** - Ramp up the pace and scale of treatments over the next ten years with a goal of eventually treating 145,000 high-priority acres of private, tribal, state and local agency lands each year.

**What:** Fund and treat high-priority acres on private forestlands.

**Who:** NMFD, partners, private landowners.

**Where:** Locations based on relevant FAP model outputs.

**1.1.B** - Ramp up the pace and scale of treatments over the next ten years with a goal of eventually treating 300,000 high-priority acres each year by all parties on all jurisdictions.

**What:** Fund and treat high-priority acres on non-private forestlands.

**Who:** NMFD, agency partners (USFS, BLM, NRCS, NMDGF, SLO, NMED, SWCDs, BIA, NPS, FWS, BOR, USACE) tribes and pueblos, land grants-mercedes and the NM Land Grant Council.

**Where:** Locations based on relevant FAP model outputs.

**1.1.C** - Align project planning with Shared Stewardship priorities.

**What:** Meet to determine what projects are planned; if needed, adjust and add new projects in high-priority landscapes identified in the FAP.

**Who:** NMFD, USFS.

**Where:** Locations based on Shared Stewardship model.



**1.1.D** - Working with partners, identify shared high priority landscapes and develop fundable projects for those areas.

**What:** Identify and develop projects for shared high-priority landscapes.

**Who:** NMFD, USFS, BLM, NRCS, NMDGF, SLO, NMED, SWCDs, BIA, tribes and pueblos, land grants-mercedes and the NM Land Grant Council.

**Where:** Locations based on relevant FAP model outputs.

**Sub-strategy 1.2** - Conduct collaborative planning and build collective capacity to increase the pace and scale of forest and watershed restoration.

**Outcomes:**

- Collaborative planning (using data and models from the FAP) is conducted to inform decision-making.
- Project managing entities produce integrated plans and collaboratively developed projects that address priorities at various geographic levels (statewide to community).

**Measures:**

- Collaboratively developed treatment plans are produced for 100 planning units in high-priority landscapes over the next ten years.
- Total funding directed to forest and watershed restoration projects in New Mexico by all agencies and partners is increased to \$45 million annually.
- New Mexico's collective capacity to plan, implement, monitor and assess restoration projects is increased by 25%.
- Number of cooperative instruments with key partners to plan, implement and/or monitor restoration projects.

**Actions:**

**1.2.A** - Participate in the Forest and Watershed Health Coordinating Group to initiate and foster development of collaborative projects, to elevate issues to the executive level and to serve as a resource for resolving them. Host action-oriented Task Teams to identify barriers and find, share and help implement solutions.

**What:** Hold quarterly Coordinating Group meetings. Host interim Task Team meetings on a standing or ad hoc basis as called for by the task(s) at hand.

**Who:** NMFD (host), all agencies & organizations.

**When:** January, April, July and October of each year starting July 2020.

**Where:** Albuquerque (Coordinating Group). Task Team meeting locations determined by the chair and members.

**1.2.B** - Coordinate leveraging of funds to meet treatment targets.

**What:** Partners meet at least once a year to coordinate funding.

**Who:** NMFD, USFS, BLM, NRCS, NMDGF, SLO, NMED, SWCDs, BIA, tribes and pueblos, , land grants-mercedes and the New Mexico Land Grant Council, conservation finance investors

**1.2.C** - Take advantage of directly applicable internal and external training opportunities.

**What:** Identify and participate in targeted training to increase staff capacity.

**Who:** NMFD and partners.

**When:** Start identifying needs and opportunities in 2020; have training plans in place and people signed up by June 2021 and continuing.

**1.2.D** - Review, maintain and update cooperative instruments as required to keep them active and meeting current needs.

**What:** Review/update or renew existing agreements and other legal instruments.

**Who:** NMFD, USFS, BLM, NRCS, NMDGF, SLO, NMSP, NMED, Tribes and Pueblos, land grants-mercedes and the NM Land Grant Council, contract administration and legal staff.

**When:** July 2021

**1.2.E** - Develop new agreements as necessary.

**What:** Initiate new agreements or other necessary legal instruments.

**Who:** NMFD, USFS, BLM, NRCS, SLO, NMSP, NMDGF, NMED, Tribes and Pueblos, , land grants-mercedes and the NM Land Grant Council, contract administration and legal staff.

**When:** Starting in 2021.



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#### 1.2.F - Coordinate cross-boundary project planning by meeting for this purpose at set intervals.

**What:** Develop joint or complimentary project plans; determine environmental review status/needs; coordinate funding and other resources required to implement projects.

**Who:** NMFD, USFS, BLM, NRCS, NMDGF, SLO, NMED, SWCDs, tribes and pueblos, land grants-mercedes, NM Land Grants Council, All Lands Task Team.

#### 1.2.G - Reach out to all relevant stakeholders in priority landscapes where projects are needed or under consideration.

**What:** Conduct outreach to stakeholders and communities, including land grants-mercedes, NM Land Grants Council, industry, and NGOs in project planning areas and areas under consideration for projects.

**Who:** NMFD and partners including but not limited to USFS, BLM, NRCS, NMDGF, SLO, NMED, SWCDs, tribes and pueblos.

**Where:** In targeted project planning areas.



Pre- and post-treatment on a hazardous fuel removal project in Grant County © Tom Ziegler/NMFD

#### Sub-strategy 1.3 - Track activity to report progress and evaluate outcomes to inform continuous planning.

##### Outcomes:

- Tracked activity is evaluated annually.
- Monitoring and adaptive management are taking place.
- Data are collected and analyzed.
- Information about what works and what doesn't is shared and used by partners to improve future planning and implementation.

##### Measures:

- Activity progress is measured, and information is made available to all.
- Number and capacity of organizations and/or institutions engaged in monitoring to assess treatment effectiveness and evaluate success.

##### Actions:

#### 1.3.A - Maintain the vegetation treatment database and Opportunity Map; upload/share project and planning data to keep it current.

**What:** Maintain/update/improve [vegetation.treatments.org](http://vegetation.treatments.org) database.

**Who:** NMFWRI (with funding from USFS), NMFD, as member of SWERI Development team, will advocate for inclusion in SWERI annual work plan. NMFD and other project managers will provide project data.

#### 1.3.B - Identify, strengthen and implement programs, processes, and resources to collect and analyze monitoring data and share knowledge gained.

**What:** Meet with relevant partners to develop a set monitoring protocol and discuss needs and plans, including multi-partner support for NMFWRI student monitoring program, BEMP, etc.

**Who:** NMFWRI, BEMP.

#### 1.3.C - Create the Shared Stewardship Portal to help all partners better identify priority areas where active management can maximize resource benefits.

**What:** Work with contractors and partners to develop the Shared Stewardship portal as a common tool to capture, plan and analyze landscape scale planning and treatment activities.

**Who:** All forest and watershed restoration agencies and partners.

**When:** Winter 2021 and ongoing.

**Sub-strategy 1.4** - Based on the science-based statewide assessment and utilizing best available knowledge about natural resource conditions and social/economic opportunities, review and confirm or update priority areas identified in the FAP.

**Outcome:**

- Current priorities based on best available data and local/traditional/professional knowledge and considerations are established by all agencies and partners.

**Measures:**

- Actions are planned and taken based on most current information.
- List and maps of priority landscapes are reviewed and kept current.

**Actions:**

**1.4.A** - Identify and fill critical data gaps before the next 10-year statewide assessment.

**What:** Seek funding and contract to fill top data gap.

**Who:** NMFD in coordination with other partners interested in those data.

**When:** By 2029.

**1.4.B** - Review priority areas in light of new information.

**What:** Review priority areas and adjust accordingly.

**Who:** NMFD with FWHCG.

**When:** As new information emerges.

**Where:** At CG meetings.

**1.4.C** - Conduct the 5-year FAP review.

**What:** Conduct 5-year review and submit report to the USFS.

**Who:** NMFD.

**When:** Early 2025.

**Where:** SFO.

**1.4.D** - Start FAP 10-Year Update process.

**What:** Initiate planning and RFP/contracting process required to conduct the 10-year FAP update.

**Who:** NMFD.

**When:** Early 2029.

**Where:** SFO.

**Sub-strategy 1.5** - Develop collaborative strategies to promote a dynamic patchwork mosaic of riparian and wetland vegetation and habitat as water availability and community priorities allow.

**Outcomes:**

- Increased base flow and attenuated flood flow through reconnection of streams with adjacent riparian zones.
- Increased sustainable wildlife habitat, improved rare plant habitat and enhanced community stewardship for riparian ecosystems.
- Locally controlled exotics and invasive plants to restore native vegetation dominance and habitat quality.
- Restored dynamic patchwork mosaic with dominance of native vegetation.

**Measures:**

- Percent of riparian restoration treatments taking place in high priority areas.
- Acres of decreased fuel loads in riparian areas designated as being at high risk to wildfire risk.
- Acres of invasive and exotic shrubs treated in riparian areas.
- Miles of riparian treatments that reconnect streams with adjacent riparian areas.
- Number of fuel reduction projects utilized to restore natural stand composition and structure to riparian areas along rivers and streams.
- Number of CWPPs with priority riparian fuel reduction identified if applicable.

**Actions:**

**1.5.A** - Work with stakeholders to plan and implement vegetation management practices in high-priority riparian landscapes with a goal to locate 50% of treatments in high-priority areas. Continue to incorporate plans into CWPPs.

**What:** Plan and conduct riparian fuels reduction projects for multiple resource benefits and utilize recommendations in existing plans such as the *San Juan Basin CWPP* or the *State Wildlife Action Plan*.

**Who:** NMFD, governmental partners, private landowners, fire managers, CWPP core teams.

**Where:** High-priority riparian areas statewide.

**1.5.B** - Collaboratively prioritize sites with high potential to restore riparian vegetation communities in each river basin or reach, including areas with potential to increase water availability through land and/or water manipulation in order to restore bosque habitat. Restoration activities may include vegetation treatments and bank lowering to restore overbank flooding, lowering land to increase groundwater availability required to sustain native riparian vegetation, or restoration techniques designed to raise and reconnect incised stream channels to their flood plain, as appropriate to site conditions.

**What:** Partners use data and other scientific resources to identify, guide, plan and implement restoration actions in different river reaches. Utilize recommendations in existing plans such as the *Middle Rio Grande Conservation Action Plan*, *NMDGF Wildlife Management Area Plan*, *National Wildlife Refuge Management Plans*, *Tribal Resource Management Plans*, and scientific resources such as URGWOM and the New Mexico Riparian Map (Muldavin, et. al, 2020).

**Who:** NMFD, land or water management entities that own or work in riparian areas (e.g. USFS, USACE, USBR, SLO, ISC, NMDGF, irrigation districts, municipalities, tribes and pueblos, land grants-mercedes) and science-based institutions (e.g. BEMP, NMFWR, Natural Heritage NM)

**1.5.C** - Coordinate with entities engaged in monitoring riparian ecosystems, analyzing data and developing riparian management recommendations, and use best available science to guide adaptive management in these environments.

**What:** Support and expand monitoring and adaptive management in riparian ecosystems to gauge the effectiveness of projects and treatments (see 1.6.A).

**Who:** NMFD and other riparian project planners and managers in coordination with scientists.

**Sub-strategy 1.6-** Conduct restoration activities in a manner that minimizes impacts to native and sensitive plants, animals, and their habitats by using the most current and up-to-date tools and resources available.

**Outcomes:**

- The state's most vulnerable plant and animal resources are protected during restoration activities.
- Negative impacts to sensitive resources are avoided or minimized through proactive planning and budgeting.
- Invasive and non-native plants are actively managed to avoid negative impacts to sensitive resources.

**Measures:**

- Number of projects that define mitigation activities to protect sensitive resources.
- Number of non-native plant control measures implemented to protect sensitive resources.

**Actions:**

**1.6.A** - Incorporate an environmental review process for all restoration projects to ensure impacts to sensitive plants, animals and their habitats are avoided or minimized.

**What:** Use the Environmental Review Tool, the USFWS IPaC System, and other available environmental review tools to identify potential impacts to sensitive species and their habitats.

**Who:** NMFD and partners including but not limited to USFS, BLM, NRCS, NMDGF, SLO, NMED, SWCDs, tribes and pueblos.

**When:** Starting July 2020, during the project planning process.

**Where:** Statewide, wherever restoration projects are planned.

**1.6.B** - Mitigate all potential impacts to sensitive plants, animals and their habitats, as identified during the environmental review process.

**What:** Mitigate potential impacts to sensitive plants, animals and their habitats through avoidance or management actions.

**Who:** NMFD and partners including but not limited to USFS, BLM, NRCS, MMD, NMDGF, SLO, NMED, SWCDs, tribes and pueblos.

**When:** Starting July 2020, in response to the environmental review process.

**Where:** Statewide, wherever restoration projects are planned.

**1.6.C** – Employ early detection and rapid response for identifying and treating invasive species, especially in critical areas such as known locations of sensitive resources.

**What:** Inventory critical areas to detect non-native, invasive plants before establishment of invasive populations and treat accordingly.

**Who:** NMFD and partners including but not limited to USFS, BLM, NRCS, MMD, NMDGF, SLO, NMED, SWCDs, tribes and pueblos.

**Sub-strategy 1.7** - Support and expand public outreach and education to foster a society that supports watershed restoration activities and values resilient and healthy forest ecosystems.

**Outcomes:**

- Public knowledge of forest and watershed conditions and support for restoration activities is high.
- Community leaders value and support restoration activities.
- Young people seek lifelong careers in natural resource management fields.
- Advocacy and care for the urban forest increases to meet multiple community needs.

**Measures:**

- Number of teachers trained on various Environmental Education programs such as the Bosque Education Guide, Project Learning Tree, Project WILD, Envirothon, etc.
- Number of informal educators are supported in various venues such as scout groups, parks, museums, etc. with materials and technical assists for educational programs.
- Number of news releases, articles, pamphlets, and other written material prepared.
- Number of multi-media projects—videos, webinars, story maps, etc.—prepared.
- Number of educational events conducted.
- Number of participants and number of seat hours (time x number of participants) for outreach activities.
- Number of community forestry projects that improve environmental, human, and economic health outcomes.
- Number of volunteer hours reported in New Mexico forest and watershed activities.
- Number of communities with advisory or advocacy organizations.
- Trends in recruitment of college students with natural resource majors, firefighters, arborists, loggers and contractors, tree planters, etc.

**Actions:**

**1.7.A** - Support programs that provide education and outreach to private stakeholders, pueblos, tribes, and communities to enhance knowledge, awareness and support for conservation and adaptive management. Engage with entities that deliver programming and outdoor and experiential education to increase understanding of the environment, as well as increasing sense of stewardship. Serve on the Steering Committee to Build a Cradle-to-Career Outdoor Education Pathway and contribute to the report and recommendations of programs to implement, fund and prioritize for the next 5 years. Participate in annual recognition events such as Arbor Month, Wildfire Awareness Week, Earth Day, etc. Promote implementation of the National Cohesive Wildland Fire Management Strategy by amplifying relevant messaging from the Wildland Fire Leadership Council (WFLC) and Western Region (WRSC).

**What:** Support existing and new programs with a focus on student and public education, such as Project Learning Tree, Project WILD, Bosque Education Guide, Bosque Ecosystem Monitoring Program, etc. Support organizations engaged in outreach such as the Fire Adapted New Mexico Learning Network, Environmental Education Association of New Mexico, FFA, 4-H Clubs, Scouting organizations, government agencies (all levels), Tribes and Pueblos, land grants, acequias, etc.

**Who:** Local, State, Tribal and Federal natural resource and education agencies, Cohesive Strategy Western Region, NGOs, schools, teachers, NMYCC individuals.

**1.7.B** - Engage the public with messaging about climate change and its effect on declining forest and watershed conditions, the actions needed to restore them to sustainable conditions and the role of fire and forest industry in natural resource stewardship.

**What:** Utilize social messaging, news releases articles, public programs, etc. to share these messages.

**Who:** Local, State, Tribal and Federal natural resource and education agencies, NGOs, individuals.

**1.7.C** - Increase public awareness of the role of the urban forest to environmental, human, and economic health to increase planting and improve care. Continue to identify opportunities to support urban forestry projects connected to human health.

**What:** Several on-going initiatives including The Nature Conservancy's Trees and Health Program, the "Healthy Trees, Healthy Lives" social media campaign, The Arbor Day Foundation's Health Campus programs, and the prescription trails program.

**Who:** NMDOH, New Mexico Urban Forest Council.



### III. Strategies

**1.7.D** - Engage volunteers and partners in community involvement, citizen action and community governance to maintain the resilience of New Mexico's forest resources including urban forests. Example actions include tree planting, monitoring, tree inventorying, establishment and maintenance of yard trees, and governance. Tools may include the Big Tree Recognition Program, Bosque Ecosystem Monitoring Program, etc.

**What:** Via various volunteer programs and volunteer agreements, create opportunities for citizens to engage in resource management.

**Who:** Local, State, Tribal and Federal natural resource and education agencies, NGOs like Tree New Mexico, Volunteers for the Outdoors, etc.



Low intensity fires in ponderosa pine stands maintain resilient forest structure and reduce fuels. © Nick Smokovich/NMFD

## Strategy #2 — Fire Management

Provide and support appropriate fire responses for wildland fires in the State of New Mexico which provide for firefighter and public safety, protection of communities, infrastructure, and ecosystems, and restoration of fire's ecological role where feasible to build resilient landscapes and watershed health. Expand workforce capacity to manage and utilize fire for resource benefit and to safely and effectively suppress fire where needed.



Emily Fire © Carmen Austin/NMFD

### Part 2.1: RESTORE ECOLOGICAL ROLE OF FIRE TO FOSTER RESILIENT LANDSCAPES AND WATERSHED HEALTH

**Sub-strategy 2.1.1** - Improve ability to make planning and fire management decisions by assuring that all fire organizations have access to spatial fire management tools to support pre-fire planning and co-management of fire.

**Outcomes:**

- Spatial fire management tools are used to support pre-fire planning and improved communication and decision-making during wildfire events.
- Reduction of fire suppression costs in areas where pre-fire planning has occurred.

**Measures:**

- Number of fire incidents that make use of newer spatial fire tools.
- Number of pre-fire plans completed.
- Dollars spent on fire suppression in areas with pre-fire plans completed compared to similar fires without pre-fire planning.

**Actions:**

**2.1.A** - Continue to support collaborative portals and data resources such as Wildland Fire Decision Support System (WFDSS), Potential Operational Delineations (PODS) mapping, and other interagency resources. Assure agencies have easy access to maps/data that assist decision making in cross-boundary incidents.

**What:** Work to develop cross-jurisdictional maps/data that identify options for fire incident management.

**Who:** Tribes, counties, state, federal agencies, private landowners and land grants and NGOs interested in pursuing this strategy.

**When:** Initiated at statewide level 1 year after release of FAP.

**Where:** Statewide and adjacent states where partners are willing.

**Sub-strategy 2.1.2** - Identify priority locations to facilitate safe and ecologically appropriate fire reintroduction (e.g. managed fires, prescribed burning).

**Outcomes:**

- Watershed conditions are such that natural ignitions can be safely managed for beneficial effects to resources.
- Communities accept managed fires from natural ignition and associated smoke when and where fires can safely achieve resource benefit.
- Communities and resource managers apply fire to landscape under prescribed conditions.

### III. Strategies

- Ecological effects of fire on weeds, plant and animal communities, and sensitive species are mitigated in fire management decisions.

#### Measures:

- Number of acres restored with prescribed fire treatments.
- Number of acres of wildfire managed for and achieving resource benefit.
- Number of fire treatments showing resource objectives are met at least 75%.
- Number of forest and land management plans that identify fire objectives and opportunities and increase acres covered by these plans by 10% each year.

#### Actions:

**2.1.B** - Prescribed fire application is well coordinated and designed to protect valued resources and improve the health and sustainability of frequent fire forest types.

**What:** Integrated fire and natural resource planning and management.

**Who:** NMFD and other fire and forest management organizations.

**2.1.C** - Work with private landowners and land managers to include fire management strategies in their land management plans.

**What:** Integrated fire and natural resource planning and management.

**Who:** NMFD, landowners, and other fire and forest management organizations.

**Sub-strategy 2.1.3** - Increase the access to fire training implementation and monitoring to build capacity, including more sessions offered and reducing the cost of training, and expanding topics to include utilizing fire and fire management in addition to fire suppression.

#### Outcomes:

- More fire workers and higher skilled practitioners are available.

#### Measures:

- Number of non-federal firefighters trained.
- Number of red cards issued.
- Number engine bosses, RX burn bosses, and other critical positions.
- Reduction in number of UTF (unable to fill) orders.

#### Actions:

**2.1.D** - Provide relevant NWCG, FEMA courses, trainee opportunities, and task book support to encourage employees to build and maintain fire qualifications.

**What:** NMFD and other agency/organizational partners will support employees attending training, mentoring and being mentored and participating in various fire activities (suppression, management, prescribed, utilization, etc.) to build and maintain skills.

**Who:** NMFD and other agency/organizations who provide firefighting resources for incident management.

**2.1.E** - Increase the number of people trained as firefighters by non-agency venues.

**What:** Develop and implement additional fire science curriculum in NM Colleges, incorporate distance learning and hybrid delivery.

**Who:** Community college, universities and satellites, RMYC, other youth conservation organization, tribes and tribal colleges, BLM, USFS, NPS, BIA, NMFD.

**When:** Middle of 2022.

**2.1.F** - Identify equipment and resources needed to expand fire management activities for suppression and prescribed burning.

**What:** Identify gaps and recommend equipment and resource needs to expand fire programs for emerging needs.

**Who:** NMFD and other agency/organizations who provide firefighting resources for incident management.

**Sub-strategy 2.1.4** - Support the development of legislation to expand the use of prescribed fire in New Mexico.

#### Outcome:

- Private land acres are increasingly managed with fire as a resource management tool.

#### Measures:

- Acres of prescribed fire treatments on private lands.
- Number of new ignition permits issued each year.
- Number of landowners, land managers, and contractors trained annually.



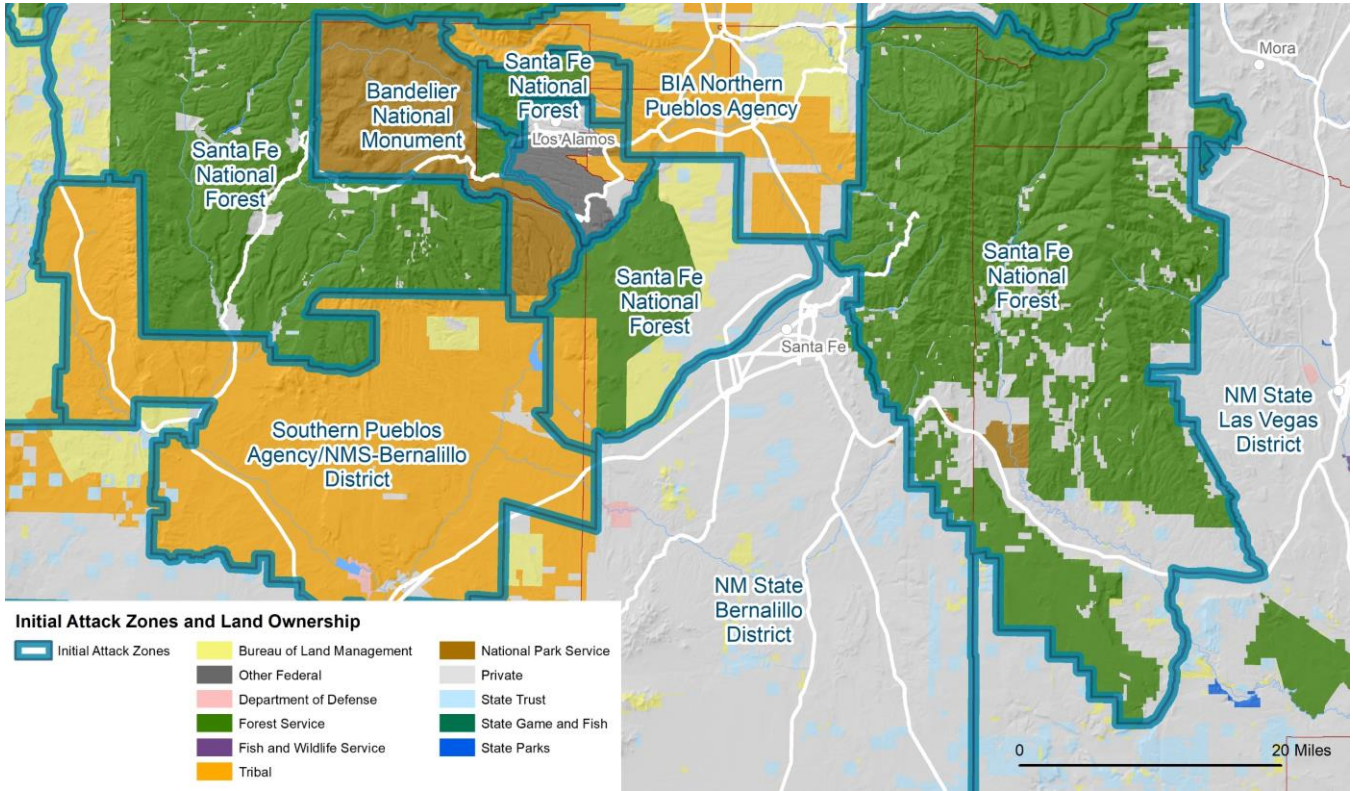
**Actions:**

**2.1.G - Implement recommendations of House Memorial 42 Working Group.**

**What:** Establish a clear category of liability in New Mexico law, create a New Mexico specific training program to build prescribed fire skills in the private sector, and address ignition permitting.

**Who:** EMNRD, NM Prescribed Fire Council, NMSU Extension and NMED

**When:** Target 2021 legislative session.



Map 40. NM Resources Agencies with fire management responsibilities established initial attack zones to ensure response is from the closest available unit regardless of jurisdiction.

**Part 2.2: WILDFIRE RESPONSE ON STATE AND PRIVATE LANDS**

**Sub-strategy 2.2.1 - Provide appropriate fire suppression response, either directly or through cooperative agreements, on wildland fires occurring on non-Federal, non-Municipal, non-Tribal lands within the State of New Mexico.**

**Outcomes:**

- Fires that occur on state and private lands are responded to appropriately with efficient resources.
- Public and firefighter safety are top priorities.

**Measures:**

- Number of firefighter deaths or injuries.
- Number of high-intensity acres burned by fires reduces over time.
- Number of legal interagency fire documents, including agreements and annual operating plans, reviewed and approved by May 1 each year.

**Actions:**

**2.2.A - Maintain and follow the *New Mexico Forestry Division Fire Policy Manual*, reviewed and updated as needed annually to guide suppression activities on wildland fires occurring on non-Federal, non-Municipal and non-Tribal Trust lands.**

**What:** Annually review and update the Fire Policy Manual. Ensure all involved employees understand the policy.

**Who:** NMFD.



### III. Strategies

**2.2.B** - Maintain cooperative partnerships with County Fire Departments for shared jurisdiction for initial response of a wildland fire event on non-Federal, non-Municipal, non-Tribal Trusts lands in New Mexico.

**What:** Support County Fire Departments on initial attack.

**Who:** NMFD, County Fire Departments.

**2.2.C** - Build and maintain the capacity and qualifications of Division employees to respond safely and effectively to wildfire.

**What:** Provide opportunities for staff training to include the range of NWCG qualifications needed for initial and extended attack and associated support functions.

**Who:** NMFD with interagency fire partners (for shared training).

**Sub-strategy 2.2.2** - Provide leadership and build collaborative partnerships to reduce the vulnerability of at-risk communities to catastrophic wildfire events.

**Outcomes:**

- County and state agencies work collaboratively to reduce fuel loads in high-risk communities.
- Residents are prepared for potential wildfire events.

**Measures:**

- Number of Firewise communities increases over time.
- Dollars of damage (losses) to communities burned by wildfire.
- Number of volunteer fire fighters trained.
- Number of rural fire departments capable of efficient wildland fire response.

**Actions:**

**2.2.D** - Referencing this FAP and [CWPPs](#), NMFD Districts will communicate with county fire marshals annually to jointly establish areas of concern and opportunities to proactively address fuel conditions.

**What:** Maintain a working discussion between counties and NMFD on fuel conditions of concern.

**Who:** NMFD, County Fire Departments, other agencies with fire responsibility.

**2.2.E** - Encourage communities to engage in programs such as Firewise, Ready-Set-Go, Code Red and other emergency notification programs, etc. to move towards the goal of fire adapted communities where fire can burn near and in communities without causing significant losses.

**What:** Maintain a working discussion between counties and NMFD on fuel conditions of concern.

**Who:** NMFD, County Fire Departments, other agencies with fire responsibility.

**2.2.F** - Create strong working partnerships with rural fire departments, and where needed, assist departments in developing wildland fire response capability with grants, training, equipment sharing, and wildland fire response opportunities.

**What:** Existing programs include Volunteer Fire Assistance grants, annual wildland training opportunities, Federal Excess Personal Property and opportunity for participation in the Resource Mobilization Plan.

**Who:** NMFD, County Fire Departments, other agencies with wildland fire responsibility.

**2.2.G** - Participate in revision of county and community CWPPs and Hazard Mitigation Plans, providing technical assistance and access to state of the art data and tools.

**What:** Assist communities to use data and planning tools from FAP, Wildfire Risk to Communities ([www.wildfirerisk.org](http://www.wildfirerisk.org)), PODs and other resources.

**Who:** NMFD, NM Counties, local governments, CWPP core teams.

**Sub-strategy 2.2.3** - Coordinate fire preparedness and pre-planning activities to ensure the Division has adequate wildfire resources available for wildfire management and suppression and to improve firefighter safety, public safety, resource efficiency, and inter-jurisdictional relationships for cross-boundary fire management.

**Outcome:**

- The Division has access to the necessary resources to safely respond to wildland fires with efficiency, effectiveness, and appropriate responses.

**Measures:**

- Number of firefighters provided temporary employment.
- Number of trainings provided to emergency firefighters.
- Number of pre-planning activities conducted annually.
- Number of jurisdictions engaged in pre-planning activities.

**Actions:**

**2.2.H** - Continue to support the collaborative Inmate Work Camp (IWC) Program which offers low security inmate's opportunities to fight fire and work on forestry projects.

**What:** IWC currently located in Los Lunas stands up 2-6 crews each season.

**Who:** NMFD, New Mexico Department of Corrections.

**2.2.I** - Hire, train and provide opportunities for emergency firefighters who are Administratively Determined (AD) on Districts and with Returning Heroes Program (Veterans) to build skills and experience in responding to wildland fires both in New Mexico and out-of-state.

**What:** Develop an experienced work force to safely suppress and/or manage wildfires on 43 million acres of non-federal, non-municipal and non-tribal lands under Forestry Division jurisdiction.

**Who:** NMFD, Workforce Solutions, Veteran Services

**2.2.J** - Support Fire Departments working within the Resource Mobilization Plan to develop and expand their wildland response programs, including increasing available resources.

**What:** Provide training, opportunities, and partnerships to increase wildland fire capacities with local fire departments. Utilize the Resource Mobilization Plan to include local fire departments in wildland fire response efforts.

**Who:** NMFD, Local Government Fire Departments.

**Sub-strategy 2.2.4** - Foster a positive fire culture that is a model for compliance with state and federal policies and promotes diversity, equity and inclusion.

**Outcome:**

- The inclusive culture of the Division is reflected in the diversity and retention of staff and emergency firefighters.

**Measures:**

- Number of firefighters provided temporary employment.
- Numbers of trainings provided to emergency firefighters.

**Action:**

**2.2.K** - Treat everyone with respect. Empower one another. Model integrity. Protect one another. Learn from mistakes. Zero-tolerance (TEMPLZ).

**What:** Implement the TEMPLZ strategy through the Division's fire program.

**Who:** NMFD and our cooperators.

**Part 2.3: SUPPORT REGIONAL, STATE, AND NATIONAL WILDFIRE RESPONSE ON ALL JURISDICTIONS**

**Sub-strategy 2.3.1** - NMFD will coordinate fire preparedness/pre-planning activities to support national fire preparedness and response.

**Outcomes:**

- Resources from agencies and rural and municipal fire departments are provided when other parts of the country need additional resources.
- When New Mexico needs assistance from other regions, the necessary agreements (e.g. Consolidated Federal Agreement, State Compacts and State to State Agreements) are in place to facilitate rapid movement of resources into the state.

**Measures:**

- Number of requests filled is at least 90% of number of requests received.
- Costs for mobilizing resources are reimbursed within 1 year from dispatch of resource.
- Number of task books worked on during out-of-state assignments.

**Actions:**

**2.3.A** - Recruit local government fire departments to participate in the Resource Mobilization Plan (RMP) providing wildland fire response resources for utilization nationwide.

**What:** Maintain a rotation of resources from local governments to provide national fire response.

**Who:** NMFD, Local Government Fire Departments.

**2.3.B** - To increase capacity during high fire danger, maintain and increase State to State Agreements and the Great Plains Interstate Compact to provide for additional resources to quickly respond from other locations.

**What:** Expand interstate agreements for sharing fire resources, particularly with western states.

**Who:** NMFD, State agencies from other states.

**2.3.C** - Encourage RMP partners and Division employees to participate on Incident Management Teams. Coordinate participation and skills development to create capacity for standing up an internal Type 3 organization when needed (all risk, off-season).

**What:** Target positions and recruit interested individuals for those positions to build capacity within the Division for incident management.

**Who:** NMFD, Local Government Fire Departments.

#### **Part 2.4: COLLABORATE ACROSS PROGRAMS AND JURISDICTIONS ON POST-FIRE RESPONSE**

**Sub-Strategy 2.4.1** – Coordinate, implement and support post-fire response on public lands that qualify for local, regional, or national Burn Area Emergency Response (BAER).

**Outcome:**

- Timely BAER response results in appropriate community engagement and mitigation responses on public lands that reduces impacts such as post-fire flooding.

**Measures:**

- BAER responses to fires on public lands that effectively engage community support.
- BAER projects implemented effectively on public lands.

**Actions:**

**2.4.A** - Connect BAER planning and implementation teams with subject matter experts, community leaders, and other stakeholders to develop collaborative landscape approaches to post-fire challenges.

**What:** Work collaboratively with federal BAER teams by providing local knowledge, resources, objectives, guidance etc. during post-fire response activities. Explore opportunities for cross-boundary assessment, planning and implementation.

**Who:** Federal, tribal, state, and local agencies, NGOs, community leaders, affected landowners and land managers.

**When:** Initiate BAER response as soon as post-fire threats are identified, usually during wildland fire response.

**Where:** Large fire activity areas and downstream resources.

**Sub-Strategy 2.4.2** – Coordinate existing programs in New Mexico that can or could help communities and landowners implement post-fire response on private, municipal and other lands that do not qualify for a local, regional, or national Burn Area Emergency Response (BAER).

**Outcome:**

- Access to and collaboration with existing post-fire resources and programs mitigates impacts to communities.

**Measures:**

- Number of post-fire responses to wildfire incidents impacting state and private lands that involve and are coordinated with community leaders and landowners/land managers.
- Annual updates made to After Wildfire NM program materials.
- Number of local plans that include post-fire pre-planning.

**Actions:**

**2.4.B** - Engage and support communities and land managers in post-fire response in a timely manner.

**What:** Coordinate with Incident Management Teams managing wildland fires, State and local agencies with emergency response authorities, NRCS, BAER teams assigned to adjacent landscapes, etc. to develop collaborative landscape responses to fire incidents that threaten state and private lands and communities.

**Who:** NMFD, NMDHSEM, USACE, NRCS, NMSU, TNC- Post Fire Learning. Network, Silver Jackets, NGOs, NMAC, federal, tribal, state and local agencies

**When:** Initiate post-fire response as soon as post-fire threats are identified, usually during wildland fire response.

**Where:** Large fire activity areas and downstream resources.

**2.4.C** - Update and maintain the [afterwildfirenm.org](http://afterwildfirenm.org) website and *After Wildfire New Mexico* guide to provide a readily accessible resource for fire-impacted communities and individuals in New Mexico.

**What:** Provide central clearinghouse of up-to-date information on safety, finance, mobilization, post-fire treatments, flooding etc. for both community leaders and affected individuals.

**Who:** NMFD, and contributing entities.

**2.4.D** - Include pre-planning for post fire response in local planning documents such as Community Wildfire Protection Plans or State/County Hazard Mitigation Plans.

**What:** Encourage post-fire response pre-planning in local plans. Provide templates, training, and technical support to ensure post-fire response planning is effective.

**Who:** NMF, NMAC, DHSEM, county & municipal governments, NGOs and consultants developing plans.

**Sub-Strategy 2.4.3** – Identify and fill gaps in authorities, funding and program direction to provide coordinated post-fire response on all lands and jurisdictions to protect lives, property and infrastructure; rebuild infrastructure resilient to post-fire conditions; and restore ecosystems after wildland fires.

**Outcome:**

- Authorities, programs and policies support coordinated timely, effective and adequately funded post-fire response to reduce wildfire impacts on all lands.

**Measures:**

- Number of wildfire response organizations that have guidelines that provide direction for post-fire response.
- Number of authorities, agreements, policies and/or programs that facilitate improved post-fire response.
- Number of post-fire projects implemented effectively on state and private lands.
- Number of post-fire projects implemented effectively on federal lands to mitigate impacts to communities and state and private lands.

**Actions:**

**2.4.E** - Coordinate with organizations and agencies on the national and regional level to develop necessary federal support and funding for post-fire response on state and private lands not eligible for BAER program response.

**What:** Address current and future issues including authority for designating post-fire coordinators, developing post-fire master agreements, coordinating data sharing with federal agencies, and coordinating federal post-fire response to support community response.

**Who:** WGA, WFLC, NASF, NGOs, federal, state, tribal, local agencies.

**2.4.F** - Work within New Mexico to build effective support for post-fire response by coordinating with state and local agencies, identifying authorities, and developing ways to fill and fund authority gaps.

**What:** Identify leadership and implementation authorities for responding to wildland fire to mitigate and respond to effects of flooding and other post wildfire issues. Establish authorities where there are gaps.

**Who:** NMDHSEM, NMF, USACE- NM, NMDOT, NM Legislature.

**2.4.G** - Develop and support programs that identify and implement actions necessary to assist ecosystem restoration and long-term recovery of burned landscapes. (See also Strategy 6.3.2)

**What:** Coordinate long-term post fire programs and projects to help restore ecosystem processes in landscapes damaged by catastrophic fires beyond the protection of property and infrastructure.

**Who:** Federal, tribal, state, and local agencies, scientists, universities, NGOs, community leaders, affected landowners and land managers.



## Strategy #3 — Private Land Stewardship:

Identify and treat opportunity areas to promote forest and watershed resilience on private lands through collaboration and direct engagement of landowners and communities.



Tree Farms at Bennion's Tree Farm Field Day © Todd Haines/NMFD

**Sub-strategy 3.1** - Strategically locate private land management actions to maximize landscape scale planning and restoration efforts.

**Outcome:**

- Increase the number of multi-jurisdictional landscape planning areas to maximize funding opportunities for private landowners within those areas.

**Measures:**

- Number of landscape planning efforts in each quadrant of the state.
- Number of landscape planning efforts in priority Shared Stewardship areas.
- Dollars and number of resources for landscape planning in those areas.
- Percentage (target is at least 50%) of Stewardship Plans in high priority areas on the Stewardship Priority Map.

**Actions:**

**3.1.A** - Create the Shared Stewardship Portal to help all partners better identify priority areas where active management can maximize resource benefits.

**What:** Develop and utilize the Shared Stewardship portal to capture, plan and analyze landscape scale planning and treatment activities.

**Who:** All forest and watershed restoration agencies and partners.

**When:** Winter 2021 and on-going.

**3.1.B** - Conduct outreach efforts to the 50% of the non-industrial private forested lands identified where federal Forest Stewardship funds can be utilized for new and updated Forest Stewardship Plans.

**What:** NMFD uses the Stewardship Priority Map and the Stewardship Mapping and Reporting Tool (SMART) to identify the 50% of non-industrial private forested lands.

**Who:** NMFD.

**Sub-strategy 3.2** - Provide technical and financial assistance to private landowners to increase active land management in high priority forests and watersheds with equitable access for all landowners.

**Outcomes:**

- Private and Tribal lands are resilient to wildfire and climate change.
- Stewardship activities take place in the areas with highest risk of wildfire and most public value for water source protection and plant and wildlife habitat.
- Field staff communicate regularly to maximize private land engagement.

**Measures:**

- Number of private landowners receiving technical assistance in priority areas identified the Forest Stewardship map.

- Dollars of private landowners' match for technical assistance received.

**Actions:**

**3.2.A** - Coordinate with Natural Resource Conservation Service (NRCS), New Mexico Association of Conservation Districts (NMACD), New Mexico Farm and Livestock Bureau (NMF&LB), NMFD and other applicable agencies and partners to jointly communicate to field staff the priority areas for private land outreach, planning and implementation.

**What:** Enhance interagency communication at all levels. Communicate statewide and district level targets and accomplishments to field staff. Collaborate to host workshops for landowners.

**Who:** NRCS, NMFD, NMACD, NMF&LB and any other applicable partners.

**When:** 2020.

**3.2.B** - Leverage funding from all available private land management incentive programs such as Forest Stewardship, Forest Health Monitoring, Landscape Scale Restoration grant program, Forest and Watershed Restoration Act, Forest Health Protection Program and Environmental Quality Incentives Program (EQIP). Manage funding to provide equitable access for all landowners.

**What:** Applicable agencies maximize funding opportunities and their own internal capacity to administer funds through annual applications.

**Who:** NRCS, NMFD and any other applicable agencies.

**When:** 2020.

**Where:** Statewide with a focus on priority areas.

**3.2.C** - Support landowners and land managers in implementing forest management activities including timber sales, fuels reductions, forest stand improvement, windbreak establishment and maintenance, reforestation, wildlife habitat improvement, etc.

**What:** Provide technical assistance in project planning. Where feasible, assist with funding mechanisms.

Engage with project implementation to ensure project success.

**Who:** NMFD, NRCS, SWCDs, NGOs, landowners and land managers.

**3.2.D** - Enhance capacity-sharing opportunities among agency personnel, New Mexico Technical Service Providers (TSP's) and partner organizations to better engage landowners.

**What:** Engage in discussion at collaborative group meetings and promote free-flowing information sharing among agencies, contractors and partner organizations to maximize private landowner planning and resilient landscape outcomes.

**Who:** NMFD, NRCS, TSP's, and NGOs.

**3.2.E** - Utilize forest health monitoring data to document impact of changes in climate and develop adaptive forest management recommendations for landowners.

**What:** Analyze drought information and insect/disease activity to identify trends and outreach to landowners to avoid and mitigate impacts of changing climate conditions.

**Who:** NMFD, USFS, NMDA, LANL, university researchers.

**3.2.F** - Utilize cooperative weed management programs to limit the spread of invasive and noxious plants in post-disturbance environments where presence can cause disruption of ecosystem functions.

**What:** Prioritize weed management in post-disturbance areas.

**Who:** NMFD, USFS, NMDA, SWCDs, CWMA.

**Where:** Focus % on lands most susceptible to changing climate.

**Sub-strategy 3.3** - Increase the acreage and quality of forest management plans reviewed and created by NMFD.

**Outcome:**

- Management planning is in place at an appropriate scale to support implementation of treatments at an increasing pace.

**Measures:**

- Acres of private land statewide under NMFD approved management plans, with a target to increase by 5,000 acres over the next 10 years.
- Number of NMFD staff with capability to write, implement and facilitate the creation of forest management plans.

**Actions:**

**3.3.A** - Increase staff expertise and cross-training in wildlife management, recreation management planning, land conservation mechanisms, and use of tools for multi-landowner landscape scale management planning for small ownerships, communities and subdivisions.

**What:** Training or peer-learning exchanges offered at least once a year by NMFD or partner experts.

**Who:** NMFD.

**When:** Beginning FY21.

**Sub-strategy 3.4** - Support property tax laws that do not lead to forest fragmentation and promote Forest Legacy and similar land conservation programs to conserve high priority forest ecosystems and landscapes.

**Outcome:**

- Landowners who actively managing their forest lands are able to qualify for agricultural land tax classification.

**Measures:**

- Number of visits to website delivering information about the importance, cost and value of managed forest to county tax assessors and commissioners.
- Number of publications, PSA and social media posts to disseminate information about private land conservation programs.
- Number of Tree Farm members.

**Actions:**

**3.4.A** - Annually review and maintain public outreach efforts, including website and literature to educate the public on conservation programs available to conserve forest ecosystems and landscapes.

**What:** Public relations and outreach efforts, including public service announcements, web-based information and social networking.

**Who:** NMFD, New Mexico Tree Farm, Land Trust Organizations, NGO's.

**3.4.B** - Utilize the New Mexico Tree Farm network to encourage counties to recognize productive forest lands as agricultural contributors, and incentives for maintaining working forests.

**What:** Tree Farm membership participates in outreach efforts and utilize their connections to educate local government decision makers.

**Who:** NMFD writes and produces outreach material and NM Tree Farm membership participates in outreach.

**Sub-strategy 3.5** - Ensure that restoration and management activities on private lands protect the state's most vulnerable resources.

**Outcome:**

- Sensitive plants, wildlife, and their habitats are maintained and enhanced.

**Measures:**

- Number of plant species successfully removed from the state list of sensitive plant species.
- Number of completed forest stewardship or management plans for private lands that consulted the Environmental Review Tool.
- Number of projects to enhance habitat for sensitive species in Important Plant Areas or in Conservation Opportunity Areas identified in the *State Wildfire Action Plan*.

**Actions:**

**3.5.A** - Starting in 2020 NMFD will incorporate an environmental review process to all management and stewardship guidance documents provided to private landowners to ensure impacts to sensitive plants, animals and their habitats are avoided or minimized.

**What:** Use the [New Mexico Environmental Review Tool](#), the USFWS IPaC System, and other available environmental review tools to identify potential impacts to sensitive species and their habitats.

**Who:** NMFD and private landowners.

**When:** Starting July 2020.

**3.5.B** - Where feasible, provide technical assistance to improve potential habitat for sensitive plants and wildlife.

**What:** Working with concerned landowners, the State Botanist, and the NMDGF each NMFD District will establish at least one project to improve and protect sensitive species habitat, within a 5-year period.

**Who:** NMFD and private landowners.

## Strategy #4 — Utility Rights of Way

Manage utility right of ways to reduce the risk of ignition of wildfire and damage to utility infrastructure by identifying priority utility rights of way and implementing accelerated management.



Tri-State Transmission line near Carson © Mary Stuever/NMFD

**Sub-strategy 4.1** - Provide tool/toolkit to help rural electric cooperatives improve required vegetation management plans along utility rights of way (ROW) in New Mexico.

**Outcomes:**

- Improved quality of vegetation management plans for utility ROW.
- Improved risk assessment for utility companies and Forestry Division.
- Improved prioritization of vegetation treatment and maintenance schedules along ROW.
- Improved effectiveness of treatment along utility lines with reduced maintenance costs.

**Measures:**

- Miles of ROW with vegetation management plans.
- Miles of ROW with hazardous fuels reduced per year.
- Dollars spent on ROW vegetation management by utilities.
- Number of ROW vegetation management training opportunities provided to utilities.

**Actions:**

**4.1.A** - NMFD will provide technical assistance to utility companies by developing a toolkit that includes a sample vegetation management plan template and treatment guidelines for utility companies in New Mexico to assist with vegetation management plan development and more effective and efficient vegetation management and maintenance along utility rights of way.

**What:** Develop vegetation management template and vegetation treatment guidelines and make these available to utilities in an electronic format in an easily accessed location. Tools include Integrated Vegetation Management.

**Who:** NMFD, PNM and other New Mexico investor-owned utility companies, Rural Electric Cooperatives, NMPRC (to share availability of resources and technical assistance and encourage utilities to improve quality of plans and guidelines), federal, tribal, state, and local entities with involved lands, RECA.

**When:** Toolkit will be available to utilities by December 2020.

**4.1.B** - Promote use of toolkit to utilities via training, webinar, or one-on-one outreach.

**What:** Make conference presentations to utility audiences, provide webinar, or engage in appropriate outreach to ensure toolkit is available statewide and maximize usage.

**Who:** NMFD, RECA, utility partners.

**When:** Through 2021.



**Sub-strategy 4.2** - Establish partnership between utilities and NMFD to assist with collaborative efforts for vegetation management and other risk reduction measures along utility rights of way.

**Outcomes:**

- Projects to reduce wildfire risk are implemented on high-priority areas for vegetation management projects.
- Utility operational efficiency and project prioritization are improved.

**Measures:**

- Number of Memorandums of Understanding in place to facilitate utility/Division partnerships.
- Number of pilot projects to reduce risk of wildfire from utility lines.
- Miles of high wildfire risk ROWs are treated.

**Actions:**

**4.2.A** - NMFD is engaged in the process when utility companies are developing vegetation management and other fire risk reduction projects. NMFD may assist with landowner contact/relationship to improve results of treatment. NMFD may assist with funding to expand treatment beyond rights of way where possible for maximum protection through forest treatment along utility lines.

**What:** Involve partners to help with prioritization, project development including securing funding through available programs (such as 2018 Farm Bill and/or Categorical Exclusion authorized in the 2019 Omnibus Bill), and implementation.

**Who:** NMFD, RECA, New Mexico utility companies, landowners and land management agencies in priority treatment areas, Rural Development, NRCS.

**When:** Complete MOU's by end of 2021, annual progress on project implementation.

**Sub-strategy 4.3** - Establish data sharing back and forth between utilities and NMFD for prioritization and partnerships for improving vegetation management along utility ROW. Overcome barriers to data sharing in order to identify priorities for accelerated vegetation management to reduce risk of wildfire.

**Outcome:**

- Improved prioritization for vegetation management projects to reduce risk of wildfire. Improve data available during wildfire response incidents.

**Measures:**

- Percent of utilities sharing data for statewide priority setting.
- Number of potential project areas identified.

**Actions:**

**4.3.A** - Establish appropriate data sharing process between NMFD, landowners/land management agencies, and all utilities to create state-wide database of power line location. Mitigate barriers that prevent data sharing.

**What:** GIS utility location data.

**Who:** NMFD, New Mexico utility companies and RECA, PRC, DHSEM.

**When:** Achieve first statewide data set by September 2020.

**4.3.B** - Identify, map and rank each mile of right-of-way by hazard level.

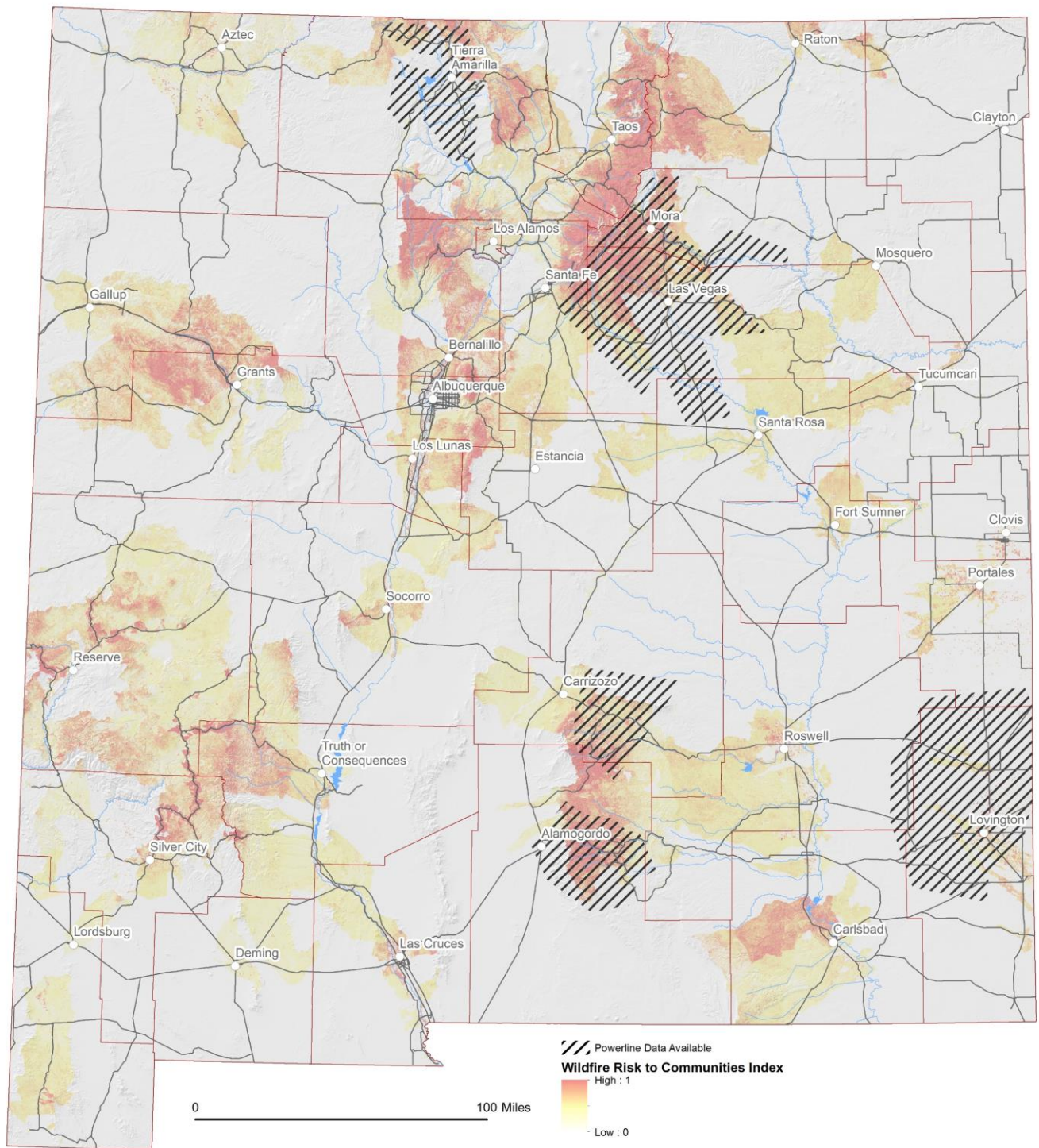
**What:** Assessment of powerline risk.

**Who:** NMFD, TNC, NM utility companies, insurance industry.

**When:** Target goal, by December 2020



Cleared transmission right of way near Luna, NM. © Nick Smokovich/NMFD



**Map 41. Four Electric Cooperatives working with Forestry Division. Project priority will focus on areas with high wildfire risk to communities within cooperative boundaries provided cooperative provide data to allow this prioritization. (Northern Rio Arriba Electric Cooperative, Mora-San Miguel Electric Cooperative, Otero County Cooperative and. Lea County Electric Cooperative).**

**Sub-strategy 4.4** - Incorporate utility location data into the Wildland Fire Decision Support System (WFDSS) for fire management guidance as wildfires are occurring. WFDSS is an access-limited geospatial reference for fire managers engaged in fire suppression and management with critical information for influencing decisions taken during fire events. Develop methods for keeping data updated and relevant. Engage utility partners in identifying important intelligence for fire managers in advance of wildfires.

**Outcome**

- Fire managers can access utility location and important utility information when engaged in large fire suppression operations.

**Measure:**

- Percent of utility information included in utility location data layer in the WFDSS.

**Actions:**

**4.4.A** - Identify and address issues to provide ROW data to the WFDSS system.

**What:** Identify data needs for WFDSS, data limitations with utilities, and develop appropriate authorization for data sharing.

**Who:** NMFD, USFS, NM utility companies.

**When:** Target goal, by December 2020.

**4.4.B** - Transfer data to WFDSS.

**What:** Share data layer with WFDSS program managers.

**Who:** NMFD, USFS.

**When:** Target goal, before 2021 fire season.

**4.4.C** - Maintain data updates to keep layer current.

**What:** Develop action plan for regularly updating data layer as needed.

**Who:** NMFD, NM utility companies, USFS.

**When:** Target goal for plan by December 2020; updates at appropriate increments.

**Sub-strategy 4.5** - Ensure that ROW vegetation management activities do not impact the state's most vulnerable resources.

**Outcome:**

- Avoid or minimize impacts to sensitive plants, animals, and their habitats by using the most current and up-to-date tools and resources available.

**Measure:**

- Number of ROW vegetation management projects using the ERT to identify and mitigate negative impacts to sensitive resources.

**Actions:**

**4.5.A** - NMFD will incorporate an environmental review process to all ROW vegetation management projects to ensure impacts to sensitive plants, animals and their habitats are avoided or minimized.

**What:** Use the Environmental Review Tool, the USFWS IPaC System, and other available environmental review tools to identify potential impacts to sensitive species and their habitats.

**Who:** NMFD and ROW partners.

**When:** Starting July 2020, during the project planning process.

**Where:** Statewide, wherever ROW management projects are planned.

**4.5.B** - Starting in 2020 NMFD will mitigate all potential impacts to sensitive plants, animals and their habitats, as identified during the environmental review process.

**What:** Mitigate potential impacts to sensitive plants, animals and their habitats through avoidance or management actions.

**Who:** NMFD and partners.

**When:** Starting July 2020, in response to the environmental review process.

**Where:** Statewide, wherever ROW management projects are planned.



## Strategy #5 — Rare Plant Conservation

Protect and conserve New Mexico's rare and endangered plant species and their habitats through collaborative partnerships between stakeholders and interested parties to aid and improve the conservation and management of rare plant species and to avoid federal listing. Refer to the [New Mexico Rare Plant Conservation Strategy \(2017\)](#) or the most current version of that document for additional information.



Pecos sunflowers © Carmen Austin/NMFD

**Sub-strategy 5.1** – Inventory, research, monitor and model to inform management and regulatory decisions.

**Outcomes:**

- Increased scientific understanding of plant distribution, natural history, and status.
- Documentation of current population status of rare and endangered plants.
- Identification of populations declines and habitat loss.
- Improved data on status and distribution of rare and endangered plants.
- Monitoring of invasive weeds that threaten rare and endangered plants.
- Prioritized research needs.
- Predictive models evaluate potential impacts of management activities.

**Measures:**

- Number of monitoring reports produced annually.
- Development of survey guidelines and surveyor qualification standards.
- Development of predictive impact and population viability models.
- Number of Citizen Scientists trained to assist with survey needs.

**Actions:**

**5.1.A** - Inventory and prioritize rare plants based on Scorecard results, management and regulatory needs and recommendations.

**What:** Establish a list of conservation priority species and conservation actions using the Plant Conservation Scorecard (see NMRPCS). Collect baseline information for species lacking information to effectively evaluate conservation status.

**Who:** Land managers, NMRPTC, NHNM, NMFD.

**5.1.B** - Monitor for population trends and threat impacts and use results to inform regulatory decisions and develop management recommendations and actions.

**What:** Identify trends and threats, including invasive weeds, and develop and communicate recommendations.

**Who:** Land managers, NMRPTC, NHNM, NMFD.

**5.1.C** - Support and conduct research to answer basic questions on natural history, genetics, and threat impacts.

**What:** Generate a prioritized research list to guide project proposals by organizations and graduate students searching for potential research projects.

**Who:** Universities, agencies, NGOs.



### III. Strategies

**5.1.D** - Develop predictive modeling for planning and evaluating management actions and population viability models to assess endangerment.

**What:** Identify.

**Who:** NMRPTC, NMHU, academia.

**5.1.E** - Identify and fill data gaps to improve knowledge on range, distribution, population size, condition, threats, and current status of *Strategy Species* based on Scorecard results.

**What:** Scorecard can be found in the [New Mexico Rare Plant Conservation Strategy \(2017\)](#).

**Who:** NMRPTC, land managers.

**Sub-strategy 5.2** - Protect, manage, and restore Strategy Species and their habitats.

**Outcomes:**

- Consistent protection of rare and endangered plants.
- Actions to protect imperiled plants preclude need for new federal listings under ESA.
- Management of invasive weeds to reduce threats to rare and endangered plants.
- Long-term stewardship of rare and endangered flora.

**Measures:**

- Number of species designated as endangered (target is a decline).
- Number of plant conservation plans developed in Important Plant Areas.
- Number of plant conservation projects implemented and maintained in Important Plant Areas.

**Actions:**

**5.2.A** - Minimize the impacts of land uses and threats to *Strategy Species* through project planning, mitigation, and conservation efforts.

**What:** Utilize project planning, mitigation activities, and conservation actions (see pp. 35-36 of NMRPCS for a complete listing).

**Who:** All federal, tribal, state, and local agencies.

**5.2.B** - Determine priority habitats to focus resources for protection, management, and restoration by mapping Important Plant Areas (Map 42), developing Conservation Opportunity Areas, and the establishment of Plant Conservation Areas.

**What:** Maintain, update, and manage Important Plant Areas, Conservation Opportunity Areas, and Plant Conservation Areas.

**Who:** NMRPTC.

**5.2.C** - Protect private and Tribal lands by promoting rare plant conservation through outreach, tax incentives and conservation easement opportunities.

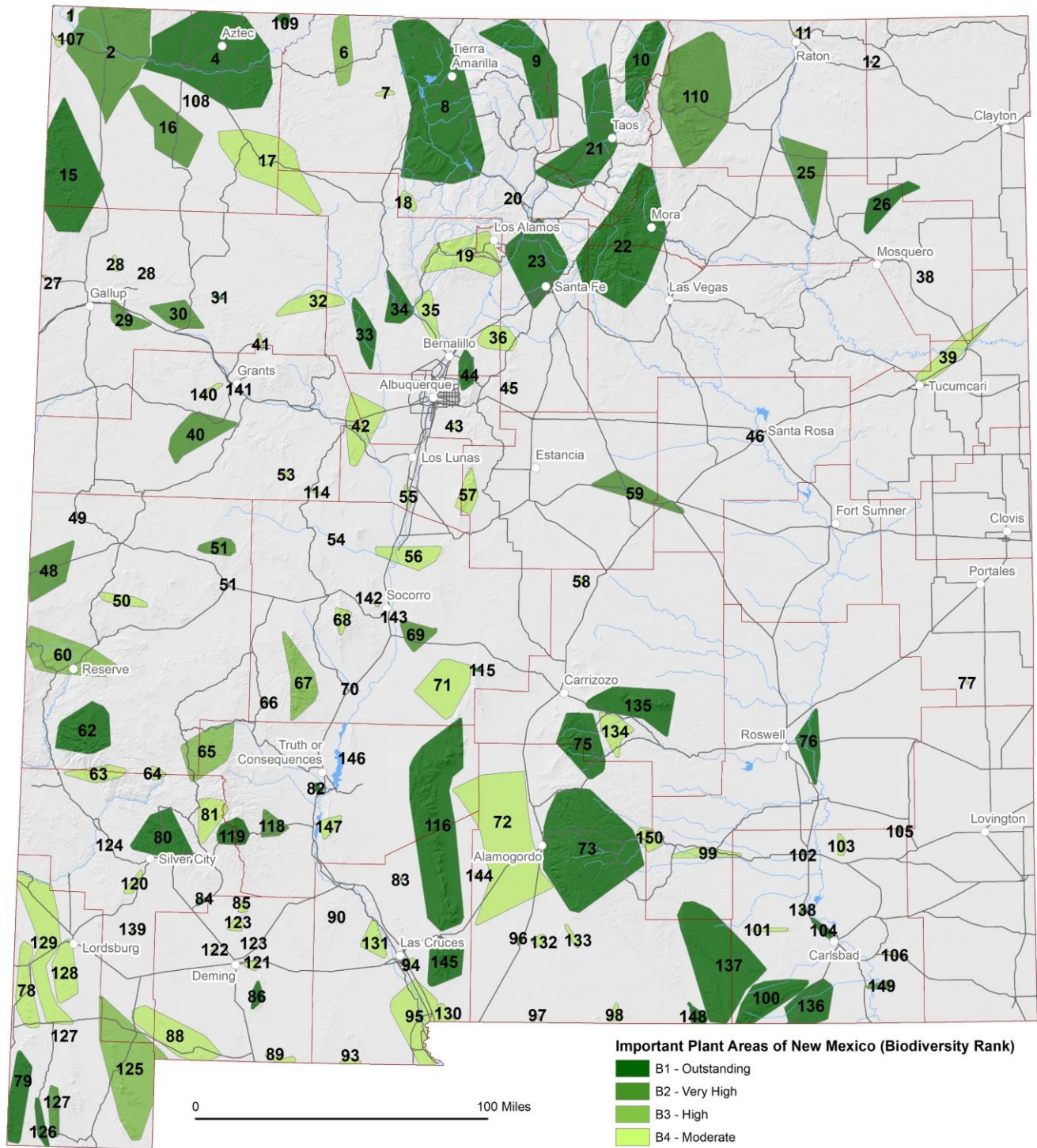
**What:** Provide information (including funding opportunities, tax credits, available resources) to private landowners, Tribes, and local land trusts to increase protection of rare plants.

**Who:** USF&WS, NRCS, NMFD, land trusts, Tribes, private landowners.

**5.2.D** - Encourage habitat management and restoration through the development of Conservation Action plans, coordinated planning and restoration efforts, and the development of resources needed.

**What:** Develop plans, incorporate conservation measures and recovery actions, prioritize species, coordinate efforts, identify barriers and opportunities, and restore impacted habitats.

**Who:** NMRPTC and partners.



Map 42. Important Plant Areas of New Mexico and their Biodiversity Rank (NHNM 2017). Detailed information for each IPA, including shape files, species lists, acreage, and county of occurrence is available to land managers on request to the Forestry Division.

**Sub-strategy 5.3 - Improve data management, storage and dissemination.**

**Outcomes:**

- New Mexico NM Rare Plant Conservation Strategy Species List and data repository exists and is maintained.
- Improved scientific understanding of rare plant distribution, abundance and status through coordinated data management.

**Measures:**

- Number of species tracked in centralized database.
- Number of updates to the species list as needed.

**Actions:**

**5.3.A - Establish and maintain a NM Rare Plant Conservation Strategy Species List and data repository.**

**What:** Improve data management through a centralized database to document active data gathering.

**Who:** NMRPTC.

**5.3.B - Improve data management capabilities to better prioritize species and focus habitat protection and restoration.**

**What:** Establish a common website to facilitate information exchange by updating and improving existing NMRPTC website or developing a new common website. Engage stakeholders.

**Who:** All federal, tribal, state, and local agencies, land managers, and NGOs.

**5.3.C - Work with public agencies to collect and share best available data for the protection and management of rare and endangered plants.**

**What:** Incorporate information into planning documents, develop and implement best management practices, and pursue special designations for rare and endangered plants and their habitats.

**Who:** All federal, tribal, state, and local agencies, land managers, and NGOs.

**Sub-strategy 5.4 - Develop ex-situ conservation and recovery strategies for rare and endangered plants and implement where appropriate.**

**Outcomes:**

- Clear management guidelines.
- On-the-ground conservation and recovery actions are facilitated.
- Establishment of plant conservation areas.

**Measures:**

- Number of plans for conservation and recovery prepared or updated.
- Number of projects implemented.
- Growth of seed banks and seed banking capacity.

**Actions:**

**5.4.A - Collect seeds and other plant materials for long-term ex-situ conservation and restoration purposes.**

**What:** Conservation actions include seed banking and population augmentation and introductions.

**Who:** All federal, tribal, state, and local agencies, land managers, and NGOs.

**5.4.B - Determine species' propagation needs.**

**What:** Develop propagation and storage protocols for taxa lacking viable seed sources such as propagation through tissue culture and storage through cryopreservation.

**Who:** NMFD, universities, NGOs.

**5.4.C - Support the analysis and delineation of targeted Conservation Opportunity Areas from the Important Plant Areas map as the foundation for establishment of permanent plant conservation areas.**

**What:** Create a list of opportunities where rare plants can be protected through designation and through supportive management activities.

**Who:** All federal, tribal, state, and local agencies, land managers, and NGOs.

**5.4.D - Augment and reintroduce rare and endangered plants where appropriate.**

**What:** Conservation actions include habitat protections, updating recovery plans, and developing recovery strategies and conservation plans.

**Who:** Land management agencies, NGOs.

**When:** Minimum of one project per year.

**Where:** High priority restoration and relocation sites.

**Sub-strategy 5.5** - Improve laws, regulations, and policies to protect New Mexico's plant diversity.

**Outcomes:**

- Reduced conflict by providing proactive conservation measures and guidelines.
- Laws, regulations, and program policies enhance conservation of New Mexico's rare plants in cooperation with stakeholders.

**Measure:**

- Number of laws, regulations, and policies instituted or updated that guide rare plant protection.

**Actions:**

**5.5.A** - Strengthen the law to protect plants from harm and reduce the number of plants that need federal protection.

**What:** Redefine "take" to expand beyond collection of plants and include management actions that harm plant habitat.

**Who:** NMFD, NGOs, legislators.

**5.5.B** - Improve existing NM State endangered plant law and develop policies needed to increase protection for state listed endangered plants.

**What:** Work with elected officials to improve the statute on criteria, process, mechanisms and resources, using best available science.

**Who:** NNMFD, all land management agencies.

**5.5.C** - Develop a programmatic framework that facilitate due diligence from federal, tribal, state, and local government entities emphasizing collaboration to guide the conservation of endangered plants with the goal of precluding federal listing.

**What:** Improve federal and state agency involvement in rare plant conservation. Engage tribes and private landowners in non-regulatory, self-oriented stewardship of rare plants.

**Sub-strategy 5.6** - Increase collaboration, education and outreach about rare and endangered plants.

**Outcomes:**

- Increased dialog and coordination among land managers and conservation partners.
- Coordinated management of rare species.
- Promotion of education and stewardship opportunities.

**Measure:**

- Programs presented, materials developed, articles written, and forms of outreach measures.

**Actions:**

**5.6.A** - Promote collaboration by developing and expanding partnerships.

**What:** Provide botanical expertise within land management agencies through staffing, funding, data management, partnerships, and volunteers to implement conservation direct management.

**Who:** NMRPCP, and federal, tribal, state, and local agencies, NGO's, botanical gardens and parks.

**5.6.B** - Expand education and outreach efforts through social media, websites, trainings, distribution of educational materials, citizen science and youth programs.

**What:** Activities may include a rare plant common website, a book on New Mexico rare plants, rare plant identification and survey training, rare plant exhibits, other educational materials (brochures, apps, signs, etc.), citizen science opportunities, youth programs, private landowner outreach and awards program.

**Who:** All agencies and land managers.

**5.6.C** - Provide maps of New Mexico's Important Plant Areas to land managers and conservation groups to help identify and prioritize Conservation Opportunity Areas.

**What:** Continue to refer land managers to the Important Plant Areas map for consideration in project planning and implementation.

**Who:** NMFD, NMNH, NMRPTC, federal, state and local land management agencies, landowners and land managers, NGOs.

**Sub-strategy 5.7** - Improve funding, infrastructure and rare plant programs.

**Outcomes:**

- Rare plants included in land use and resource management planning.
- Formal agreements exist between primary stakeholders.



**Measures:**

- Funding levels for rare plants in all agencies and organizations.
- Numbers of plant programs, strategies and projects for all agencies and organizations.

**Actions:**

**5.7.A** - Support and expand the NM Forestry Division Endangered Plant Program.

**What:** Support and expand the New Mexico Rare Plant Conservation Partnership (NMRCP) and activities, obtain consistent long-term funding.

**Who:** NMRPCP currently includes NMFD, BLM, USFS, NHNM, USFWS, NMRPTC, NNHP (Navajo Nation Department of Fish & Wildlife), Center for Plant Conservation (CPC), Institute of Applied Ecology, NMSLO, NMNPS, and private individuals. Potential partners include universities and colleges, additional tribes and pueblos, additional agencies, NGOs including botanical gardens, and other private parties.

**5.6.B** - Facilitate the development of rare plant programs in other agencies, tribes, non-governmental organizations or institutions.

**What:** Develop cooperative agreements, engage stakeholders, promote conservation programs, expand botanists among agencies, tribes, academia, and conservation organizations.

**Who:** All agencies and land managers.

## Strategy #6 — Reforestation

Create conditions for planting the right tree in the right place for the 2100 climate and bring burned lands to a healthy function for people and the environment.



New Mexico State Forestry seedlings ready for distribution © Wendy Mason/NMFD

### Part 6.1: SEED COLLECTION AND STORAGE

**Sub-strategy 6.1.1** - Establish a seed collection program and associated seedbank/cooperative among multiple agencies, tribes, landowners, organizations and states to ensure genetically diverse and climate ready seedlings can be produced for reforestation of burned lands and other deforested areas.

**Outcome:**

- Reliable seedbank storage facilities accommodate the current reforestation back log and provide for future needs for seedlings for restoration.

**Measures:**

- Number of high-quality, genetically diverse seed sources available to meet restoration needs now and into the future.
- Number of viable seeds available in storage for recognized seed zones.

**Actions:**

**6.1.A** - Develop a state-based collaborative to collect seed and manage the seed bank to ensure seed demands are met based on reforestation needs across the landscape and across boundaries. These collaboratives will ensure that collection and storage meet 5 million seedlings/year while considering the need to plant the right tree in the right place for the anticipated 2100 climate.

**What:** Identify funding sources either public or private to ensure seed collection and storage system facilities are developed and sustained.

**Who:** NMFD, state land management agencies, USFS, NGO's, Tribes, BLM, corporations and Universities.

**When:** Begin in 2021 with full implementation and support by 2025

**Where:** The intent is to have these seed banking facilities adjoin the two (2) central nurseries once these locations have been determined in order to eliminate seed loss due to travel and maintain seed viability and quality control.

**6.1.B** – Analyze and model seed zones for critical tree species in New Mexico. Incorporate USFS and university genetics studies throughout the southwest to update seed zone areas as new data becomes available.

**What:** Utilize seed viability and progeny testing to improve seed zone classification in New Mexico to provide a context of managing locations of harvested seeds with locations of where to plant for relative success considering future climate impacts and forest development.

**Who:** USFS, John T. Harrington Research Center, NMFD, NMHU, SWRI, Tribes, NGO's, private industry, non-profits, UNM, Valle Calera, NPS, East Jemez Collaborative, USGS.

**When:** Initiate seed collection and progeny testing in 2020; carry out 10-years to update models as new data is developed and current climate impact is factored.

**Where:** Statewide seed collection, if workforce and funding allow, otherwise opportunistic seed collection as critical seed species produce seed. This can also be included with demonstration sites as part of data parameters for collection and extrapolation.

**6.1.C** – Create a 10-year seed collection plan, updated regularly, that monitors availability of seed throughout the state and evaluates Return on Investment. Also develop a publicly available New Mexico web interface seed database as a companion to the plan. The database will monitor seed source data from mother tree to germination, to field planting and survival success. Monitoring will provide input for the seed collection plan.

**What:** Seed plan will be collaborative/cooperative plan developed by multiple partners. The database may be a modification of the NMFD conservation seedling program database already in existence.

**Who:** NMSU, NMHU, NMFD would host the web interface database, USFS, UNM, SWRI, Tribes, NGO's, Non-profits, Institute for Applied Ecology.

**When:** Initiate framework for the plan and database late 2020 with a projected goal of plan development and data base interface running by 2022.

**Where:** Either at the John T. Harrington Research Center, NMHU or NMFD.

## Part 6.2: NURSERY CAPACITY AND SEEDLING PRODUCTION

**Sub-strategy 6.2.1** - Expand nursery capacity in New Mexico, produce adequate number of high-quality seedlings to meet reforestation needs for burned areas and other reforestation opportunities.

### Outcomes:

- Production of high-quality seedlings to meet current and future restoration needs including existing back log of planting areas on recent burned lands.

### Measures:

- Number of seedlings produced annually at nurseries in the state, with a target to produce 5 million seedlings/year.
- Number of new nurseries constructed or other increases to growing capacity.

### Actions:

**6.2.A** - Develop a state-based collaborative to manage and support a minimum of two (2) nurseries to improve transportation efficiency, with the capacity for 5 million seedlings annually to meet the current and future need for burned area reforestation efforts.

**What:** Establish agencies or entities via a collaborative to manage the two (2) nurseries to meet current and future seedling production needs. Nurseries can also serve as repository for seed storage, processing and associated infrastructure to support seedling demand.

**Who:** NMFD - Conservation Seedling Program, USFS, BIA, Tribes, NGO, TNC, Non-profit, NMSU, NMHU, UNM, private investors.

**When:** Have facilities in place and producing within the state by 2025.

**Where:** Mora is currently the epicenter for New Mexico and will branch out to an additional facility in the state that either has the infrastructure, applicable site, or adequate workforce. Potential sites are on tribal reservations (Mescalero, Santa Clara, Navajo Nation, etc.), NMFD—Conservation Seedling Program, NRCS—Los Lunas facility, or a private nursery in Albuquerque, Rio Rancho, Santa Fe, or Los Lunas.

**6.2.B** - Utilize a state-based collaborative to identify and prioritize planting needs around the state, determine available funding anticipated, and estimate the species and number of seedlings needed to ensure efficient and practical uses of nursery capacity.

**What:** Reforestation collaborative will help identify funding sources and seedling needs so the right trees (from the right seed zones) are produced for planned planting projects.

**Who:** NMFD - Conservation Seedling Program, USFS, BIA, BLM, Tribes, NGO, TNC, Non-profit, NMSU, NMHU, UNM, private investors, corporate investors, wildlife foundations and organizations with ecosystem services.

**When:** Annually, with planning looking out over several years as needed based on target age of seedlings to be planted.

## Part 6.3: LANDSCAPE ASSESSMENT AND SITE SELECTION

**Sub Strategy 6.3.1** - Provide and develop data and information on both tree survival and climate models to improve the likelihood that trees planted in the next decade will survive and thrive throughout their lifetimes (*Right Tree Right Place 2100 Strategy—RTRP 2100*).

**Outcomes:**

- Seedling survival rates are consistently greater than 50%.
- Planted trees live to produce seed for the next generation.

**Measures:**

- Number of reports, published papers, or other documents that share new data on tree success in changing climates.
- Development and updating of Best Management Practices on seed collection, seed storage, seedling production, site selection, planting techniques to improve tree survival.
- Development and updating of tool that helps select seed used for specific planting projects.

**Actions:**

**6.3.A** - Develop a workflow or model to inform decisions of what seeds to use to grow seedlings for specific planting projects to ideally get the right tree in the right place for the future (RTRP 2100). Update the tool as needed when new data or information become available.

**What:** Conduct landscape assessments to ensure the likelihood that target areas (burned and forested) will support seedlings in the future. Assessments will include seed collection strategies and appropriate site selection. These will all tie into the information from nurseries and seed stock, progeny testing and database/seed plans for RTRP in 2100 strategy.

**Who:** Colleges and Universities, USGS, NPS, NMF, USFS, MMD, University of Arizona Laboratory of Tree Ring Research, Tribes, NGO's, TNC.

**When:** Initiate 2020 with 10-year objectives and either annual or 3-year revisits to incorporate new data, technologies or techniques throughout the entire chain of reforestation i.e. seed collection, progeny testing, nursery production, planting and workforce development/training, survival and monitoring.

**Where:** Universities, Nursery facilities and throughout the southwest to incorporate new data, research and technology.

**6.3.B** - Develop and update Best Management Practices (BMP) as needed for each reforestation phase (seed collecting, seed storage, progeny testing, seedling production, seedling handling, planting, monitoring).

**What:** Protocols for maximizing long-term survival will be developed and made available to practitioners.

**Who:** Colleges and Universities, NMF, USFS, BIA, Tribes, NGO's, TNC.

**Sub strategy 6.3.2** - Identify and prioritize opportunities for reforestation to ensure future forests on moderately and severely burned lands.

**Outcome:**

- High or moderate severity burn areas which 1) are not likely to regenerate naturally, 2) have potential for successful reforestation, and 3) can moderate long-term flooding issues within the watershed through reforestation efforts, are planted with appropriate tree seedlings.

**Measures:**

- Completion of a state-wide map updated annually to serve as a guide for prioritization of reforestation areas and lay the framework for a planting strategy.
- Need for the extent of reforestation is defined including the type(s) of species and genetics (e.g. seed zones) to ensure adequate survival or reforestation for future climate impacts.

**Actions:**

**6.3.C** - Map location(s) of high and moderate severity burned areas throughout the state within the last 10-years. Identify potential planting areas within these polygons to either reforest or establish pods of future seed trees.

**What:** Mapping high priority areas where planting is needed and further identify areas for post planting monitoring of seedling survival and restoration efforts.

**Who:** NMF, USFS, NMSU—John T. Harrington Mora Research Center, NRCS, TNC-NM, UNM, and tribal governments.

**Where:** Recent and future burn areas within moderate and high severity landscapes.



**Sub-strategy 6.3.3** - Develop climate-ready methods, strategies and a matrix for planting prescriptions considering future climate impact to seedling survival. This will require reforestation goals specific to each land managing agency and shall include mapping of all planting sites pre and post planting.

**Outcomes:**

- Model and map of areas where reforestation will be successful is used and based on-site specific criteria developed through mapping of burn severity in forested and watershed areas and with guidelines for site specific species and genotypes for that ecotone or forest type to improve species survival in future climate envelope.
- Project managers and landowners have access to information and strategies to ensure acceptable survival rates and plant forests that have a good chance of surviving in the future.

**Measures:**

- Percent of seedling survival when planted with this process.
- Number of technical assistance requests by forest landowners or uses of the decision matrix tool to guide the placement of the right tree in the right place for the anticipated 2100 climate.

**Actions:**

**6.3.D** - Determine criteria for evaluating potential landscapes on how forests have dealt with climate impacts in the past and what impacts are expected in the future. Include forest refugia areas spared during wildland fire which provide adequate site conditions and habitat for effective reforestation efforts. Use information to develop site specific micro-site selection strategies, planting stock selection, and planting techniques to improve seedling survival.

**What:** Map or model of reforestation benefits within each forest type and the ecological benefits associated with the development of forests through the successional process. This may include potential carbon offsets or benefits and if certain forest types provide more carbon sources or create more carbon sinks.

**Who:** TNC and NMFD map these areas and provide a baseline of potential diversity benefits including any ecological benefits.

**6.3.E** - Develop a decision matrix tool to advise the project manager or tree planter in site selection for maximizing seedling survival. The matrix should include information on target criteria for planting spot locations for each site or species, site preparation required prior to planting to ensure adequate seedling survival, guidelines on care and handling of seedlings from nursery to planting spot, and effective/efficient methods on proper planting technique to maximize seedling survival and funding availability or limitations, which directly relates to future forest growth/condition including climate impact, cultural goals, product availability and acceptable Return on Investment.

**What:** Establish a map of reforestation need across landscape boundaries based on burn severity and agency/landowner priorities/funding parallel with matrix. Need to consider water quality/availability, available resources and site conditions, slope stabilization, soil development and cultural values.

**Who:** NMFD, MSI (Mountain Studies Institute), TNC, NMSU, USFS, U.S. Geological Survey.

**When:** Develop a draft matrix and map late spring 2020 for the Jemez Mountains area through the East Jemez Landscape Restoration Project; then create a Summer/Fall 2021 for a state-wide map in Fall 2021.

**Where:** Target areas per National Forest or Mountain Ranges throughout the state. Can incorporate landowner or manager reforestation areas current and future with expected dates to help with seed collection, propagation, planting, monitoring to maximize success and investment. Pick planting areas outside of planned prescribed burn areas or fuel treatment areas.

**Sub-strategy 6.3.4** - Assess local site characteristics for reforestation success, including soil health/condition, reforestation potential, competition with other plants, herbivory effects and the potential need for soil micro-organism inoculation.

**Outcome:**

- Forest managers and landowners have technical resources to guide assessment of local site conditions and to pick areas for planting that will have reasonably high survival rates.

**Measures:**

- Completion of reforestation Best Management Practices (BMP's) applicable across all landscapes and that consider future climate effects on seedling growth or mortality.
- Size of the gap between planting need and seedling availability to meet the needs.

**Actions:**

**6.3.H** - Create a guide to reforestation for the 2100 climate that considers planting prescriptions, site specific outcomes, goals based on forest type; while considering soil health, site potential, competition and herbivory impacts.

**What:** Collaboratively develop a guide to reforestation.

**Who:** NMFD—Conservation Seedling Program, USFS, TNC, State Land Office, NMDGF, NMSU, NMHU, FWRI, tribes, non-profits and non-governmental organizations; lead agency will need to be established to spearhead and push forward all strategies.

**When:** Initiate in 2020 and have in place with lead agency by end of 2021.

**Where:** Possibly break out by regions within the state or ecozones and formulate a statewide guide and strategy based on these areas; this will also help define the gaps, find solutions to those gaps and refine goals and planning efforts. These factors may help to define a lead agency for this strategy.

**Part 6.4: PLANTING PROJECTS AND STRATEGY**

**Sub-strategy 6.4.1** - Apply prescriptions from sub-strategy 6.3.4 with demonstration projects that illustrate the outcomes, success and vulnerabilities of planting seedling to survive in the future climate, and explore carbon offset program for New Mexico to help expand funding for future reforestation.

**Outcomes:**

- Data collected from demonstrations informs the guidance documents, matrix and strategies.
- Demonstration sites are selected so the findings can be extrapolated to similar areas and condition across the state.
- Data is collected from test plot studies through mine operators, which investigate the effects of different medium types as cover over mined areas, amendments, plant species, selection, survival/growth. These sites are characteristically similar to severe burned areas and data can be extrapolated and compared.
- Data is collected for possible legislation to capture the amount of carbon offset of tree planting and restoration and extrapolate this toward carbon credits or incentives for tree planting/restoration in burned areas.

**Measures:**

- Number of lessons learned (adaptive management) adapted into Right Tree in the Right Place (RTRP) 2100 strategy and tools.
- Number of demonstration sites implemented in forested areas and mine reclamation areas.
- Quantity of carbon offset and captured/stored as a result of tree planting and incentives toward future climate impacts.

**Actions:**

**6.4.A** - Select demonstration sites with data parameters identified and provide site redundancy to establish adequate baseline data. Factors and data will be fluid, including methodology, to ensure a dynamic guidance framework that works across the landscape and across jurisdictions.

**What:** Identify demonstration site parameters and data needed to extrapolate in similar forest types, ecozones or burned areas for reforestation success given future climate impacts.

**Who:** East Jemez Landscapes Futures watershed group, NMSU nursery staff and potentially tribal affiliates currently engaged in burned area. reforestation, USFS demonstrations sites and Valle Caldera planting study areas, MMD.

**When:** Pick demo sites for planting between 2020 - 2021, establish and develop 2022 with guidance and methodologies provided by 2025.

**Where:** Select East Jemez as first demonstration site because of need, on-going or in-coming project areas based on grant funding.

**6.4.B** - Based on demonstration data, provide guidance and strategy matrix to implement cross-boundary burned area reforestation state-wide with ultimate goal of RTRP 2100.

**What:** RTRP 2100 monitoring protocol developed, implemented and improved with appropriate questions and answers through monitoring and update process.

**Who:** NPS, NMSU, USGS, UNM, MSI, Tribes, NGO's, NMHU, TNC, USFS.

**6.4.C** – Assess the opportunity to establish a New Mexico specific carbon offset program or the feasibility of participating in voluntary carbon markets.

**What:** Work with the US Climate Alliance to assess options for carbon offsets from reforestation, soil conservation, and land protection.

**Who:** NMFD, EMCD, NMDA, US Climate Alliance and NGOs.

### Part 6.5: MONITORING AND ADAPTIVE MANAGEMENT

**Sub-strategy 6.5.1** - Develop and implement monitoring protocols to track capacity in seed collection, nursery capacity, site preparation, seedling handling, planting and seedling survival.

**Outcomes:**

- Data and information improve the likelihood that the right tree is planted in the right place for 2100.
- New data and information are frequently assimilated to improve models, seed plans, and best management practices through all levels.
- Adequate and viable seed supply is collected and stored.
- Adequate nursery capacity exists for restoration needs.
- Survival monitoring is used to inform techniques for site preparation, seedling handling, and out planting.

**Measures:**

- Number of protocols developed.
- Number of monitoring reports.

**Action:**

**6.5.A** - Develop monitoring protocols for all aspects and scales of reforestation. Identify ways to ensure seed/location pairings (where seeds from one area are planted in another area) are tracked and evaluated. Include protocols for monitoring seed viability and storage, ensure seed location is identified from collection to planting. Identify site characteristics that correlate with higher survival rates. Identify checklists to insure proper seedling transportation, storage, and handling. Identify and track survival over time.

**What:** Protocols are developed and utilized to provide quality control to all aspects of the reforestation chain of activities. Adaptive corrections are made to improve process as needed.

**Who:** Colleges and Universities, USGS, NPS, NMFD, USFS, University of Arizona Laboratory of Tree Ring Research, Tribes, NGO's, TNC.

**When:** Initiate in 2020 with 10-year objectives and either annual or 3-year revisits to incorporate new data, technologies or techniques throughout the entire chain of reforestation i.e. seed collection, progeny testing, nursery production, planting and workforce development/training, survival and monitoring.



Seedling surrounded by wood chip mulch. © Krista Bonfantine



## Strategy #7 — Urban and Community Forestry

Maintain and increase a resilient tree canopy in populated areas to provide cooling shade, clean and protect water, increase people's access to nature's health benefits, and support local economies.



Civitan Park, Farmington. 2004 ReLeaf project 10 years later ©Mary Stuever/NMFD

### Part 7.1: INCREASE A RESILIENT URBAN TREE CANOPY

**Sub-strategy 7.1.1** - Identify and promote tree and shrub species for New Mexico urban environments that can survive both current and projected climates.

**Outcome:**

- An urban forest canopy more resilient to climate change and the impacts of pest and disease.

**Measures:**

- Lists of recommended climate-ready tree species for each primary urban growing zone of New Mexico.
- Number of climate-ready tree seedlings sold through the Conservation Seedling Program.
- Number of websites/communication methods hosting climate-ready tree species lists.

**Actions:**

**7.1.A** - Conduct geospatial analysis of future climate conditions in each of the primary urban growing zones of New Mexico and develop lists of trees and shrubs most likely to succeed in those conditions.

**What:** Create a map of primary urban growing zones based on combinations of plant hardiness zones, elevation, temperature, and precipitation, with a corresponding tree and shrub species list for each zone.

**Who:** NMSU Horticulture and TNC's Albuquerque Urban Conservation Program are currently working on these efforts with support from NMFD, U&CF Program and Conservation Seedlings Program.

**When:** Initial effort in CY2020, with updates every 1-3 years, as additional data is available.

**Where:** Statewide, starting with Albuquerque.

**7.1.B** - Identify climate-ready seedstock and grow seedlings for sale to the public through the NMFD Seedlings program to assist with reforestation.

**What:** Seedstock identified as being climate resilient and urban adaptable will be grown out in nurseries around the state to supply the public and municipalities.

**Who:** Texas A&M Forest Service Urban Tree Improvement Program; NMSU Mora Research Station; Statewide municipal nurseries; NMFD Conservation Seedling Program.

**When:** Initial program will be multi-year, with goal for first seedlings to be available in 2025.

**7.1.C** - Conduct outreach and provide information on climate-ready tree species to nursery owners, homeowners, landscape planners and designers, and commercial/institutional installers.

**What:** Provide lists of climate-ready tree species to top avenues for communication.



### III. Strategies

**Who:** Outreach via Colorado Nursery and Greenhouse Association, New Mexico Chapter of American Society of Landscape Architects, Think Trees New Mexico Annual Tree Care Conference, NMSU Horticulture Extension, NMFDC Communications, Master Gardener Program, botanical gardens.

**When:** Immediately following completion of Action 7.1.A above.

**Where:** Existing websites and communication methods.

**Sub-strategy 7.1.2** - Identify areas with specific challenges to urban forest biodiversity, age, health, and resilience to target replanting efforts.

**Outcome:**

- Urban forests with greater age and species diversity as a result of targeted, data-driven replanting efforts.

**Measures:**

- Number of communities with initial tree inventories.
- Number of communities continuing to expand tree inventories.
- Number of targeted articles and presentations about data-driven urban tree health concerns and solutions.
- Completion of New Mexico Pest and Pathogen Monitoring and Response Plan.

**Actions:**

**7.1.D** - Expand statewide tree inventorying efforts using the statewide tree inventory cloud-based tool and protocol developed, with an extra effort to include Tribal communities. Use collected data to focus resources to likely pests and pathogens and target outreach to correct common maintenance problems.

**What:** As part of the *New Mexico Statewide Community Forest Analysis and Planning* project NMFDC Urban and Community Forestry Program has a statewide tree inventory license with Plan It Geo's Tree Plotter that can be used by any community to inventory up to 200 trees.

**Who:** Local governments, NMFDC Urban & Community Forestry Program, NMFDC Forest Health Program.

**7.1.E** - Develop a statewide pest and pathogen monitoring and response plan, including communication, responsibility, monitoring, and public awareness.

**What:** Initial efforts were made to develop an Emerald Ash Borer Plan; the key stakeholders agreed that it should be broadened to address common pest and pathogen mortality agents.

**Who:** NMSU Plant Sciences, NMDA, NMFDC Forest Health Program.

**When:** Compile initial efforts and utilize other state templates to create plan in 2021.

**Sub-strategy 7.1.3** - Integrate urban forestry into all scales of city and state-scale master plans, emphasizing the role of the urban forest as green infrastructure to mitigate heat and manage stormwater.

**Outcome:**

- Urban forest managed and budgeted for in the same manner as other infrastructure.

**Measures:**

- Number of communities with tree care ordinances.
- Number of community master plans that include the urban forest as infrastructure.

**Actions:**

**7.1.F** - Emphasize the need for urban tree management ordinances for all sizes of municipalities to reduce liability from tree hazards and to maintain planting pace with development and growth.

**What:** Every community, no matter the size, should have a basic tree care ordinance establishing the responsibility for trees in the public right of way.

**Who:** New Mexico Municipal League, New Mexico Association of Counties, The Arbor Day Foundation.

**Where:** Priority focus on medium to large communities without a tree ordinance.

**7.1.G** - Include urban forestry as a requirement for consideration in all municipal and county comprehensive plans.

**What:** Community planning efforts that acknowledge the need for the urban forest.

**Who:** New Mexico Department of Finance and Authority Finance and Administration Community Development Bureau, New Mexico Municipal League, New Mexico Association of Counties.

**7.1.H** - Develop model to assist communities in balancing tree canopy irrigation needs and tree canopy cooling benefits to allow smart canopy goals.

**What:** Tree canopy goals and water conservation goals are disconnected from one another and are often set at random and possibly unrealistic levels.

**Who:** OSE, ABCWUA, research institutions.

**Sub-strategy 7.1.4** - Advance urban forest design principles that include appropriate soil volume and quality and make the greatest use of available water in supporting urban trees and landscapes.

**Outcome:**

- Urban trees with longer life expectancies.

**Measure:**

- Number of community development standards that include the urban forest as infrastructure and provide for maintenance.

**Actions:**

**7.1.I** - Pursue local policy and design standards that incorporate and incentivize arid low impact development practices and increase training in their use and maintenance.

**What:** Utilize the urban forest as green stormwater infrastructure; example plan—NMDOT Stormwater Management Manual.

**Who:** Arid Low Impact Development Coalition, New Mexico Environment Department Surface Water Bureau, OSE, NMDOT.

**When:** Active and on-going,

**Where:** Initial focus in greater Albuquerque area and Santa Fe.

**Sub-strategy 7.1.5** - Increase urban tree and shrub canopy by strategically targeting planting in areas with the most human health and safety need.

**Outcome:**

- Increased urban tree and shrub canopy in the areas with the most need.

**Measures:**

- Number of communities with tree planting prioritization plans.
- Number of neighborhood tree planting events.

**Actions:**

**7.1.J** - Perform aerial tree canopy and heat island analysis on 10 priority communities identified in the FAP Urban Forests and Communities Resource Assessment to identify tree canopy deficits and strategic tree planting areas and to provide project-level information to communities for planning.

**What:** TNC was able to prioritize areas within the City of Albuquerque for planting initiatives based on heat islands and underserved populations.

**Who:** Will need a contractor to perform this modeling.

**When:** Available funding will likely support 1-2 communities per year.

**Where:** Priority communities identified in the *New Mexico Forest Action Plan Urban Forests and Communities Resource Assessment*.

**7.1.K** - Expand Albuquerque neighborhood tree planting models statewide and/or programs with financial incentives for residential tree planting.

**What:** The Albuquerque Neighborhoods program and TNC's Albuquerque Tree Planting Program, which are run entirely on local funding and private donations, are proving to be a successful model for getting urban trees into communities with the most need.

**Who:** Tree New Mexico, The Nature Conservancy Albuquerque Urban Conservation Program.

**When:** Active and on-going.

**Where:** Currently in Albuquerque; focus on priority communities identified in the *New Mexico Forest Action Plan Urban Forests and Communities Resource Assessment*.

**Sub-strategy 7.1.6** - Integrate the urban forest into landscape scale efforts to create habitat, restore water cycles, and mitigate climate change.

**Outcome:**

- Urban forest also recognized as a tool in landscape-level environmental initiatives.

**Measures:**

- Number of urban trees planted.
- Percentage of Re-Leaf Projects with Climate Change Focus.

**Actions:**

**7.1.L** - Re-align the New Mexico Forest Re-Leaf tree planting program to address climate change mitigation goals and pursue state legislature funding and Federal energy savings tree funding to support the program.

**What:** The New Mexico Forest Re-Leaf program is currently underfunded by private donations; the New Mexico Climate Action Plan calls for tree planting to help mitigate climate change. Aligning these two programs may increase funding and effectiveness.

**Who:** New Mexico Forest Re-Leaf Tree Planting Advisory Committee

**When:** Provide a proposal for the 2021 legislative session.

**7.1.M** - Promote tree canopy as a tool for agencies and companies implementing energy savings programs and climate change mitigation efforts.

**What:** Capitalize on Federal funding and carbon credit programs as they come available to New Mexico.

**Who:** New Mexico Urban Forest Council, New Mexico Climate Task Force

**Part 7.2: MANAGEMENT, MAINTENANCE, AND STEWARDSHIP OF THE URBAN FOREST**

**Sub-strategy 7.2.1** - Expand collaboration between urban forestry and related fields, agencies, and sectors to diversify and leverage stewardship of the urban forest.

**Outcome:**

- Capacity to meet local urban forestry management responsibilities is shared and integrated across diverse agencies and organizations.

**Measures:**

- Number of partner organizations included in New Mexico Urban Forest Council workshops.
- Number of meetings with local governments to discuss urban forestry management.
- Inclusion of trees and landscaping in New Mexico School Facilities Association design process.
- Number of local hazard mitigation plans that include the urban forest as a consideration eligible for funding.

**Actions:**

**7.2.A** - New Mexico Urban Forest Council meetings and workshops continue to identify priority urban forestry focus areas and invite partners for discussion and action item setting.

**What:** Workshops with a focus area selected (e.g., green stormwater infrastructure, pest management, tree inventoring) attract key stakeholders to participate.

**Who:** New Mexico Urban Forest Council.

**When:** Three to four times per year.

**7.2.B** - For each of the priority communities identified in the *New Mexico Forest Action Plan Urban Forests and Communities Resource Assessment*, identify key partners and stakeholders, and set up meetings to introduce them to the Urban and Community Forestry Program and *New Mexico Statewide Community Forest Analysis and Planning: Management Plan*.

**What:** Initial meetings with priority communities to introduce them to available resources to manage their urban forest.

**Who:** Local partners such as New Mexico State University County Extension, Soil and Water Conservation Districts, Municipal Planning and Facilities Departments, Economic Development organizations.

**When:** Target 2-3 community meetings per year.

**Where:** Priority communities identified in the *New Mexico Forest Action Plan Urban Forests and Communities Resource Assessment*.

**7.2.C** - Implement the *New Mexico Statewide Community Forest Analysis and Planning: Management Plan* recommendations regarding opportunities for cross-boundary management of the urban forest and creative solutions to maintenance staffing.

**What:** Details in the *New Mexico Statewide Community Forest Analysis and Planning: Management Plan*.

**Who:** NMFD, New Mexico Municipal League, New Mexico Association of Counties, Potential new partners: New Mexico School Facilities Association, New Mexico General Services Administration.

**When:** On-going.

**Where:** Priority focus on small to mid-size New Mexico communities who do not have dedicated city foresters.

**7.2.D** - Integrate urban forests with trees and other landscaping into K-12 school facility development design processes.

**What:** Incorporate trees and landscaping into the design when developing new school building and remodeling project plans even if they cannot be funded initially, so that these projects can be targeted for funding and successfully installed later.

**Who:** New Mexico School Facilities Association, NM Chapter of the American Society of Landscape Architects, Arbor Day Foundation Tree Campus Program.

**When:** July 2021.

**Where:** Schools statewide on the New Mexico School Facilities Association's priority list for new school construction and remodeling.

**7.2.E** - Work with local governments to incorporate urban forests into risk management programs and Hazard Mitigation Plan scope requirements (e.g., fire, flood, wind, and other hazards).

**What:** Include risks to and from urban trees during extreme weather events in risk management programs and seek funding for projects to mitigate that risk through the Department of Homeland Security and Emergency Management's grant programs.

**Who:** New Mexico Department of Homeland Security and Emergency Management, New Mexico Municipal League.

**When:** July 2021.

**Where:** Utilize the *New Mexico Statewide Community Forest Analysis and Planning: Tree Inventory* to prioritize communities based on tree risk.

**7.2.F** - Work with stakeholders to develop industry directory and programs that increase the use of urban tree wood waste through wood recycling and utilization.

**What:** Utilize New Mexico aging and senescing urban canopy to provide economic benefit at removal.

**Who:** New Mexico Forest Industry Association, New Mexico Recycling Coalition, private urban wood businesses.

**When:** July 2021.

**Where:** Greater Albuquerque area as a priority community for pilot programs.

**Sub-strategy 7.2.2** - Incorporate findings about urban tree and shrub survival in changing Southwestern climate in urban forest management practices and recommendations.

**Outcomes:**

- Trees and shrubs in the urban forest adapt to changing climate conditions.

**Measures:**

- Number of New Mexico educational and research institution positions and classes/programs for urban forestry.
- Number of published articles and conference talks specific to arid southwest urban forest management.

**Actions:**

**7.2.G** - Fund and fill the New Mexico State University Urban Forestry Extension position, to increase research specific to urban forests in New Mexico and the southwest and to expand education efforts statewide.

**What:** New Mexico State University Plant Sciences Department unfilled position for Urban Forestry Extension.

**Who:** NMSU, NMDA.

**When:** 2020.

**Where:** Located at NMSU with statewide responsibilities.

**7.2.H** - Incorporate available research about factors that influence tree irrigation and tree species performance in arid climates, and other data about why trees fail in urban setting, into recommended best management practices.

**What:** Conference speakers, published articles, and other resources specific to managing the urban forest in New Mexico and the arid southwest.

**Who:** OSE, New Mexico State University Plant Sciences, Think Trees New Mexico, International Society of Arboriculture, United States Forest Service Denver Field Station, Arid Low Impact Development Coalition, New Mexico Irrigation Association, New Mexico Xeriscape Council

**When:** Target dissemination of information at Think Trees New Mexico Annual Tree Care Conference.



**Sub-strategy 7.2.3** - Increase statewide training opportunities on proper tree care and maintenance practices.

**Outcome:**

- Improved health of the urban forest as a result of better trained maintenance staff.

**Measures:**

- Number of local governments sending staff or volunteers to professional training on urban tree care.
- Number of people trained through hands-on or computer-based arborist trainings.
- Number of local Tree Steward programs throughout state.
- Number of NMFD staff and County Extension staff receiving basic urban tree care training.

**Actions:**

**7.2.I** - Promote the Think Trees New Mexico Annual Tree Care Conference, International Society of Arboriculture Conference, and/or other local/regional tree care conferences and pursue opportunities for local government staff or community volunteers from smaller communities to attend.

**What:** Local/regional professional training opportunities for New Mexican tree care staff and volunteers.

**Who:** Think Trees New Mexico, International Society of Arboriculture, Society of Municipal Arborists.

**When:** Active and on-going.

**7.2.J** - Continue and expand the statewide New Mexico Tree Stewards program by developing remote instruction methods (e.g., video programs with instructors).

**What:** Curriculum and training resources available to train community volunteers to accomplish minor tree maintenance tasks.

**Who:** Tree New Mexico, Albuquerque Bernalillo County Tree Stewards (pilot program), New Mexico State University Extension.

**When:** Tree Stewards pilot program launched in 2019, with second iteration in 2020; Tree New Mexico contracted to expand the program to other communities statewide.

**7.2.K** - Provide basic tree care training and resources to NMFD District Office staff and NMSU County Extension agents to increase arboriculture resources statewide.

**What:** Increased local capacity to answer the public's tree care concerns and to effectively manage community tree risk.

**Who:** NMFD District Offices, NMSU County Extension Offices.

**When:** Pilot a training program in 2021 using New Mexico Tree Stewards curriculum, with annual refresher training offered.

**Where:** Virtual/on-line.

**7.2.L** - Identify an existing Spanish-language tree care curriculum for commercial tree care workers and seek opportunities to make available.

**What:** Existing curriculum has been developed by Texas, California, and Arizona urban and community forestry programs, with additional resources developed by the USDA Forest Service.

**Who:** International Society of Arboriculture, Think Trees New Mexico, Tree Care Industry Association.

**When:** Identify funding needs and sources in 2021, initial program in 2022.

**Sub-strategy 7.2.4** - Provide communities with cost-saving tools to assist in management of the community forest.

**Outcome:**

- Active management of urban trees by local government regardless of community size.

**Measures:**

- Number of local governments with urban forestry programs that include tree ordinances and a budget.
- Number of communities assisted through the Community Forestry Assistance Program.
- Number of Tree City USAs and Tree Campus USAs.
- Number of 'hits' on the NMFD Community Forestry webpage.

**Actions:**

**7.2.M** - Implement the *New Mexico Statewide Community Forest Analysis and Planning: Management Plan* and its resources and tools with local governments to encourage development of local sustainable urban forest programs and update as needed.

**What:** Implement the Management Plan, which is a compilation of resources and strategies for local governments to utilize.

**Who:** New Mexico Urban Forest Council, New Mexico Municipal League, New Mexico State University County Extension

**When:** The Management Plan was launched in early 2020; on-going implementation and annual review and update if needed.

**7.2.N** - Continue to utilize the Community Forestry Assistance Cost-Share Program to fund projects that develop sustainable local urban forests.

**What:** Award funding from the USDA Forest Service Consolidated Financial Agreement with NMFD to local initiatives.

**Who:** New Mexico Urban Forest Council.

**When:** Active and on-going with funding available biennially.

**7.2.O** - Continue to encourage municipalities and Pueblos to meet and maintain the standards for the Arbor Day Foundation's Tree City USA recognition, and for colleges to meet the requirements of the Tree Campus USA program.

**What:** The Tree City USA and Tree Campus USA programs set basic standards of care for urban forests, and recognition for those communities that meet the standards.

**Who:** Arbor Day Foundation.

**When:** On-going; program certification is annual.

**7.2.P** - Improve the Urban and Community Forestry Program's webpage on the NMFD website to include available resources for management of the urban forest.

**What:** Update and refresh of the website, using the New Mexico Statewide Community Forest Analysis and Planning: Management Plan as a resource guide.

**Who:** NMFD Communications Program.

**When:** Update by end of calendar year 2020.



Young trees and old trees in Raton © Jennifer Dann/NMFD

## Strategy #8 — Restoration Economy

Build and enhance current sustainable communities, businesses, and jobs to carry out the work of this FAP. Use the wood biomass generated in forest and watershed restoration projects for heat, energy and timber and non-timber forest products to meet community needs. Provide a sustainable wood supply through restoration of high priority forests and watersheds.



Log deck © Carmen Austin/NMFD

**Sub-strategy 8.1** – Support community-based and industry wood utilization by assisting and encouraging private forest landowners to more actively manage their forest and related resources.

**Outcomes:**

- Coordination among various landowners and landownerships.
- Consistent wood supply for community-based and wood-using industry.

**Measures:**

- Number of stewardship plans in areas with high wood demand identified in forest industry map.
- Number of certified Tree Farms in New Mexico.

**Actions:**

**8.1.A** - Increase the number of stewardship plans developed for areas with higher levels of wood demand by communities and wood-using industry.

**What:** When developing forest stewardship plans encourage landowners to support forest and wood products businesses by adding a forest industry map and identifying community needs.

**Who:** NMFD, NRCS, private landowners and NGOs.

**When:** July 2020 and on-going.

**Where:** Statewide based on FAP output.

**8.1.B** - Educate landowners about Best Management Practices and enforce forest harvest regulations/commercial timber harvest regulations.

**What:** Work collaboratively with landowners and forest industry.

**Who:** NMFD, private landowners.

**When:** July 2020 and on-going.

**Where:** Statewide based on FAP output.

**8.1.C** - Increase landowner participation to the American Tree Farm System and the forest certification program.

**What:** Coordinate timber supply from tree farmers to forest and wood products businesses.

**Who:** NMFD, private landowners.

**Where:** Statewide based on FAP output.



**Sub-strategy 8.2** – Practice shared stewardship across landscapes to make strategic investments aimed at mitigating risk, improving forest health, and increasing resilience in New Mexico’s ecosystems.

**Outcome:**

- State and Federal Agencies, along with key stakeholders including Tribes and Land Grants, leverage efforts to achieve greatest impacts with project implementation resulting in improved forest health and resilience.

**Measures:**

- Number of shared stewardship projects that utilize state-based resources and increase wood utilization as a part of restoration projects.
- Number of shared stewardship projects involving tribes and land grants.

**Actions:**

**8.2.A.** - Work with partners to promote effective communication and collaboration to increase capacity for timber supply and process forest products.

**What:** Work and develop shared goals and decisions for forest and watershed management on public lands.

**Who:** NMFD, USFS, BLM, NRCS, NPS, NMDGF, NMDOT, NMSP, SLO, municipalities and counties.

**Where:** Statewide based on FAP output.

**8.2.B** - Use state and federal authorities to conduct government-to-government consultation directly with Indian nations, tribes and pueblos on implementing Shared Stewardship strategies on ancestral lands.

**What:** Work with native communities on projects and utilization of products.

**Who:** NMFD, USFS, Indian nations, tribes and pueblos.

**Where:** Statewide based on FAP output.

**8.2.C** - Work with traditional Hispanic communities, land grants, and acequias as essential participants in Shared Stewardship.

**What:** Work and develop shared goals and decisions for forest and watershed management on land grants and acequias.

**Who:** NMFD, land grants and acequias.

**Where:** Statewide based on FAP output.

**Sub-strategy 8.3** - Support forest trade association and members. Promote sustainable utilization businesses and markets.

**Outcomes:**

- Thriving forest industry and utilization business advances local economies and reduces restoration expenditures.
- New businesses are equally able to start and thrive as existing industry.

**Measures:**

- Rate for worker’s compensation insurance per \$100/payroll.
- Number of bridges and other state infrastructure with weight limits that support transport of wood to processors.
- Number of businesses (consultants) providing support for prescribed burn plans or implementation.
- Number of technical assistance responses to industry for help developing/incorporating new and innovative technology and/or expanding markets.

**Actions:**

**8.3.A** - Provide support to industry for the high cost of workers compensation insurance for forest-related work.

**What:** Support the Forest Workers’ Safety Certification Program.

**Who:** NMFD, NMFIA, forest industry.

**8.3.B** - Advocate for improvements in transportation infrastructure to increase operation efficiency.

**What:** Initiate a multi-agency plan, to be completed within 12 months, to:

- Better harmonize with adjacent states on truck weight limits and axle spacing for timber harvest transport.
- Evaluate critical bridge infrastructure and prioritize improvements on selected corridors.
- Incorporate NM forest hauling needs into NMDOT’s Freight Plan, which will be updated in 2020-2021. Some changes to weight limits and axel configurations may require legislative action.

**Who:** NMFD, NMFIA, NMDOT.

**When:** By September 2021.



**8.3.C** - Help forest and wildland/prescribed fire industry build strong and sustainable businesses.

**What:** Assist industry with business and marketing plan development and loans.

**Who:** NMFD, SBDC, WESST.

**8.3.D** - Promote new and innovative technologies that make use of all material resulting from restoration activities to add value and create a market for lower value wood.

**What:** Promote utilization of woody biomass thermal applications, biochar and mass timber.

**Who:** NMFD, CWSF, ECMD, USFS

**8.3.E** - Encourage viable markets for wood and utilization products.

**What:** Support policies and incentives that strengthen markets for wood products and good forest stewardship.

**Who:** NMFD, CWSF, USFS, FPL, NM True.

**8.3.F** - Coordinate state and federal funding sources to provide stability of project workflow and wood supply for restoration businesses and communities.

**What:** Identify all funding mechanisms available for ecological restoration and maintenance activities and jointly pursue specialized opportunities

**Who:** NMFD, ECMD, USFS, BLM, USDA RD, NRCS, NPS, NMDGF, NMDOT, NMSP, SLO, DFA, tribes, land grants, municipalities, counties, through the Forest and Watershed Health Coordinating Group.

**Sub-strategy 8.4** - Recruit and retain restoration workforce and increase capacity to conduct all aspects of forestry activities (fire suppression, fire management and application, forest management, forest industry, reforestation, urban & community forest projects, fuels reduction, burn restoration, and so forth).

**Outcomes:**

- Trained and available labor force available to meet NM's restoration, reforestation and long-term maintenance needs.
- Improved retention rate with focus in underserved communities.
- Improved life skills training and mentoring for new workers to increase retention.
- Jobs provided and sustained in rural communities.
- Improved professional development of natural resource managers.
- Youth outreach outlined in Strategy 1.7 results in pathways to careers in resource management and implementation.

**Measures:**

- Percentage of first year hires return or move onto fire worker/natural resource work.
- Percentage of retained workers move up to next skill number and/or who are cross trained in multiple restoration skills.
- Number of technical assists to increase workforce capacity.
- Number of skilled workers with sufficient training to collect seed, grow and plant seedlings.
- Number of firefighters qualified and available.
- Number of students graduating in natural resources and urban forestry programs.
- Number of professionals trained and/or certified.

**Actions:**

**8.4.A** - Provide education and training to forest and fire industry.

**What:** Cross-train forest workers in fire, restoration, reforestation and rehabilitation-related jobs.

**Who:** IWC, RHP, YCC, FSG.

**8.4.B** - Coordinate state assistance and supporting programs that assist with workforce development, help connect those that need workers with those that need jobs.

**What:** Identify all funding mechanisms available for workforce assistance.

**Who:** EDD, NMWS, NMSBDC, NMMEP, LANL, WESST.

**8.4.C** - Provide life skills training to support forest workers and firefighters' ability to remain available.

**What:** Partner with social services programs like tribal behavioral health for life skills, credit unions for financial literacy.

**Who:** Social Service Providers at the local or regional levels implementers/matchmakers are tribes, RMYC, private contractors to connect.

**8.4.D** - Support efforts for worker certification for various skills when there is public support and compelling reasons to ensure worker safety and aptitude. Examples may include tree climbing for cone collection, prescribed burning, or arborists. Work with appropriate stakeholders to conduct feasibility analysis, and if warranted develop certification program including state licensing and legislature or professional organizations, etc.

**What:** Adult education or training to help develop a skilled workforce for various forestry initiatives including reforestation, urban forestry, fuels reduction, firefighting, etc. Certification documents education and skills development.

**Who:** NMFD, IWC, RHP and Conservation Seedling Program, USFS, NMHU, NMSU, YCC, Tribes, NGO's, Valle Caldera, BLM, BIA, ISA, SAF, NWCG, NMFIA.

**8.4.E** - Establish a work force training consortium to address barriers for capacity sharing (workforce, funding, data sharing/development) between agencies, universities and organizations.

**What:** Initiate a consortium to determine where and how workforce should be trained to include required skills. The consortium may also initiate legislative support through various channels with a potential to create a memorial to recognize the need to make this taskforce permanent.

**Who:** NMHU, NMSU, UNM, Tribes, NMFD, NMDGF, NMSLO, NMOSE, TNC, NGO's, non-profits, SWRI, YCC, Counties, Municipalities, Valle Caldera, USFS, USGS, National Park Service (NPS), NRCS, U.S. Fish and Wildlife Service, BLM, BIA, Tree City USA, Community Foundations, Corporations i.e. Amazon, Coke Cola, breweries, private donors.

**Where:** Existing programs that may be contributing partners: IWC, RHP, YCC, NRCS-Los Lunas Plant Materials Center, NM Agricultural Stations, Tribal greenhouses.

**8.4.F** - Incorporate forest and watershed restoration, fire ecology, nursery management and urban forestry curriculum in college-level forestry and landscape architecture programs.

**What:** Classes on forest and watershed restoration, fire ecology, and urban forest management as part of standard curriculums, increasing New Mexico knowledge base.

**Who:** NMHU, NMSU, UNM CNMCC, Northern New Mexico.

**8.4.G** - Develop and provide professional training for arborists, natural resource staff seeking professional development and/or certification.

**What:** Increased opportunities for professional level training.

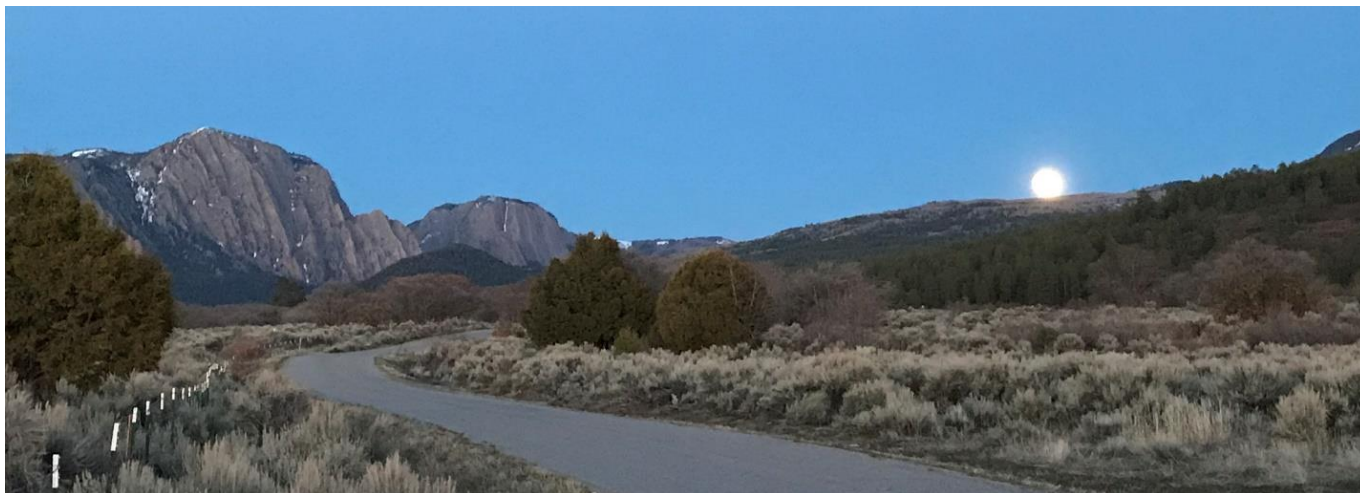
**Who:** International Society of Arboriculture New Mexico Chapter, Tree Care Industry Association, Think Trees New Mexico, New Mexico State University Extension, Society of American Foresters, Universities, Agencies, Tribes, NGOs.



Ribbon cutting ceremony at the Walatowa Pellet Mill, Jemez, NM. © Carmen Austin/NMFD

## Strategy #9 — Land Conservation

Identify priority conservation lands to protect habitat that maintains and enhances biodiversity, wildlife habitat connectivity and water sources, and maintains working forests and lands with significant natural and cultural resource and ecological service values.



Moonrise at Brazos Cliffs, Ensenada, NM. © José Carrillo/NMFD

**Sub-strategy 9.1** - Develop and maintain a statewide land conservation strategy using relevant science to help guide conservation investments with state and federal funding. The conservation strategy should identify biodiversity hotspots and cultural resources including valuable riparian areas, wildlife corridors and pinch-points, and important public water source and working forests.

**Outcomes:**

- State and federal funds for land conservation are spent in the highest priority areas.
- Habitat fragmentation is limited.
- Water sources and riparian areas are protected.
- Cultural resources are protected.
- Working forests and rangelands continue to produce economic and ecological benefits.

**Measures:**

- Percent of land conservation transactions using Forest Legacy Program, Land and Water Conservation Fund, Natural Heritage Conservation Act, and Natural Land Protection Act funding are in areas identified as a priority in the statewide land conservation strategy.
- Number of agencies and non-governmental organizations contributing to developing and maintaining the statewide land conservation strategy.

**Actions:**

**9.1.A** - New Mexico creates a statewide blueprint for land conservation to guide the investment of state and federal funds. This FAP strategy will serve as the first iteration of a statewide blueprint for land conservation adopted by NMFD and partners in the FWHCG.

**What:** Update the statewide land conservation strategy whenever there are updates to the State Wildlife Action Plan, State FAP, Forest Legacy Assessment, or other plans or data that introduce new scientific information requiring an update to the land conservation strategy.

**Who:** NMFD, USFS, NMDGF, SLO, NMDA, USFWS, NHNM and conservation organizations.

**Where:** Locations based on relevant FAP model.

**Sub-strategy 9.2** - Protect, enhance, and sustain the priority conservation lands identified in the FAP through conservation easement acquisition and public land acquisition and designations.

**Outcomes:**

- Connectivity of natural lands is conserved.
- Biodiversity is maintained.
- Wildlife corridors are maintained or enhanced.

- Cultural resources are protected.
- Endangered species habitat is protected.
- Water sources are protected.
- Working forests and lands are sustained.

**Measures:**

- Acres of land identified as high priority for conservation protected through public land acquisition or conservation easement acquisition.
- Percent of land identified as high priority for conservation permanently protected through acquisition of land or easement.

**Actions:**

**9.2.A** - Funding is secured for purchase of conservation lands and easements through existing state programs including Natural Heritage Conservation Act and Natural Lands Protection Act; and these two Acts could be merged into one program.

**What:** When budget allows, seek funding for Natural Heritage Conservation Act and Natural Land Protection Act at \$5 million per year or roll these programs into a statewide Natural Resources and Agricultural Trust Fund.

**Who:** NMFD, NMDGF, conservation organizations.

**9.2.B** - Assist non-governmental organizations, acequias and tribes to better utilize the existing land conservation programs such as the Natural Heritage Conservation Act to protect important source waters and lands with high conservation value.

**What:** Clarify the ways in which acequias and tribes can apply for Natural Heritage Conservation Act funding and explain the role of non-for-profit corporations as partners in Natural Lands Protection Act acquisitions.

**Who:** NMFD, NMDGF

**9.2.C** - Improve the efficiency of the Land Conservation Incentives Tax Credit Program to boost voluntary placement of conservation easements on high-value properties without the phasing that leads to small parcel size and increased transaction costs.

**What:** When budget allows, increase the ceiling of \$250,000 tax credit per easement transaction to \$500,000 or \$1,000,000.

**Who:** NMFD, land trusts and other conservation organizations.

**When:** Seek to amend the Land Conservation Incentives Act in the 2021 session.

**9.2.D** - Increase the capacity at NMFD to effectively manage Land Conservation Incentives Program, Natural Heritage Conservation Program and Natural Lands Protection Program.

**What:** When budget allows, provide training for NMFD staff in land conservation and appraisal techniques, including by attending training at the national Land Trust Rally.

**Who:** NMFD.

**When:** FY2022 or beyond.

**Sub-strategy 9.3** - Provide equitable access to land conservation tools including easements, acquisitions, and transfers to all New Mexico landowners.

**Outcome:**

- High priority lands for conservation are placed under easement or public acquisition regardless of landowner ability to pay upfront for the surveys and appraisals.

**Measure:**

- Number of acres conserved where surveys and appraisals were provided for a transaction with a low-income landowner.

**Actions:**

**9.3.A** - Provide guidance to landowners who are property-rich and cash-poor to utilize the existing programs to pay for appraisals and other due diligence surveys necessary to put a conservation easement on a property.

**What:** Clarify how, under the Natural Heritage Conservation Act and Natural Land Protection Act, projects may be developed through local government partners, such as Soil and Water Conservation Districts. Transaction costs can be covered if the local government will hold an interest in the easement or land that is equivalent or greater in value to the transaction costs provided. In such situations, the programs provide equitable access to opportunities to for conservation sellers.



**Who:** NMFD, NMDGF, conservation organizations, local governments.

**Sub-strategy 9.4** - Create a statewide land conservation marketing program targeting landowners who would benefit from the array of land conservation programs and opportunities.

**Outcomes:**

- Landowners understand the benefits of land conservation and how they can take action to contribute.
- Land conservation activity to protect important scenic areas, endangered species habitat, wildlife habitat, water sources, and working forest lands increases exponentially when funding is available.

**Measures:**

- Number of land conservation marketing efforts in each district of the Forestry Division.
- Number of conserved parcels statewide, with the goal that the number of parcels doubles after five years of marketing effort.

**Actions:**

**9.4.A** - A statewide communication plan to promote land conservation to New Mexico landowners is implemented in conjunction with the New Mexico True tourism campaign and the emphasis on developing Outdoor Recreation opportunities. There is no statewide communication plan to promote land conservation to New Mexico landowners.

**What:** NMFD and conservation organizations develop marketing materials for land conservation including social media, videos/PSA, and billboard designs; conservation organizations apply for grant funds or provide marketing expertise.

**Who:** NMFD, NMDGF, conservation organizations, marketing contractors.

**9.4.B** - Each NMFD district has 2-4 marketing efforts in their geographic region within 3 years.

**What:** NMFD districts customize marketing efforts for local landowners.

**Who:** NMFD, local conservation organizations.

**When:** July 2021 and ongoing.

**Where:** Districts.

**Sub-strategy 9.5.** The FAP land conservation strategy fosters dialogue between agencies, NGOs, industry and land trusts and county and municipal planning departments to increase protection of high value conservation areas and resources that are at risk from development.

**Outcome:**

- County and municipal planning departments actively work to integrate land conservation, corridors conservation, protection of biodiversity, and conservation of waters sources and riparian areas into their work routines and increase land conservation outcomes.

**Measures:**

- Acres of land conserved through county, municipal or other local government action.

**Actions:**

**9.5.A** - Interagency collaboration with state agencies, non-governmental organizations, land trusts or county and municipal planning departments is improved so high value conservation areas and resources that are at risk from development are conserved.

**What:** NMFD will share the products of the FAP to start conversations about how to proactively work together to conserve high-priority areas and direct development to areas with lower conservation value.

**Who:** Interagency collaboration with State and Tribal government agencies including NMFD, NMDGF, New Mexico Municipal League, New Mexico Counties, land trusts, conservation organizations and other partners.

**When:** July 2021 and on-going.

**9.5.B** - Agencies and divisions with land management functions or oversight (e.g. NMDGF, SLO, OCD, NMED, IAD, NMDA, etc.) coordinate their land conservation planning and implementation, including sharing and accessing the same data and programs.

**What:** Request the FWHCD review the individual agency plans and the statewide land conservation strategy annually.

**Who:** Agency representatives to the FWHCG (NMDGF, SLO, OCD, NMED, IAD, NMDA, etc.).

## Strategy #10 — Outdoor Recreation

Forests are widely used for outdoor recreation. Opportunities for outdoor recreation on private lands are enhanced. Educational opportunities are developed where restoration treatments are in frequently visited areas.



Wildflower tour on the Cumbres & Toltec Scenic Railroad © Carmen Austin/NMFD

**Sub-strategy 10.1** – Provide outdoor recreation in forested areas on a variety of land ownership types.

**Outcomes:**

- Sustainable outdoor recreation use and jobs grow.
- New Mexico's beautiful natural settings are a continued draw for in- and out-of-state tourism.

**Measures:**

- Number of outdoor recreation jobs.
- Number of visitors enjoying outdoor recreation when they visit the state.

**Actions:**

**10.1.A** - Develop a system for advance planning on a season by season basis between agencies so that planned work is vetted; and for the public to be given advance notification of recreation closures (e.g. trails and campgrounds) due to restoration projects (e.g. mechanical thinning and prescribed burning).

**What:** Create an annual work plan that identifies restoration projects slated for areas that are popular for recreation. Notify and redirect recreation users for closures that will last longer than one week.

**Who:** Stakeholder networks, Parks, EDD/ORD, Tourism, NMDGF, USFS, NPS, BLM, FWS, BOR, USACE, municipalities and businesses.

**When:** Starting August 2020 for 2021 field season.

**Sub-strategy 10.2** - Develop a system and procedures for shifting outdoor recreation and tourism during wildfire and when post-fire risks are severe.

**Outcomes:**

- Recreationists get clear communications about staying safe and staying out of the way during emergency operations. Recreationists are given options for alternative activities.
- Resource damage in sensitive areas or from overuse is minimized.

**Measures:**

- Number of outdoor recreation jobs and visitors to the state enjoying outdoor recreation during severe wildfire season.

**Actions:**

**10.2.A** - Inform all partners of incident management plans pre-fire plan for notification and shifting of tourism and outdoor recreation uses.

**What:** Consistent expectations and messaging for agencies and to public.

**Who:** Focus on agencies that manage recreation sites and don't have much wildfire experience: BOR, USACE.

**When:** Starting August 2020 for fire season.

**10.2.B** - Develop a pre-fire plan for coordinating notification, restrictions, and shifting of tourism and outdoor recreation uses, including a comprehensive strategy to redirect visitors to places where recreation is safe and enjoyable.

**What:** Coordinate funding and other resources.

**Who:** NMFD, Parks, EDD/ORD, Tourism, NMDGF, and federal partners, municipalities and businesses.

**When:** Starting August 2020 for 2021 fire season.

**10.2.C** - Work with incident management teams on specific management of managed fires to ensure that recreationists are considered when developing fire restrictions and in wildfire incident messaging and alternative plans.

**What:** In pre-season planning and during incidents, Agency Representatives will ensure recreationists are included in plans for messaging as needed.

**Who:** NMFD staff and other engaged agency personnel, Public Information Officers and Incident Commanders.

**When:** Year around, but particularly on managed fires.

**10.2.D** - Develop alternative areas for outdoor recreation that increase capacity and also offer lower fire risk.

**What:** Agency Reps will identify priority investment areas to expand outdoor rec options, including potential acquisition with the Land and Water Conservation Fund.

**Who:** ORD, TD, NMFD, USF&WS, USFS, BOR, NPS, & BLM, and conservation organizations.

**When:** Work begins in fall 2020.

**Sub-strategy 10.3** - Restore forests, woodlands and grasslands that are settings for high-volume recreation such as State Parks, ski areas, water recreation sites, and trail heads.

**Outcome:**

- Resources are leveraged to implement priority projects leading to beautiful, safe and sustainable recreation sites and settings for outdoor recreation and to inform public on restoration objectives.

**Measures:**

- Acres restored in high use and high priority recreation areas.
- Number of improvements made to ingress/egress routes to recreation areas made for wildfire safety.
- Dollars of shared funding invested in projects.

**Actions:**

**10.3.A** - Identify 5-10 restoration projects in high use recreation areas in areas with high fire and post-fire debris flow risk/hazard, especially in areas with one-way in/out.

**What:** Coordinate funding, planning and implementation capacity across agencies and with stakeholders including Outdoor Recreation businesses.

**Who:** Stakeholder networks, NMFD, Parks, EDD/ORD, Tourism, NMDGF, and federal partners, municipalities and businesses.

**When:** Starting June 2020 with Coyote Creek State Park; identify through the FAP and use FY21 funding to prioritize projects.

**Sub-strategy 10.4** - Support and encourage outdoor recreational opportunities, businesses, and infrastructure on private lands.

**Outcome:**

- Private landowners and managers offer premiere outdoor recreational opportunities that add to the economic health of outdoor recreation to New Mexico without creating stress on sensitive areas or promoting overuse.

**Measures:**

- Number of private landowners offering outdoor recreation opportunities, installing recreational infrastructure and building businesses targeting recreationists.

**Actions:**

**10.4.A** - Identify recreation opportunities in Forest Stewardship Plans that meet landowner objectives and improve recreational opportunities for both the landowner and potential visitors.

**What:** Each forest management plan where landowner has indicated an interest in outdoor recreation addresses resource management activities in-line with the landowners' goals and objectives, such as including trail building guidelines. Rare plant and endangered species habitat is avoided in recreation planning, recreation use, and inadvertent spread of invasive species is considered.

**Who:** Foresters, state, consultants, NRCS etc., developing private forest management plans and landowners.

**10.4.B** - Provide information to private landowners on outdoor recreation business development opportunities.

**What:** Work with Economic Development Department to keep landowners aware of potential funding opportunities for improving commercial recreational opportunities (water parks, ziplines, hostels, yurts, etc.).

**Who:** EDD, NMFD, NMDGF, other state staff, local chambers, landowners.

**10.4.C** - Help facilitate a learning network among landowners (camps, retreat centers, etc.) engaged in outdoor recreation to provide pertinent information on managing forests for resilience and safety.

**What:** Support organizations that work with camps and other recreational facilities with forest management technical assistance for members.

**Who:** EDD/ORD, NMFD, NMDGF, NRCS.

**When:** Continuing, but in a more specific and directed manner.

**Sub-strategy 10.5** – Public is engaged in outdoor recreation and understands fire-safe practices, climate change impacts, and understands the need for and practical implications of forest restoration activities.

**Outcome:**

- Public practices good stewardship while they are recreating; support for forest restoration and growth of outdoor industries.

**Measures:**

- Number of unattended campfires.
- Number of visitors to Smokey Bear Historical Park.
- Dollars for youth and outdoor recreation programs.

**Actions:**

**10.5.A** - Marketing of sustainable outdoor recreation that considers wildfire risks and climate change.

**What:** Coordinate funding and other resources.

**Who:** Tourism, EDD/ORD, Parks, NMFD, NMDGF, and federal partners, municipalities and businesses.

**When:** Starting June 2020 with Destination Development Roadmap (Tourism Department).

**10.5.B** - Curriculum is developed and deployed to provide information about forest management issues including wildfire, community safety, sustainable outdoor recreation practices and climate change.

**What:** Inventory existing programs to avoid duplication coordinate funding, staff and other resources to fill the gaps.

**Who:** PED, Parks, EDD/ORD, Tourism, NMFD, NMDGF, NMDOT, NM Environmental Education Association, NM Forest and Watershed Restoration Institute, Southwest Fire Consortium, federal partners, municipalities, businesses.

**When:** June 2021.

**10.5.C** - Increase fire and climate information presented at popular recreation sites.

**What:** Inventory existing programming and build over time.

**Who:** NPS, Parks, USFS, EDD/ORD, Tourism, NMDGF, and federal partners, municipalities and businesses; Scouting organizations and Philmont/Demonstration Forest.

**When:** July 2020.

**10.5.D** – Utilize Smokey Bear Historical Park as a center for fire history, fire prevention, fire ecology information dissemination to the public.

**What:** Interpret various areas of fire education to make connections between New Mexico's rich cultures, biodiversity, history, as it pertains to fires in New Mexico. Utilize existing and future programs such as NFPA Sparky, Ready-Set-Go, Firewise, NM Fire Adapted Communities, various fire learning networks, etc. Focus on interrelationships between people, ecosystems, and fire.



### III. Strategies

**Who:** NMFD (SBHP and Division), National Smokey campaign, USFS (Fire Prevention Officers and others), Smokey Bear Hometown Association, NRCS, NMDGF.

**Where:** Smokey Bear Historical Park is located in Capitan, New Mexico. Programs have a wider impact, depending on delivery and media (e.g. - online outreach—worldwide audience, while in-person outreach is geographically adaptable).

#### **Sub-strategy 10.6 – Youth are provided opportunities for outdoor careers.**

**Outcomes:**

- Kids spend time outdoors.
- Youth find outdoor employment that provides a cradle to career pathway.

**Measures:**

- Number of youths in YCC Programs.
- Number of students in NMHU Natural Resources Program .
- Number of youths to participate in Outdoor Equity Fund Programs.

**Actions:**

**10.6.A** - Continue to collaborate among stakeholders to support and encourage youth programs such as YCC, Envirothon, Forestry Camp, Every Kid in a Park, Outdoor Equity Fund, and foster grant opportunities to increase outdoor education programming. Participate in the outdoor education steering committee developing the state's Cradle-to-Career Outdoor Education Pathway with recommendations for programs to implement, fund and prioritize.

**What:** Coordinate funding and other resources.

**Who:** YCC, NMHU, NMFD, Parks, EDD/ORD, Tourism, NMDGF, BLM, USFS BIA and NRCS, municipalities and businesses, Scouting organizations, stakeholder networks.

**When:** July 2020.

**10.6.B** - Engage with youth through community and school opportunities to promote education on careers in forestry and fire management.

**What:** Coordinate funding and other resources.

**Who:** NMFD District Offices and Staff, NMDGF, BLM, USFS.



Hikers enjoy forest trails. © Laura McCarthy/NMFD

# IV. Priority Landscapes

## Priority Setting Concepts

While many landscapes across the state need restoration, the reality is that funding and staff capacity are limited. Recognizing this, the Forestry Division and its partners worked together to develop strategies for prioritizing where dollars and time should be invested. These are outlined in the Strategies section of the Forest Action Plan. Every strategy with a geospatial component includes at least one sub-strategy aimed at prioritizing landscapes for taking action.

The Forestry Division uses three lines of consideration in setting priorities: (1) value and condition of the natural resource; (2) threat to the resource/urgency of the need to act; (3) opportunity to act. Information about the first factor (Resource) and second factor (Urgency) is science driven. Information about values, threats and conditions are derived from data and analyses in the Natural Resources Assessment, augmented by traditional knowledge systems and local expertise. Urgency may also stem from cost-benefit considerations which change over time. Resource and Urgency weigh heavily in setting long-term priorities. The third factor (Opportunity) considers social and financial circumstances, such as availability of funding or partnerships, that create a window of opportunity to act. Opportunity considerations become critical when making mid-term decisions such as scheduling environmental and cultural analyses and short-term decisions such as which projects to fund in the coming year.

Science is at the heart of the process for identifying priority landscapes for restoration. The Statewide Natural Resources Assessment produced geospatial models depicting landscapes where important natural resources and other highly valued assets are expected to be impacted by natural and human-caused threats. The approach and data sources used to characterize resources and hazards are described in Chapter 3 and explained in detail in the Data

Atlas. Science is at the heart of the process for identifying priority landscapes for restoration. The Assessment produced geospatial models depicting landscapes where important natural resources and other highly valued assets could be impacted by natural and human-caused threats. The resulting models were described in Chapter 3.

The Assessment models were augmented with best available data provided by regional scientists, then analyzed by the US Department of Agriculture's Rocky Mountain Research Station (RMRS) and vetted by local subject matter experts to produce a set of map products that will guide restoration in New Mexico over the next decade. The key maps in this Forest Action Plan are the Priority Landscapes Model (Map 46), which identifies priority landscapes for restoration across all jurisdictions with forest and woodland cover types; and the Shared Stewardship Map (Map 47), which focuses in on high priority landscapes on National Forest System lands and adjacent lands.

Both maps were developed through a Scenario Investment Planning analysis conducted by scientists from the RMRS National Fire Decision Support Center (see Appendix D). The intent of Scenario Investment Planning (SIP) is to align restoration activities based on priorities established in assessments (such as the Assessment) with state and regional management goals. SIP analysis weighs different options against each other to see where agencies can invest to get the most benefit from each restoration dollar spent. Such information enables state and federal managers to jointly establish landscape-scale restoration priorities for targeted treatments and to focus available resources to implement projects in priority landscapes, which the State and the USDA Forest Service, Southwestern Region committed to do in the New Mexico Agreement for Shared Stewardship.



#### IV. Priority Landscapes

In New Mexico, the SIP process evaluated where activities can achieve multiple restoration objectives, including reducing risk from wildfire and post-fire impacts to water supply and water quality, communities and infrastructure, and biodiversity tradeoffs were revealed by comparing how much the risk is reduced for each of those priority metrics—water, community, biodiversity—when projects prioritize one or another of the metrics. The analysis was done for every HUC12 (12 digit Hydrologic Unit Code) watershed with forest and woodland cover types in the state and watersheds were ranked according to the likelihood that restoration activities would reduce risk the most for all three metrics combined. The SIP maps depict the watersheds that ranked highest for meeting water, community and biodiversity objectives. While these do not represent every restoration objective addressed in this Forest Action Plan, they do provide an overall “big picture” of highest risks and benefits.

The Priority Landscapes Model shows the top 500 watersheds identified by the SIP analysis, plus high-priority riparian areas identified by regional scientists using the same water, community and biodiversity metrics (Map 46). These lands represent approximately 20% of all watersheds at risk, based on the Statewide Assessment data. The Priority Landscapes Model is the overarching map for identifying priority landscapes on all ownerships.

This information will guide partners in planning, funding and conducting restoration activities across jurisdictions.

The Shared Stewardship Map is a subset showing the top 250 watersheds (Map 47). These are located primarily in areas with ponderosa pine, mixed-conifer and higher elevation forest types, and include mostly National Forest System lands and some Tribal lands. This correlation is not surprising given the history of federal land acquisition in New Mexico, where much of the most productive lands in terms of timber and grazing, and hence water, ended up under Forest Service management. The Shared Stewardship model will guide the Forestry Division and Southwest Region of the US Forest Service in developing and conducting cross-boundary projects in joint priority landscapes.

Two maps are derived from the Priority Landscapes Model to guide activities under programs with specific restoration goals. These include the Private Lands Stewardship Map, which identifies priority landscapes in private ownership and adjacent lands, and the Legacy Map, which identifies priority areas for forest land conservation in New Mexico and shows where lands are already conserved. Additional maps are associated with certain strategies and sub-strategies and appear both in the Strategies section and in the Data Atlas.



Brazos Cliffs near Chama © Daniela Roth/NMFD

## Tracking and Reporting with Shared Stewardship Portal

The FAP is intended to be a resource that the Forestry Division and its partners can use for coordinating shared stewardship of the state’s forests and watersheds. In this context, shared stewardship means ensuring all agencies with an interest in reducing risks and increasing resiliency of forest and woodland

ecosystems through active management have the tools they need to assist in identifying shared priorities and collaborating in efforts to address needs on priority landscapes. The FAP strategies include many recommendations for actions that will move all partners forward together towards common goals. One of the tools called for in this plan—as well as envisioned in the state’s Forest and Watershed Health Plan—is an online portal for tracking and sharing project information. The portal is designed to be a tool that allows project managers and decision makers from different agencies to jointly plan landscape scale treatments, document accomplishments, and analyze outcomes to maximize each project’s benefits to New Mexico residents and natural resources.

The Shared Stewardship portal, due to be released in 2021 or 2022, is a data management system that enables the Forestry Division and its partners to collaboratively plan activities and track accomplishments on the ground, including project details like geospatial data and current status from planning through implementation and monitoring.

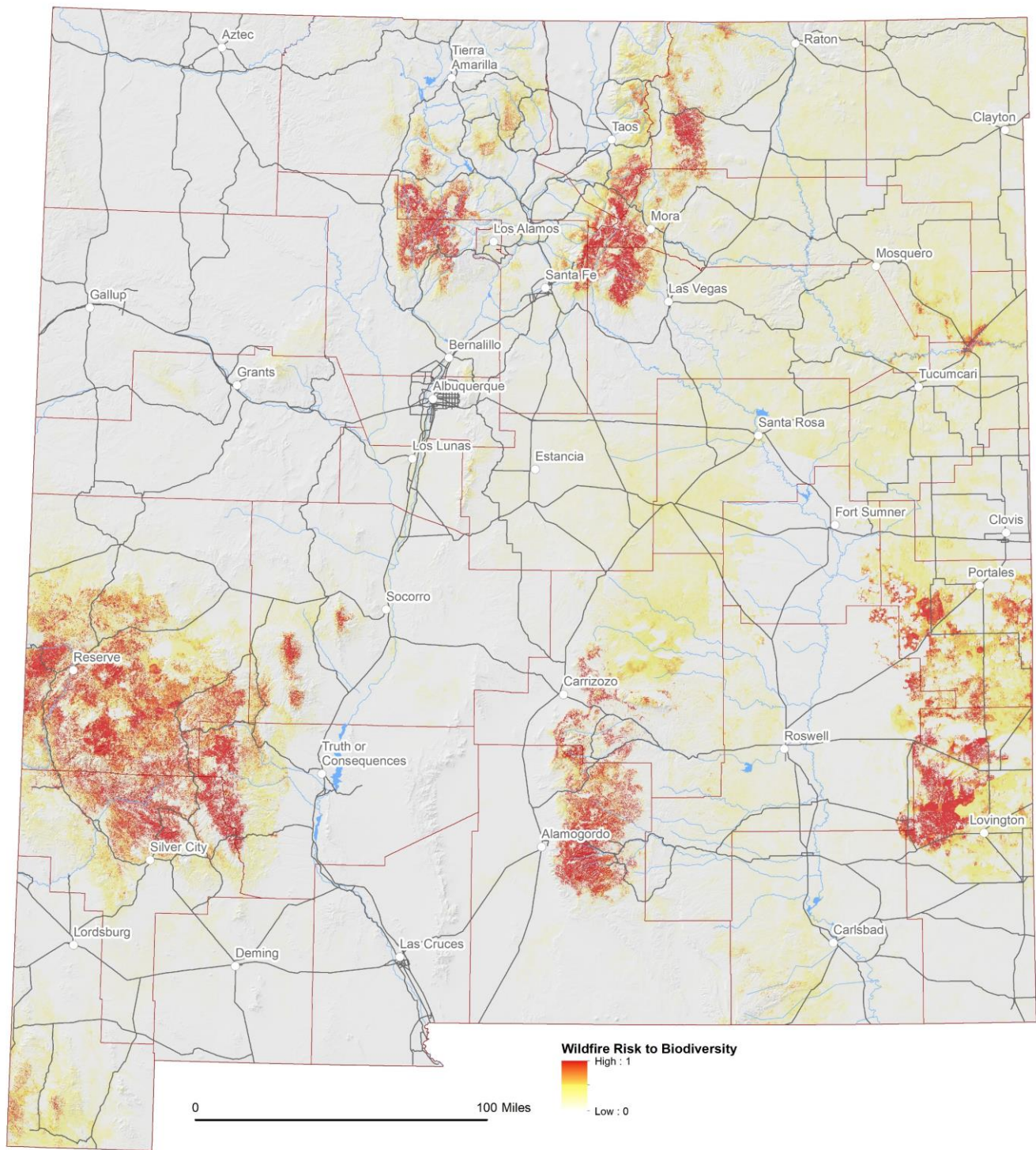
The Shared Stewardship portal will support better investments by improving:

- Decision making, by providing a platform to consider potential project areas before spending money on the ground.
- Shared Stewardship, by using the platform to look for overlapping priorities areas and overlapping investment priorities.
- Outcomes, by providing information needed to make better decisions and inform continuous planning:
  - More work done on the ground through leveraging investments.
  - Greater impact of the work done by leveraging investments.
  - Improved alignment with priority areas across agencies.
  - Improved accountability to taxpayers, stakeholders, and others to demonstrate money is being well spent.
- Executive reporting, by capturing consistent data for reporting accomplishments against shared priorities.



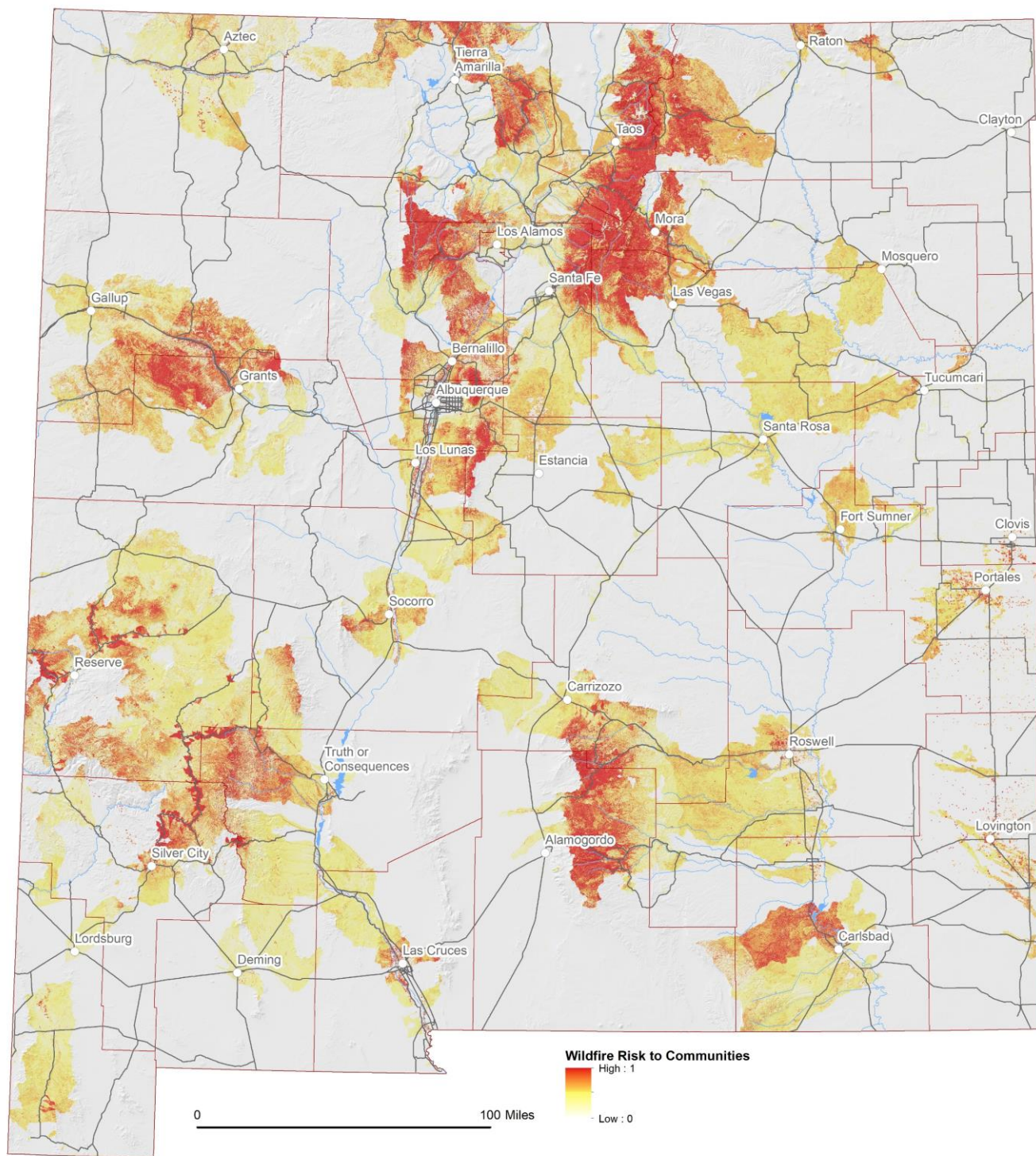
This project in the Luera Mountains included support from Forestry Division, New Mexico Department of Game & Fish, Bureau of Land Management and U.S. Forest Service. © Susan Rich





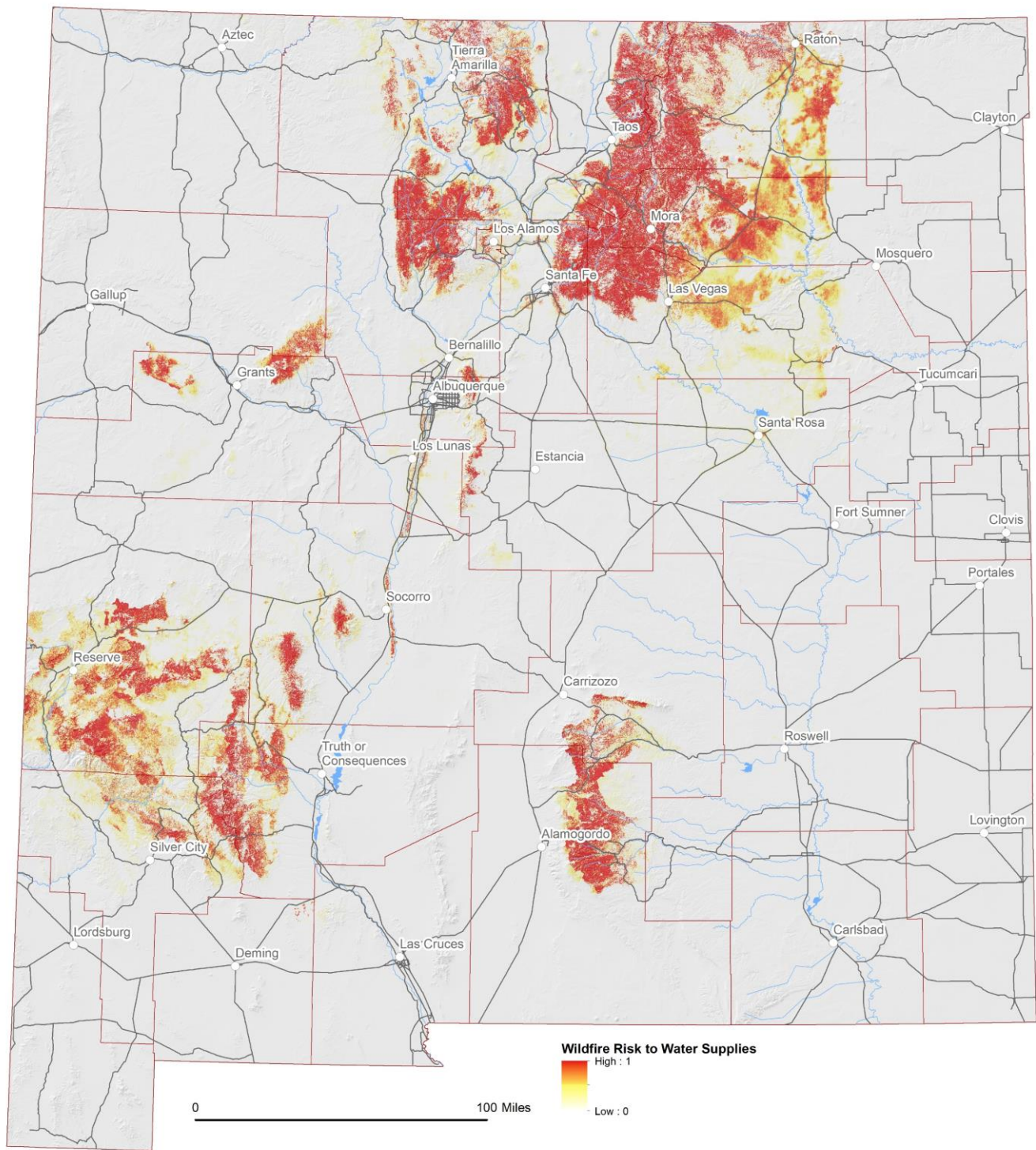
**Map 43. Wildfire risk to biodiversity used in the shared stewardship prioritization of watersheds. This is the combined wildfire risk to critical habitat for terrestrial threatened and endangered species, large intact blocks of habitat, important plant areas, habitat connectivity (both least cost and omnidirectional), habitat for species of economic and recreation importance, NMCHAT species of concern, and riparian corridors. A General Technical Report from the Rocky Mountain Research Station documenting the development of this data is in review.**





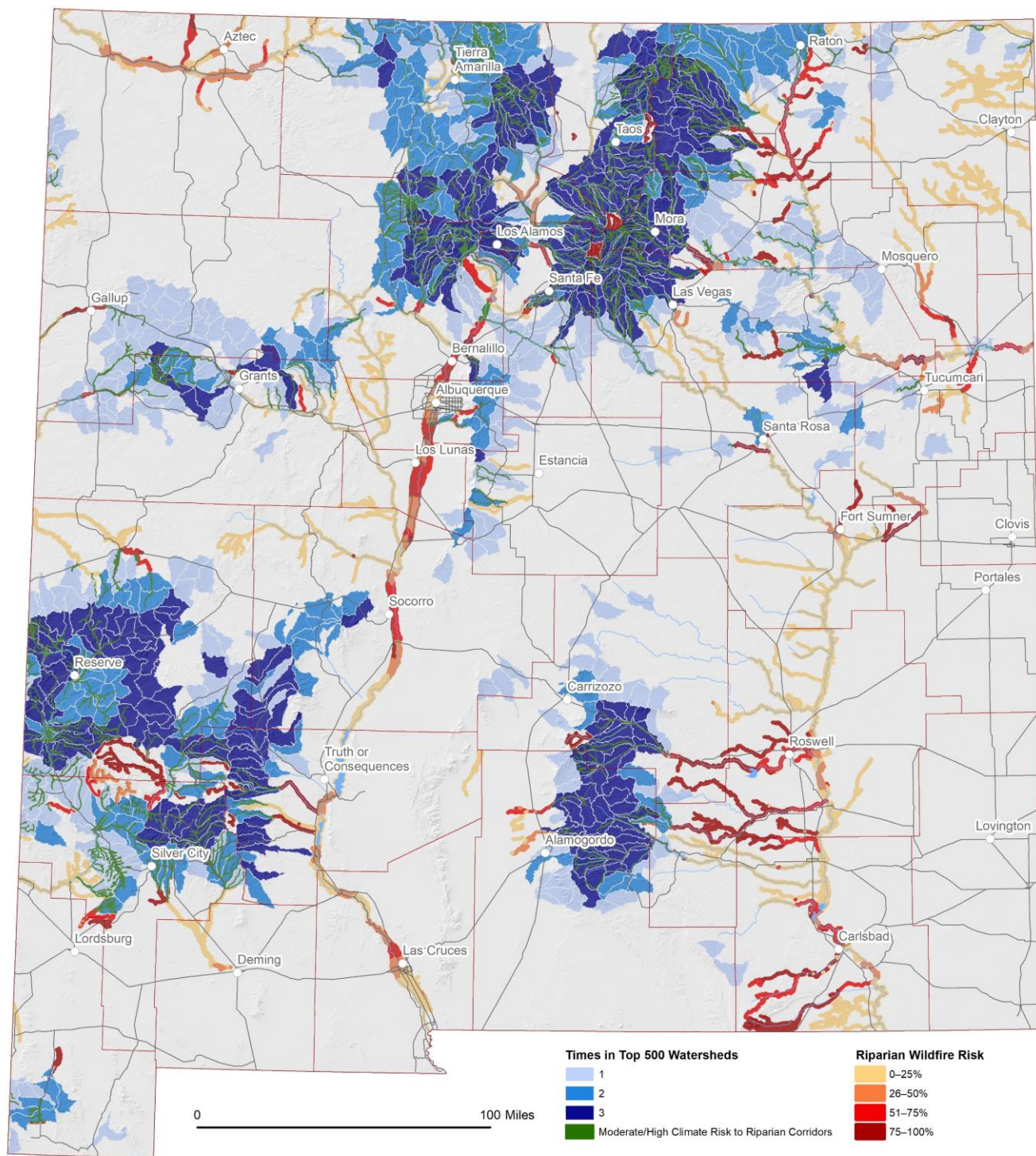
Map 44. Wildfire risk to communities used in the shared stewardship prioritization of watersheds. This is the summation of wildfire risk to buildings, post-fire flood risk to buildings, and post-fire debris flow risk to major roads. A General Technical Report from the Rocky Mountain Research Station documenting the development of this data is in review.





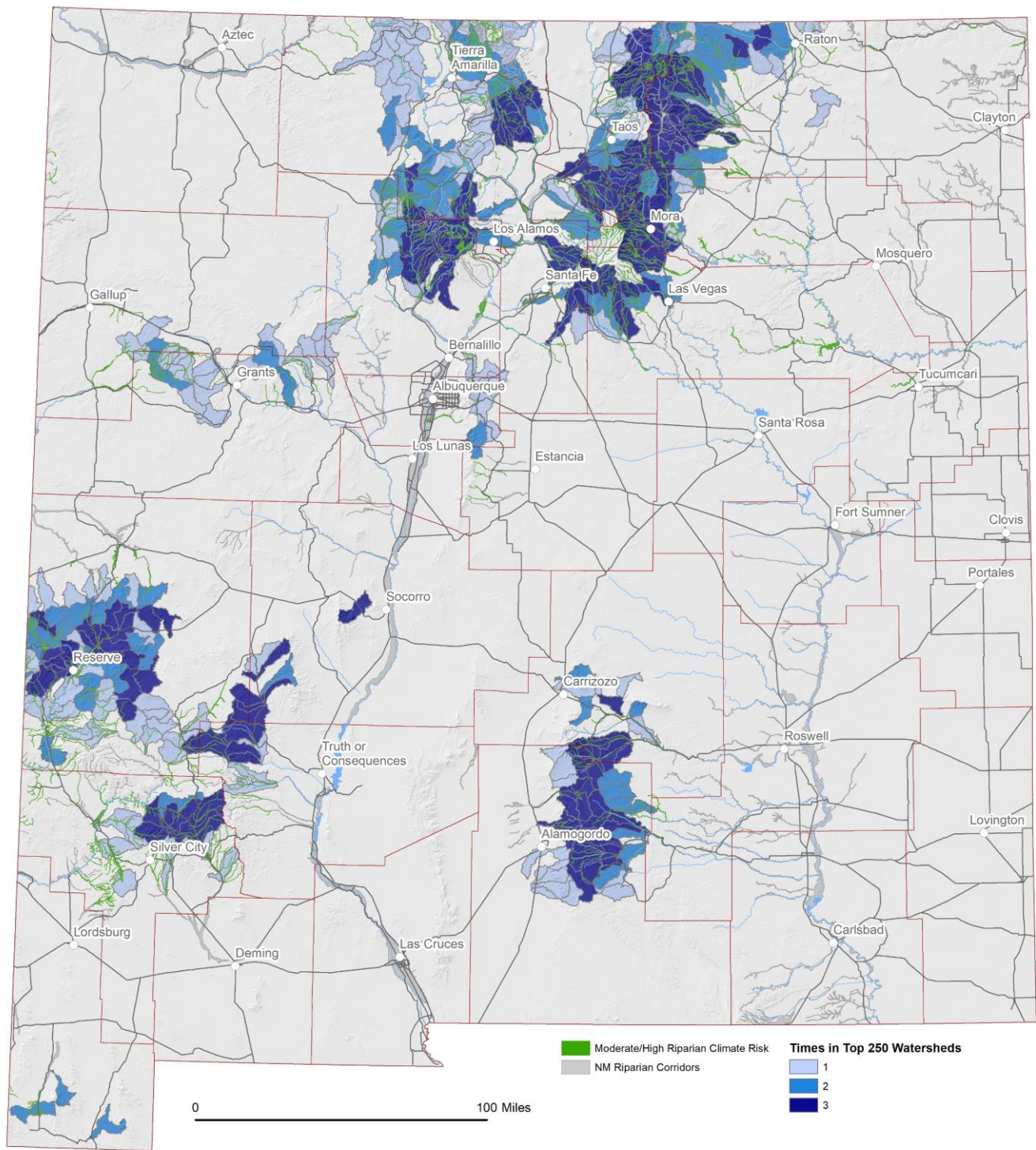
**Map 45. Wildfire risk to water supplies used in the shared stewardship prioritization of watersheds. This is the summation of wildfire risk to irrigation and public water supplies, post-fire erosion risk to intakes and diversions, and post-fire debris flow risk to water transmission. A General Technical Report from the Rocky Mountain Research Station documenting the development of this data is in review.**





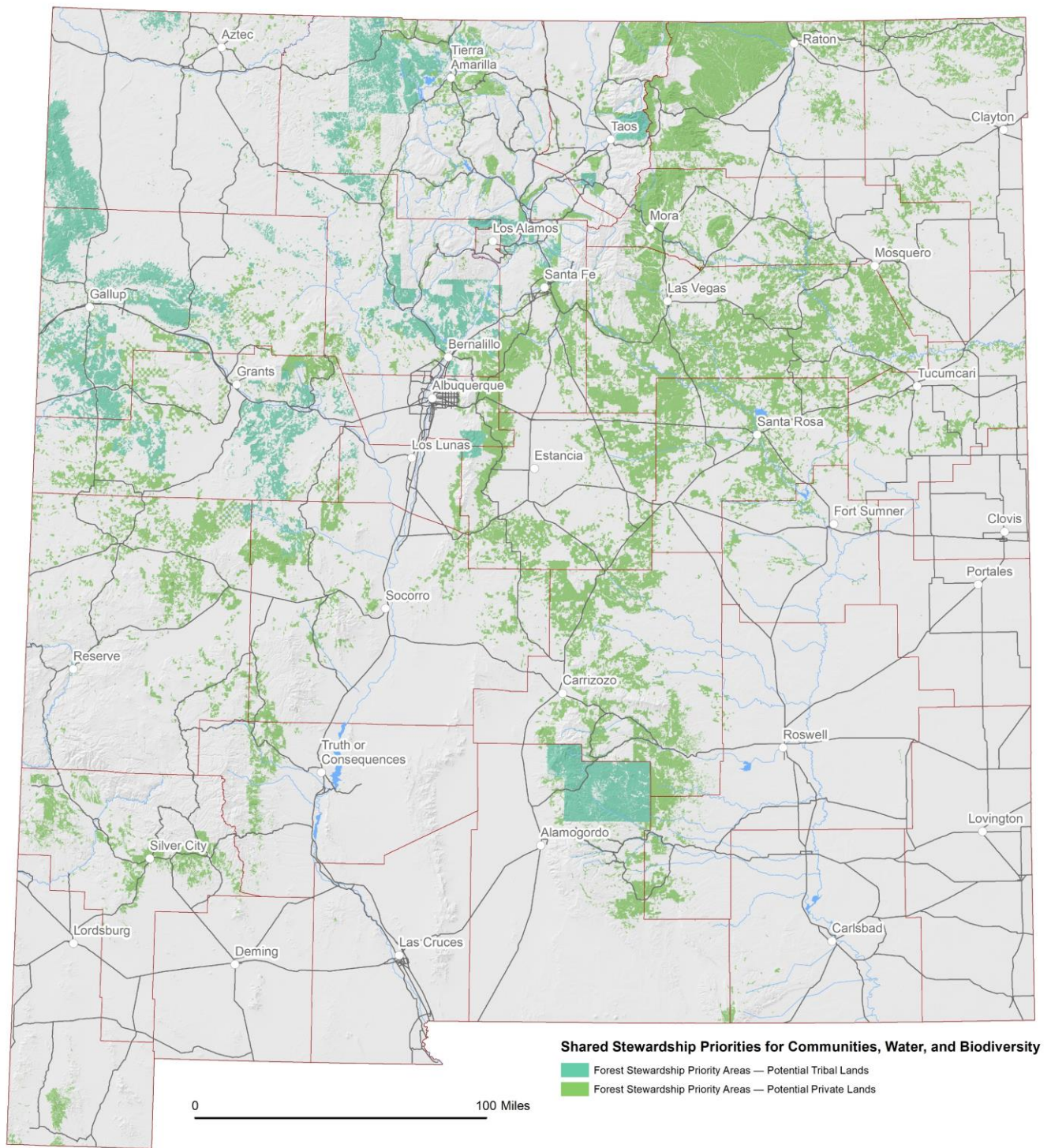
Map 46. All lands Shared Stewardship priority watersheds and riparian areas. A General Technical Report from the Rocky Mountain Research Station documenting the development of this data is in review.





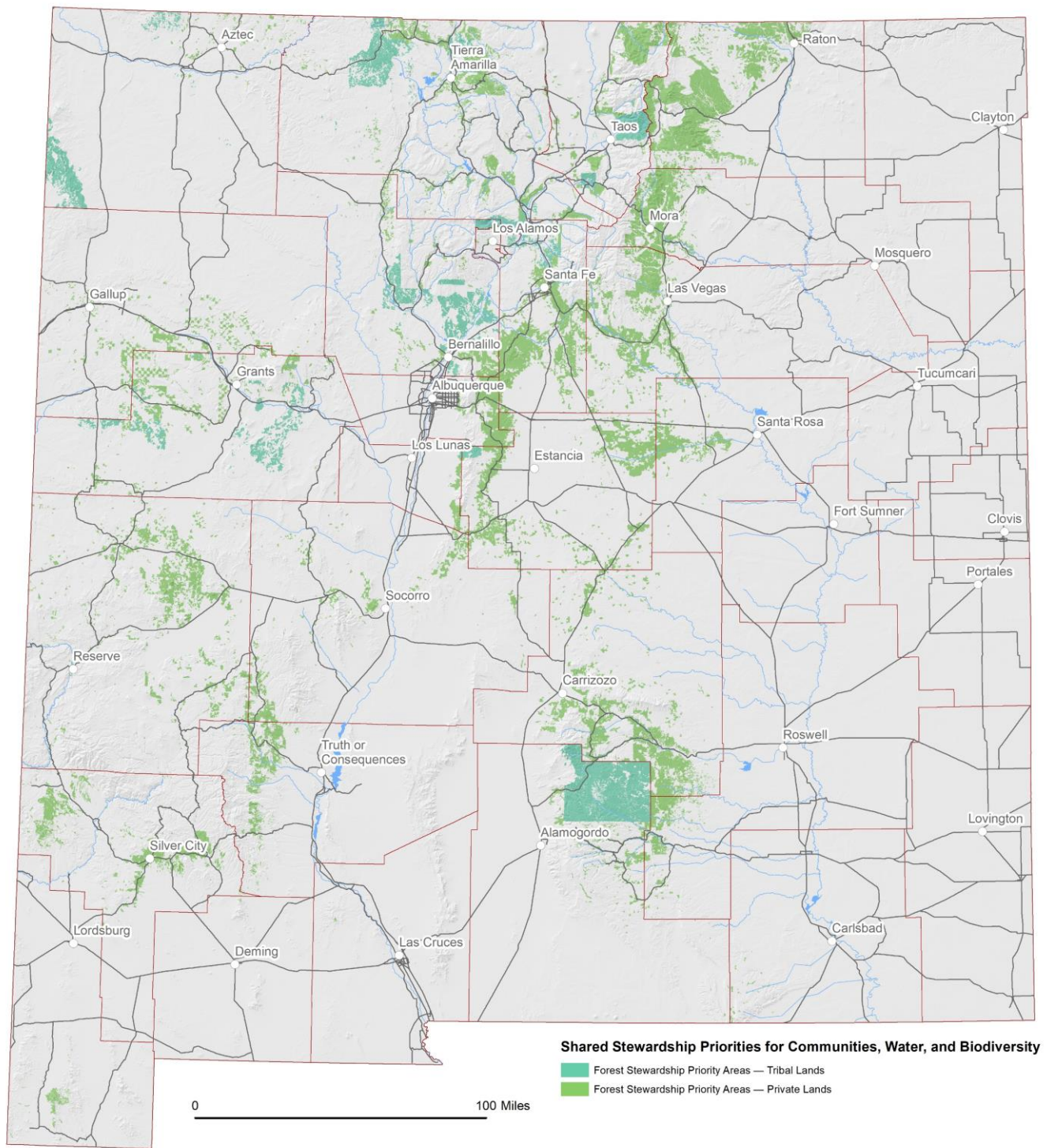
Map 47. USFS Shared Stewardship priorities showing the top 250 watersheds.





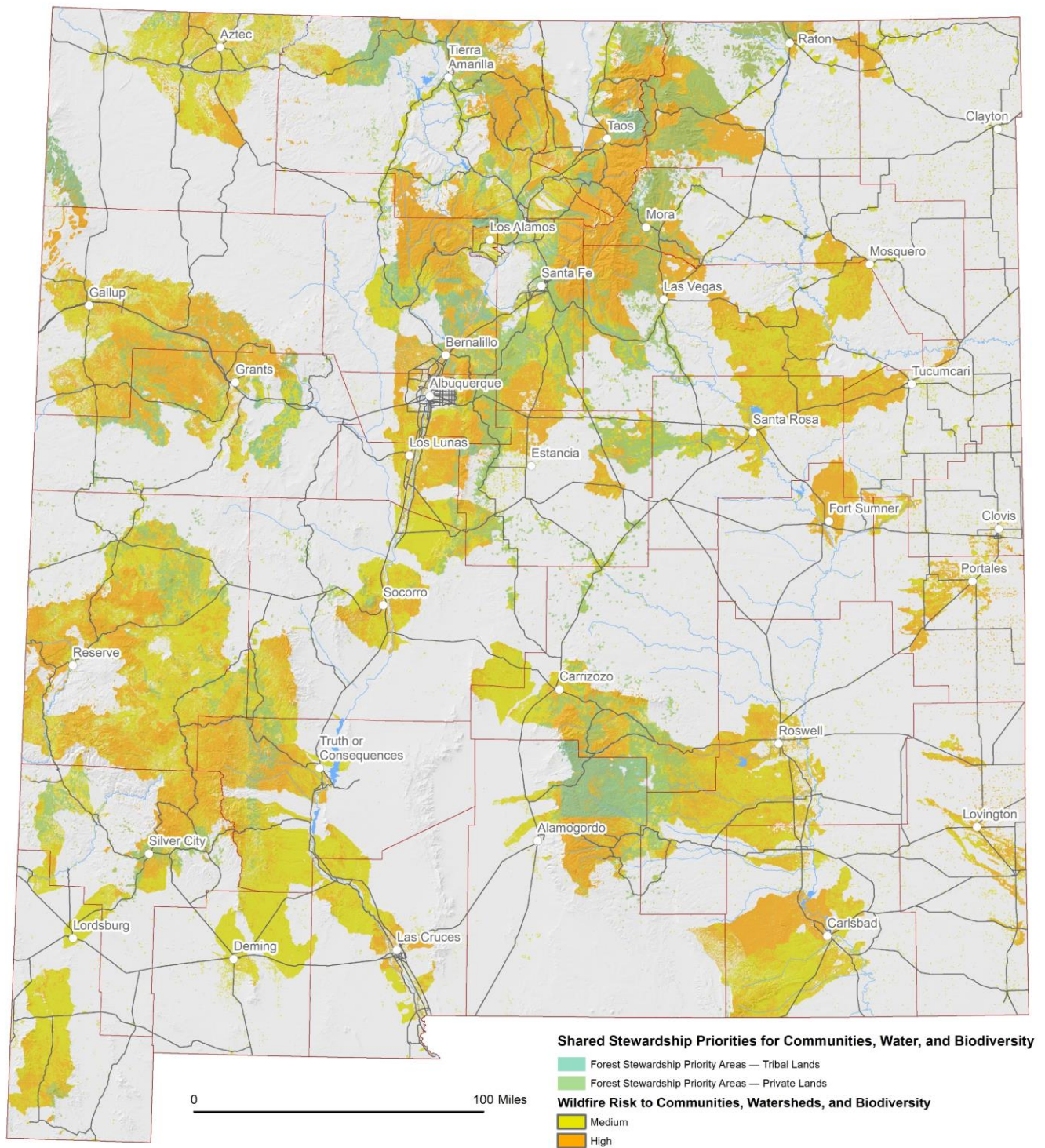
Map 48. Private and Tribal Lands Forest Stewardship potential map.





Map 49. Private and Tribal Lands Forest Stewardship priority map. 1) Total possible stewardship area is 9,106,186 acres. 2) 50% target for Possible Stewardship Area is 4,553,093 acres. 3) Attained stewardship area is 4,004,354 acres.





Map 50. Private and Tribal Lands Stewardship priority map incorporating risk layers for wildfire, biodiversity and water supply.



# V. Forest Legacy

The New Mexico Forest Legacy Program's Assessment of Need (AON) was completed in 2001 and approved by the Secretary of the U.S. Department of Agriculture on March 22, 2002. This chapter of the New Mexico Forest Action Plan was approved in June 2020 by the New Mexico Forest Stewardship Committee.

## Goals and Objectives of the New Forest Legacy Program

The over-all goal of New Mexico's Forest Legacy Program is to conserve and enhance land, water, wildlife, and timber resources while providing for the continued harvest of New Mexico's forest lands and maintenance of natural and public values. Specific objectives include the following:

- Identify and protect environmentally important, privately owned forest lands threatened with conversion to uses that are inconsistent with traditional forest uses including, but not limited to, residential subdivisions, commercial development, treeless pasture, cultivated farmland, and mining that causes extensive surface disturbance.
- Reduce forest fragmentation caused by subdivision and development.
- Provide environmental benefits through the protection of riparian areas, native forest plants and animals, remnant forest types, and natural ecosystem functions.
- Promote forest stewardship.
- Provide watershed and water supply protection.
- Provide employment opportunities and economic stability through the maintenance of traditional forest uses.
- Maintain important scenic resources.
- Provide links to public and other privately owned protected areas.
- Protect rare, threatened, endangered, and sensitive species.
- Protect or enhance habitat connectivity and related values needed to ensure biodiversity.
- Enhance recreational opportunities.
- Protect important historical and cultural sites;
- Provide undeveloped buffer areas to already protected areas.



Vallecitos High County Legacy Project @ José Carrillo/NMFD

Fragmentation of forest ownership, further subdivision, development, and conversion to non-forest uses are the greatest threats to forest values and the rural cultures that depend upon them. The Forest Legacy Program helps assure that both traditional uses of private lands and the public values of New Mexico's forest resources are protected for future generations. All private forested land in New Mexico has been designated as part of the program and is a potential project site however forested areas are prioritized from high to low based on the following map layers which are from the Assessment:

1. New Mexico Buildings
2. Carbon Biomass
3. Critical Habitat
4. Mines
5. Fishing Polygons
6. Fishing Polylines
7. Important Plant Areas
8. Irrigation Conveyance
9. Land Grants
10. Reservations and Pueblos
11. Sawmills
12. Saw Logs
13. Public Water Supply
14. Recreational Sites
15. Scenic Byways
16. Trails

## Eligibility Criteria

Eligible areas in New Mexico represent a rich and varied assortment of forest lands. To be eligible for inclusion in the Forest Legacy Program, the proposed area must be an environmentally important forest area that is threatened by conversion to non-forest uses. Many forest lands across New Mexico will meet the national eligibility criteria for the Forest Legacy Program. Environmentally important forest areas must contain one or more of the following important public values:

- Opportunities for the continuation of traditional forest uses such as forest management, timber harvesting, other commodity use, and outdoor recreation.
- Critical watersheds.
- Riparian areas.
- Important fish and wildlife habitat.
- Threatened or endangered species habitat.
- Scenic resources.
- Known cultural resources.

To determine the outstanding properties, each area will be evaluated within its regional context in addition to the documentation of important values within its boundaries. Regional values may be expressed in terms of regionally distinctive scenic, geologic, or biological resources and societal benefits. Ideally, areas selected will embody multiple public values of regional scale, be acquirable and manageable, enjoy public support for that purpose, be threatened with conversion in the short term, and contribute to biodiversity.

The Forestry Division's Forest Legacy Program State Coordinator evaluates applications using eligibility criteria and then the New Mexico Forest Stewardship Committee evaluates using project evaluation criteria. Both criteria are listed below.

To be eligible for inclusion, a property must be forest land, at least five acres in size, and meet all four eligibility criteria. 'Forest land' is defined as any land with trees that has at least 10% canopy cover, or that formally had such cover, and that is not currently developed for non-forest use. Lands that had previously been forested but have been converted, may be considered as forest lands, if the property is covered by an approved Stewardship Plan that intends to reestablish forest cover. A parcel must be at least 75% forest lands to qualify for Forest Legacy funding. No ranking is implied by the order in which any of these criteria or subsets are listed.

## 1. Threat

To meet this criterion, the property must be threatened by one of the following:

- conversion to non-forest uses or;
- further subdivision into smaller parcels.

## 2. Public Values

To meet this criterion, the property must possess one or more of the following public values:

- natural aesthetic or scenic values;
- public education opportunities;
- public recreation opportunities;
- riparian areas;
- fish and wildlife habitat;
- threatened or endangered species habitat;
- cultural and historical resources;
- traditional forest uses; or
- other important ecological values.

## 3. Planning

To meet this criterion, the property must have one of the following:

- a Forest Stewardship Plan or equivalent forest management plan approved by the State Forester or his or her designated representative in accordance with National Forest Stewardship Program criteria, or
- where land is acquired in fee or timber management rights are transferred in a conservation easement, a management plan will be developed by the organization acquiring those rights.

## 4. Funding

To meet this criterion, there must be non-federal matching funds of at least 25% available in the form of cash or in-kind contributions.

## Project Evaluation Criteria

The Forest Legacy Subcommittee of the New Mexico Forest Stewardship Committee has adopted the following selection criteria. Project emphasis is placed upon productive, working forests with resident landowners who contribute to the local culture and community values.



**Parcel supports local economic and social values:**

- Permanent residence of landowner (or at least one of multiple owners) is within parcel or in adjacent community (10 points).
- Landowner's income or personal needs at least partially supplied by parcel's forest resources (0-6 pts).
- Parcel enhances public recreation or educational opportunities (0-4 pts).

**Size of easement (0-4 points):**

Forest easements of less than 40 acres receive no extra points. Forest easements of 40-100 acres receive 1 point; 100-200 acres, 2 points; 200-400 acres, 3 points; >400 acres get all 4 points.

**Parcel abuts other areas protected from development (0-4 points):**

Adjacent to a national park or state or national wildlife refuge; other conservation easement areas; or lands in government or private conservation organization ownership.

**Threat of fragmentation (choose only one):**

- Current landowner plans to subdivide and sell smaller units (6 points).
- Current landowner may sell entire property (4 pts).
- Property may be divided among landowner's heirs (4 pts).

**Potential for development:**

- Domestic water and utilities available (2 points).
- Close to urban area or recreational destination (2 pts).
- Location desirable because of scenic views, waterfront, or ease of access (2 pts).
- Terrain and slopes favorable for development (2 pts).

**Complements state or federal interests or assistance programs (0-4 points):**

- State and federal clean water goals are furthered; U. S. Fish & Wildlife Service Habitat Management Plan or Wildlife Habitat Improvement Plan in effect; non-forested areas within property enrolled in Conservation Reserve Program; significant wetlands are protected; etc.

**Evidence of commitment to forest management and project completion:**

- Project has partners that can provide expertise and services for options, appraisals, title search, surveys, etc. (0-10 points).
- Forest Stewardship Plan completed (2 pts).
- Leverage commitment from grantor or partners—graduated scale based on percent of total estimated project cost—1 point for each additional 10% non-federal match in excess of the maximum 25% contribution. Example: a project with a total value of \$1 million with a \$250,000 non-federal contribution earns no extra points. That same project with a \$350,000 non-federal contribution earns 1 point, \$450,000 earns 2 points, etc. (6 point maximum).

**Environmental, ecological, and historical values:**

- Parcel has riparian shoreline (1 point for every 100 feet, 6 point maximum).
- Drains into, and is within five miles of, a public/domestic water supply point of diversion (6 pts).
- Within a priority watershed (4 pts).
- Habitat supports state or federally listed threatened or endangered species (6 pts).

V. Forest Legacy

- Part of a large contiguous block of adjacent forest (4 pts).
- Part of important permanent or seasonal wildlife habitat identified by the New Mexico Department of Game and Fish (4 pts).
- Includes ecological communities (other than riparian) that are uncommon or dwindling within the state (4 pts).
- Frontage on designated scenic route or is part of an important scenic view (4 pts).
- Contains a state registered archeological site, historical site, or other important local landmark (4 pts).



Rocky Mountain iris in an aspen stand in the Pecos Wilderness. © Laura McCarthy/NMFD

## Project Development Process

Upon approval of a New Mexico Forest Legacy Program by the state, U.S Forest Service, and USDA Secretary, the following steps would be taken to implement an active program.

### Step 1. Public Outreach

- NMFD, Forest Stewardship Committee and land trust organizations contact landowners to make them aware of Forest Legacy Program.
- Present Legacy Program and application information on the NMFD web page.

### Step 2. Written statement of interest from landowner to NMFD

- NMFD sends application materials to landowner.
- Application assistance rendered by NMFD, interested land trusts, consultants, or stewardship advisors.

### Step 3. Formal application submitted to NMFD

- Forest Legacy Subcommittee of the Stewardship Committee reviews project proposals against eligibility criteria.
- Forest Legacy Subcommittee interviews applicant and scores the project potential against the selection criteria.
- NMFD notifies landowner regarding eligibility and ranking score for Forest Legacy Program.

### Step 4. Comparative ranking of projects

- Full Stewardship Committee ranks top scoring applicants and makes recommendation to State Forester on project priorities.

### Step 5. State Forester submits top projects to U.S. Forest Service Regional Office.

- State Forester and U.S. Forest Service will select projects based on available funding and regional priorities.

### Step 6. Conservation Easement developed

- Forest resource assessment and Stewardship Plan, or equivalent plan, established.
- Development rights valued by federally approved appraisal.
- Federal Forest Legacy money available at closing.
- NMFD or other government agency closes and records easement.

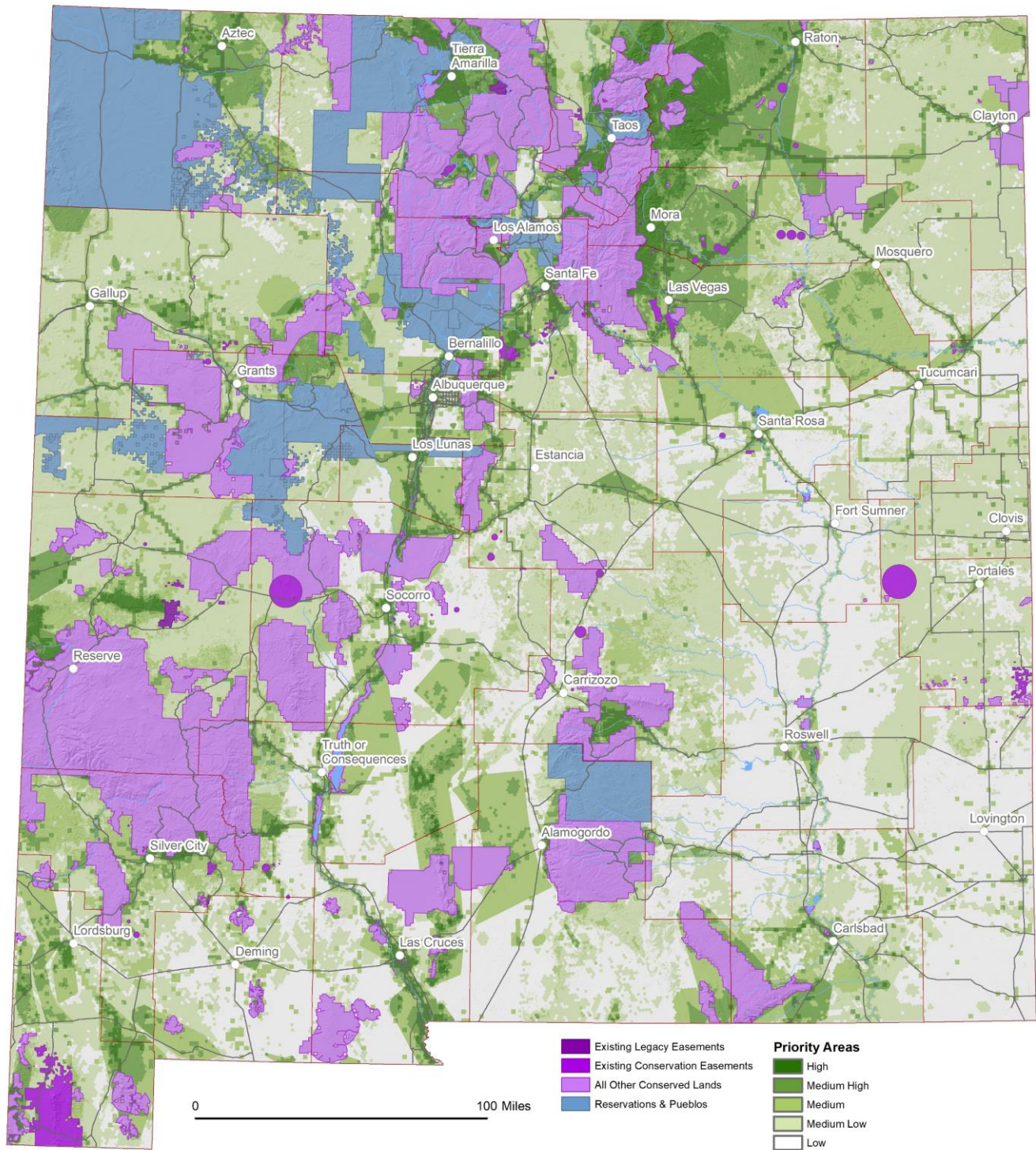
### Step 7. Monitoring and Enforcement

- Easement monitored on an annual basis by NMFD or private land trust.
- Restrictions enforced by government agency holding title to easement.

The maps on the next two pages show potential forest legacy sites from high to low priority in New Mexico.

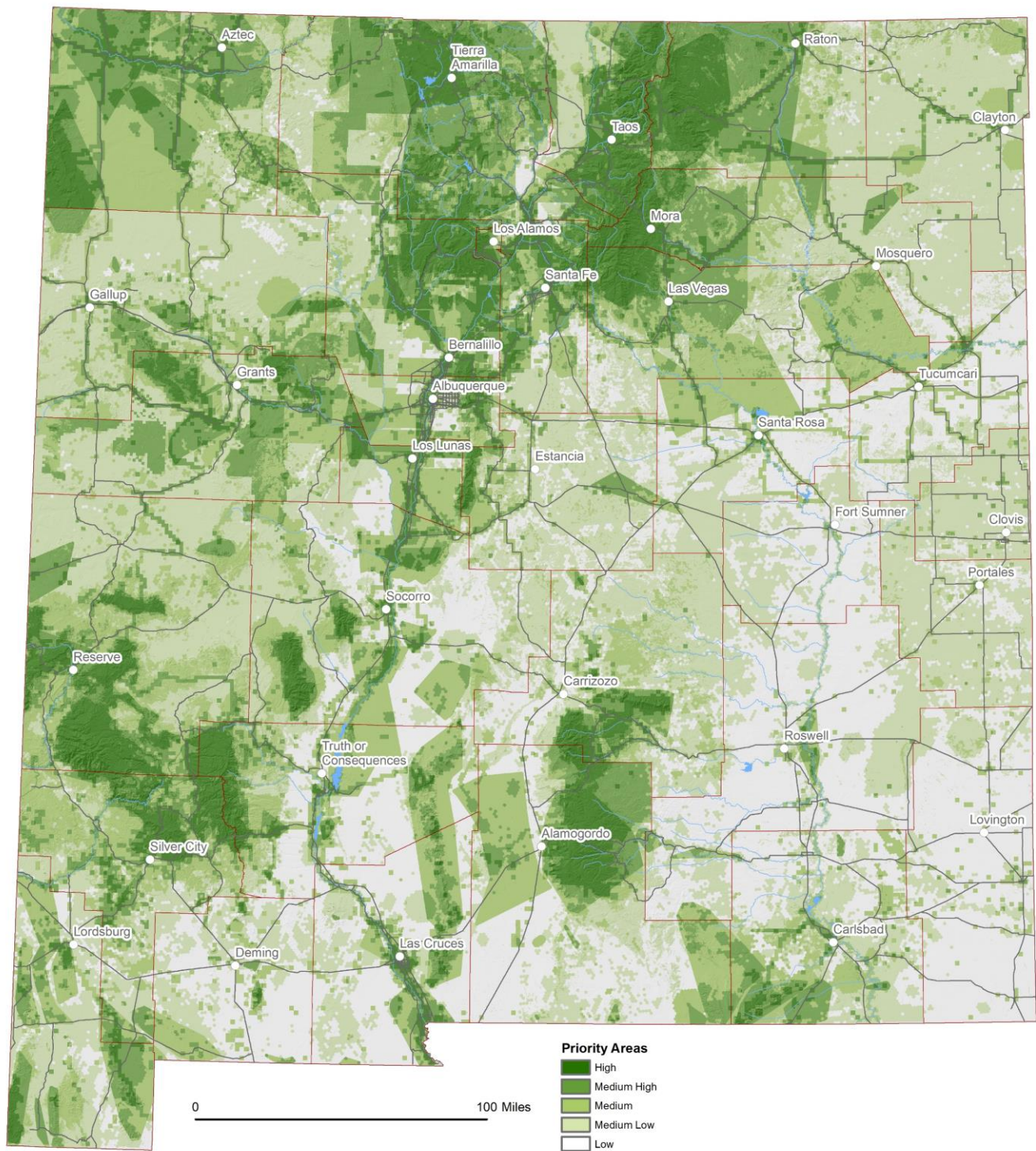


V. Forest Legacy



Map 51. New Mexico Forest Legacy map showing lands in conservation status. 1) Legacy Easement Area is 35,815 acres. 2) Conservation easement area is 559,208 acres. 3) All other conserved lands is 12,526,717 acres. 4) High and Medium High priority areas cover 17,184,389 acres. 5) Conserved lands in High and Medium High priority areas is 8,526,779 acres.





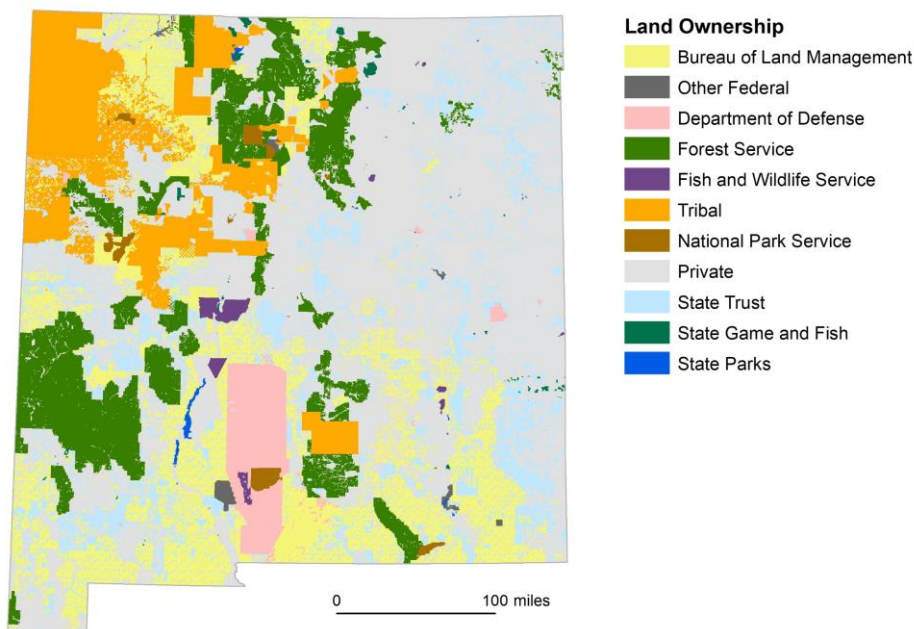
Map 52. New Mexico forest legacy map without conserved lands.

# VI. Background

Although the New Mexico Forest Action Plan is a document developed primarily for a professional audience, users and partners are likely to include nonprofessional natural resource managers and individuals not familiar with New Mexico's forests. This *Background Chapter* is a brief introduction to New Mexico's forests, and summarizes some general understandings. Given New Mexico's ecosystems are extremely diverse and complex, there is no information presented in this chapter that will hold true under all conditions. References for this section are on the Forestry Division's website as a dynamic document to expand and maintain. This semi-annotated reference list includes not only sources for this document, but references that can aid the reader in developing a deeper knowledge about New Mexico's natural resources.

## New Mexico's Natural Resources

New Mexico is the fifth largest state, covering 121,590 square miles and is largely privately owned, with 44 percent of total land within private ownership (Table 6; Map 53). The state shares the western portion of its southern border with Mexico, and is surrounded by the States of Arizona, Utah, Colorado, Oklahoma, and Texas. Its landscape ranges from large grassland expanses to deserts to high snow-capped peaks. The size and topography of the state make it one of the most biologically diverse in the nation. The state is the fourth most diverse overall providing habitat for nearly 5,000 species (without counting insects and arthropods) including: 4,204 plants (4th in US); 154 mammals (3rd in US); 447 birds (2nd in US); 98 reptiles (3rd in US); 26 amphibians (27th in US); and 54 freshwater fish (38th in US).



Map 53. Land ownership in New Mexico. Source data from the Bureau of Land Management, used to produce data in Table 8.

Forests and woodlands cover approximately 22 million acres (28 percent of the state); grasslands, the largest vegetation class in the area, stretch across 29 million acres (37 percent of state); shrub-scrub vegetation typical of desert cover 18.5 million acres (24 percent of state). While riparian habitats make up less than one percent of the landscape, they are some of the most diverse habitats in terms of plants and animals in New Mexico.



Forests in New Mexico are generally associated with mountains. From the highest elevations (Wheeler Peak 13,161 ft.), mountain ecosystems transition from treeless alpine tundra, through mesic (wet) and dry coniferous forests, into lower elevation woodland systems, which are dominated by piñon-juniper woodlands, foothill grasslands, and shrublands. New Mexico has extensive montane and lower montane-foothill vegetation including Southwestern mixed conifer and ponderosa pine forests, as well as mixed ponderosa pine-oak forests in the southwestern part of the state. Another important ecosystem is the historically cottonwood-dominated forests found along our rivers and locally referred to as the bosque.

Much of New Mexico is dominated by non-forest vegetation. Temperate grasslands comprise about 37 percent of the state, mostly in the east, where ownership is primarily private. These grasslands support many communities whose economies are dependent on farming and ranching. Most New Mexico grasslands in the east can be considered southern shortgrass prairie dominated by large expanses of blue grama and buffalo grass. Climate and edaphic (soil) factors are the dominant factors driving the structure and composition of the grasslands. As the climate becomes more arid species more typical of desert grasslands, such as black grama and bush muhly become more common; with greater precipitation, the dominant shortgrass species are typically replaced by common mixed-grass species like little bluestem and switchgrass. Edaphic factors drive variation at more local scale, and species such as sand blue

stem, western wheatgrass, and galleta can be found in specific sites. Grazing and its interaction with fire are important processes that maintain the shortgrass prairie. Exclusion of these processes encourages encroachment and expansion of shrub species into the systems. In New Mexico we are fortunate to have some of the largest remaining intact prairie grasslands.

Wetlands and riparian ecosystems are precious, comprising less than 1 percent of New Mexico. Riparian forests and wetlands are rare and biologically critical communities that traverse the upland systems along water courses. New Mexico's desert systems are known for their large number of native fish species. A significant percentage of all wildlife in the Southwest uses riparian habitat and approximately 80 percent of all sensitive and specially designated vertebrate species in New Mexico depend upon riparian or aquatic habitat at some time during their life cycle. Maintenance of hydrologic regime including riparian flows and water quality is essential to maintaining proper functioning of our riparian systems.

Deserts and dry shrublands cover about 18.5 million acres in New Mexico and can be found within the Chihuahuan Desert, the Apache Highlands, and the Colorado Plateau ecoregions (Map 54). These are extreme environments, having both hot summers and cold winters. A surprisingly diverse array of plants and animals manage to thrive in these harsh conditions. The Chihuahuan Desert is particularly notable for its high plant species diversity, including more species of cactus than any other ecoregion on Earth.

## Ecosystem Classifications

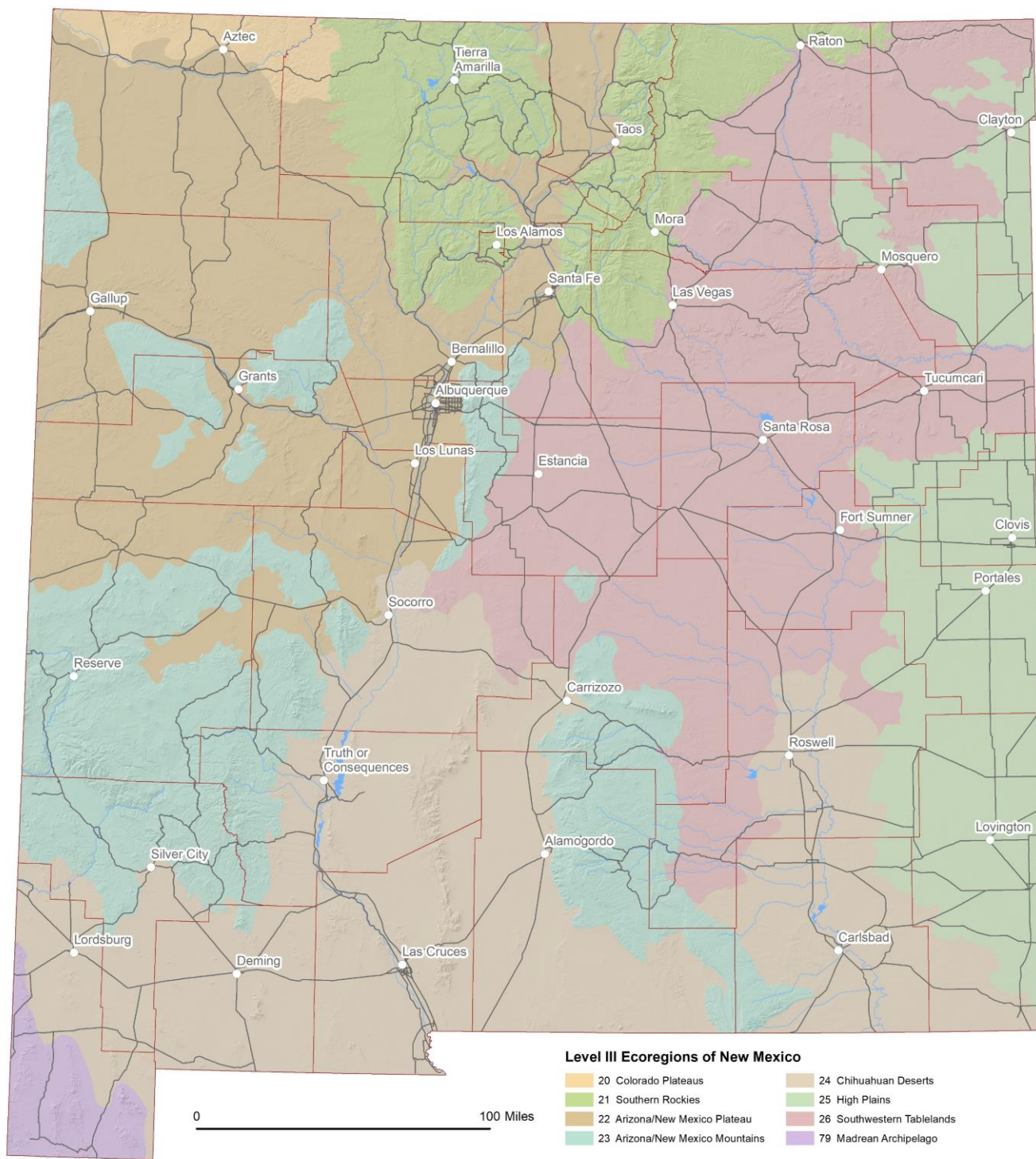
Classification systems for ecosystems are tools to help describe and understand the complexity of the natural world. Using various classification systems can help us understand the diversity of New Mexico's ecosystems. However, because this natural complexity is influenced by various factors including climate history, precipitation pattern, geographic attributes, geological parent material, soil development, and human interaction, no classification system can be applied precisely as there are gradations between each class and exceptions to each observed generality. The classification concepts presented here provide a context for understanding New Mexico's diverse environment, yet each reader will identify locations where the classification cannot clearly be applied.

Classification systems are generally tiered—with broad scale generalizations common at the highest level, and specific details important at levels that consider local geography and plant communities. In general, management implications are more useful at lower level classifications such as by Ecological Site Descriptions or Plant Associations, than applying these understandings to a high-level classification such as a Life Zone. For example, the guidance that ‘a target basal area of 60-80 square feet per acre to reduce fire intensity’ is a better ideal for a group of Plant Associations with a grassy understory (ponderosa pine/Arizona fescue, ponderosa pine/mountain muhly, etc.) than to say that the guidance is useful for the entire ponderosa pine life zone since this basal area level in pine/oak often results in generating more intense fire behavior in the dense oak resprouts.

Since classification systems are a human construct on a natural environment that rarely conforms to clean classification, natural resource managers use several approaches to understand their project areas, with each classification system providing a lens of insight that informs their management decisions.

### **Ecoregions**

Although a simple geographic classification splits New Mexico in to four regions—the Great Plains, the Colorado Plateau, the Rocky Mountains, and the Basin and Range—resource managers tend to use [Ecoregion Classifications \(EPA\)](#) to understand geographical differences. Ecoregions represent a holistic classification using geography and including the interacting life zones, species found there, and functions as whole. There are eight level III ecoregions and 55 level IV ecoregions in New Mexico (Map 54). The eight level III ecoregions are the Colorado Plateau (20), Southern Rockies (21), Arizona/New Mexico Plateau (22), Arizona/New Mexico Mountains (23), Chihuahuan Deserts (24), High Plains (25), Southwest Table Lands (26), and Madrean Archipelago (79). These ecoregions are defined by interacting patterns of the biota, geology, physiography, soils, land use, hydrology and climate.



Map 54. Level three ecoregions of New Mexico as mapped by the U.S. Environmental Protection Agency.



**Life Zones**

The formal life zones defined by Merriam that are found in New Mexico are Lower Sonoran, Upper Sonoran, Transition, Canadian, Hudsonian, and Arctic-Alpine (see Figure 4). For forested areas, a more useful life zone delineation is based on dominant tree species and generally consists of bosque, piñon-juniper woodlands, ponderosa pine, mixed conifer, and spruce-fir. Based on recent research on fire ecology, resource managers often differentiate between dry mixed conifer and wet mixed conifer with the former having historically frequent fires, and the latter having longer return intervals between fires.

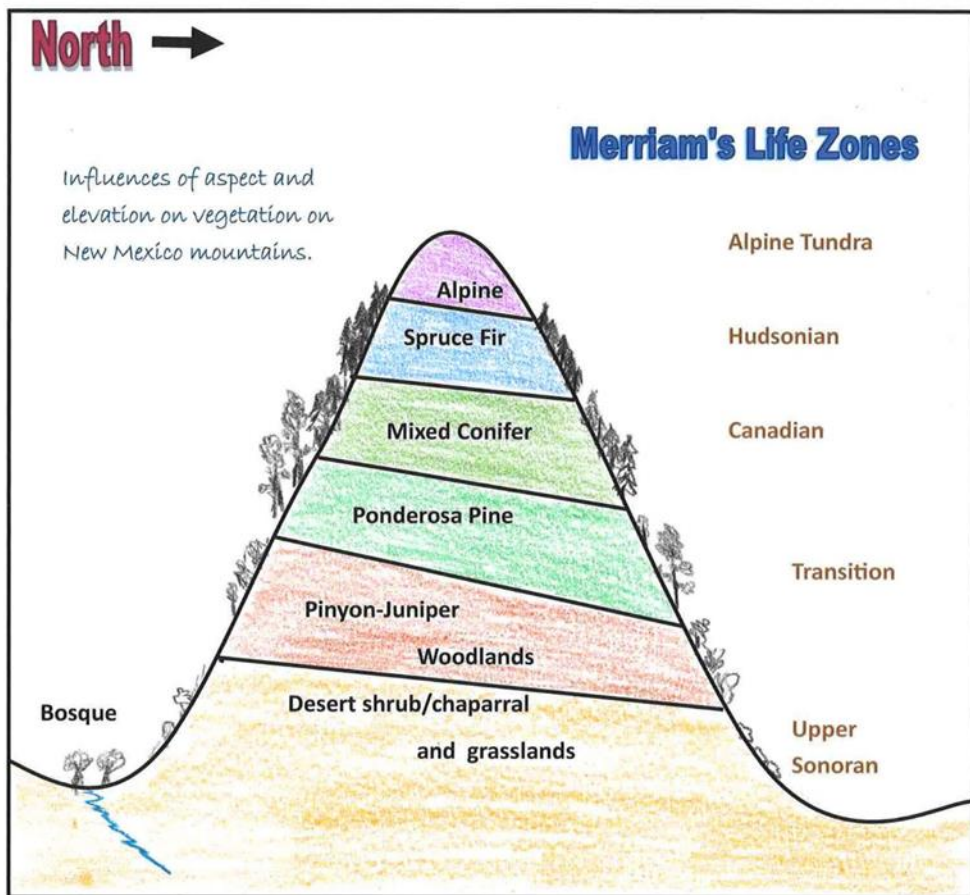


Figure 4. Geographic influences on life zones of New Mexico. Illustration by Mary Stuever/NMFD.

**Plant Associations**

For woodland and forests, plant associations provide a specific level of classification where management implications can be generally be discussed with successful utility. Although each species has its own site requirements for survival—including rainfall amount and timing, sun exposure, soil composition, and so forth—specific site conditions provide a niche for several of the same plants to occur together when these conditions exist. This repeated pattern allows managers to focus in on the indicator plants that are more specific to certain site parameters. Obviously, there are gradations between each site, but the concept of plant associations is extremely useful for those developing site specific prescriptions for management activities.

Plant associations are named for the most shade tolerant tree in the overstory, and the best indicator plant in the understory. The naming conventions used do not necessarily represent the natural conditions of the ecosystem. For example, a white fir/screw-leaf muhly stand in healthy, resilient condition is dominated by a ponderosa pine overstory and often has a rich grass understory where the dominant grass is Arizona

fescue. The presence of screw-leaf muhly, however, indicates the site is wetter than the adjacent white fir/Arizona fescue site. Similarly, a white fir/screwleaf muhly site would also be wetter, though it may look similar in appearance, than a ponderosa pine/screwleaf muhly site found at slightly lower elevations. Though both will look similar under frequent fire regimes, they respond to management treatments differently.



Corkbark fir/Arizona peavine plant association on Mount Taylor © Mary Stuever/NMFD

### Soil Surveys

Soil surveys provide another lens for resource managers who are developing site-specific prescriptions for management. Soil surveys are maps of soil classification based on the principles of soil science and drawing heavily from geomorphology, theories of soil formation, physical geography, and analysis of vegetation and land use patterns. Soil surveys are produced nationwide by the National Cooperative Soil Survey, a program of the Natural Resources Conservation Service. Although soil surveys were once published in book form, they are now available on the NRCS's [Web Soil Survey \(WSS\) site](#), where a person can create a custom soil survey. By making the data and information available online, it allows for the rapid flow of the latest soil information to the user.

### Ecological Site Descriptions

Ecological site descriptions (ESDs) are a classification system that combines site characteristics including physiographic, climate, soil and water features with plant communities' features such as plant species, vegetation states, and ecological dynamics. Like plant associations that are linked to management implications, ESDs include management alternatives for the site and related resources and are linked to relevant literature, information and data sources. Although ecological site descriptions are planned to cover all plant communities, including forests, forest ESDs are still under development for much of New Mexico. ESDs developed by the Natural Resources Conservation Service are stored and accessed with [Ecosystem Dynamics Interpretative Tool \(EDIT\)](#).

### Terrestrial Ecological Unit Inventory

Terrestrial ecological unit inventory (TEUI) is similar to ESDs and used on Forest Service lands. The system classifies ecosystem types and maps ecological units at different spatial scales. The system distinguishes among land areas that differ in important ecological factors, such as geology, climate, soils, hydrology and vegetation. Maps and information about ecological units are applied in land use planning to describe land capability and identify suitability for various uses.



View from Jicarita Peak © Daniela Roth/NMFD

## Natural Resource Management

Initially, understanding the complex web of partners and stakeholders involved in managing New Mexico’s natural resources can be daunting, especially with many shared jurisdictions and responsibilities. Yet, to maximize our available resources and provide the best management options for the state, this intricate web of federal, tribal, state, and local agencies, organizations and individuals works together regularly.

Responsibility for stewardship and management of approximately half of forests and woodlands in New Mexico falls to federal agencies, primarily the USDA Forest Service. Various sources report the area of forests and woodlands using different categories. The national Forest Inventory and Analysis Program data (up through 2018) is provided in Table 6 (by jurisdiction) and Table 7 (by forest type). In Table 8, total landownership acres by agency is sourced from the Bureau of Land Management (Map 53). Vegetation types by various agencies as derived from the LANDFIRE Program (Map 55) is also presented in Table 8. The major differences between these two sources of data is the definition of various categories. For example, mesquite woodlands (~4.4 million acres) are considered woodlands in the FIA dataset and desert shrublands in the LANDFIRE dataset.

With limited exceptions, the Forestry Division does not own and manage land within New Mexico, but works with partners to promote healthy, sustainable forests in New Mexico through its various programs, encouraging sustainable economic growth while protecting and enhancing watershed health and community safety.

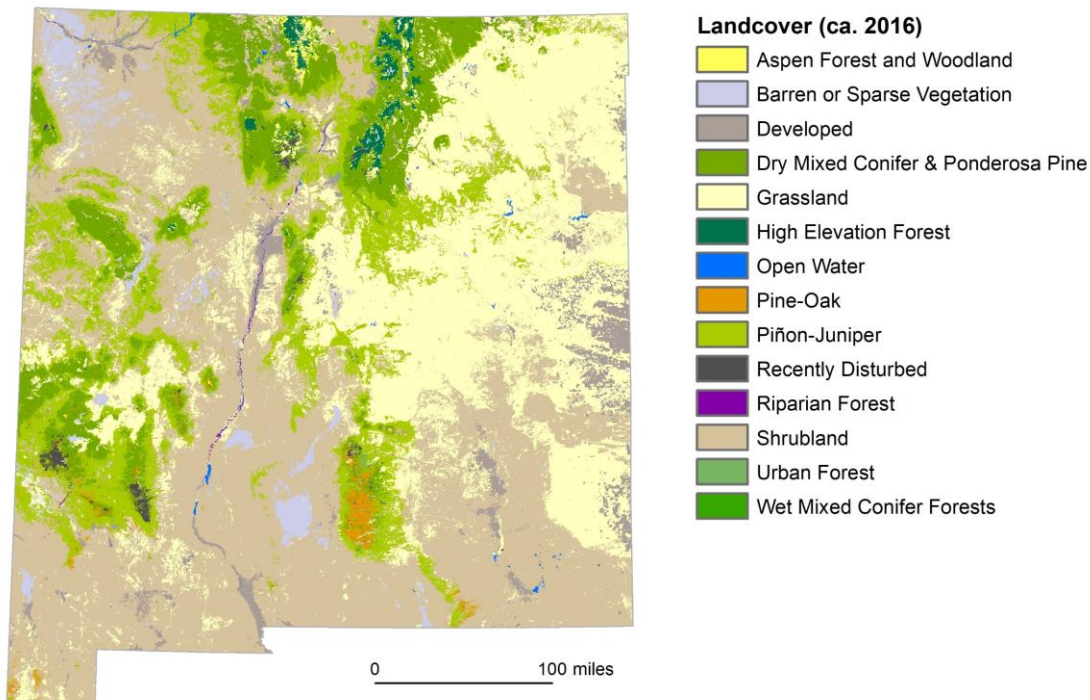
Table 6. Forest Inventory and Analysis estimate of forest/woodlands by jurisdiction.

<i>Land Use - Major</i>				
<b>Ownership Class</b>	<b>Total</b>	<b>Timberland</b>	<b>Reserved Forestland</b>	<b>Other Forestland</b>
<i>----- Acres -----</i>				
Total	24,625,323	4,295,190	1,567,794	18,762,339
National Forest	7,749,958	2,574,425	1,181,520	3,994,013
National Park Service	165,514		165,514	
Bureau of Land Management	2,783,752	36,415	136,813	2,610,524
Fish and Wildlife Service	63,667		63,667	
Dept of Defense	704,529			704,529
Other Federal	70,392		6,005	64,387
State	2,204,148	128,109	14,276	2,061,762
County and Municipal	47,366	13,589		33,778
Private	10,835,997	1,542,651		9,293,346



Table 7. Forest Inventory and Analysis estimate of forest/woodlands by forest type.

Ownership Class	Ownership Group				
	Total	National Forest	Other Federal	State and Local	Private
----- Acres -----					
Total	24,625,323	7,749,958	3,787,854	2,251,514	10,835,997
Pinyon / juniper group	13,668,376	3,591,182	1,676,704	1,165,774	7,234,716
Douglas-fir group	907,608	584,012	-	30,132	293,464
Ponderosa pine group	2,615,857	1,581,804	92,636	68,485	872,932
Fir / spruce / mountain hemlock group	822,608	594,915	17,686	24,248	185,760
Other western softwoods group	104,343	63,736	-	-	40,607
Oak / hickory group	4,307	4,307	-	-	-
Elm / ash / cottonwood group	74,095	6,005	-	23,569	44,522
Aspen / birch group	422,667	291,237	5,676	6,026	119,728
Other hardwoods group	1,436	-	-	1,436	-
Woodland hardwoods group	4,391,607	804,745	1,271,777	752,372	1,562,713
Exotic hardwoods group	24,464	-	-	-	24,464
Nonstocked	1,587,954	228,015	723,375	179,473	457,091



Map 55. Generalized landcover classification.

Table 8. Landcover by ownership.

Landowner	Sparse Vegetation	Grassland	Shrubland	Forest & Woodland	Riparian Forest	Urban Forest	Recently Disturbed <sup>3</sup>	Developed	Open Water	Total
----- Thousands of Acres -----										
Bureau of Land Management	332	1,812	10,089	1,150	5	4	8	94	8	13,502
U.S. Forest Service	135	616	1,114	7,037	29	6	248	20	2	9,208
Department of Defense	261	162	2,012	99	1	1	1	20	2	2,558
National Park Service	148	43	128	132	1	0	20	3	0	476
U.S. Fish and Wildlife Service	10	72	269	19	4	0	0	4	3	383
Department of Agriculture	1	6	102	0	0	0	0	0	0	109
Bureau of Reclamation	1	19	33	15	1	0	1	3	13	86
U.S. Department of Energy	0	1	18	16	0	0	0	2	0	36
Other Federal Agency	0	0	1	0	0	0	0	0	0	1
Sovereign Tribal Nations	831	785	4,252	2,100	24	9	23	225	12	8,262
Private	339	15,587	10,000	5,079	86	111	30	2,593	68	33,893
NM State Trust Lands	122	3,479	4,393	842	4	3	5	160	3	9,010
NM Dep. of Game and Fish	1	22	56	91	2	0	0	4	3	179
NM State Parks	1	19	52	8	8	0	0	4	22	114
<i>Total</i>	2,185	22,623	32,518	16,587	165	135	337	3,131	136	77,818

## Rare Plant Conservation Strategy

A total of 4,204 plant taxa have been documented in the state; this includes 235 rare and endangered plant species, of which 109 are endemic (i.e. they only occur in New Mexico and nowhere else in the world). The New Mexico Rare Plant Conservation Strategy (NMRPCS) promotes stewardship of New Mexico’s rare and endangered plants through active collaborative partnerships. The Rare Plant Strategy (#5) in this document is intended to summarize but not replace the NMRPCS which emphasizes a coordinated approach to address impacts to New Mexico’s rare and endangered plants and provide for their long-term conservation and stewardship.

The NMRPCS’s proactive conservation measures and guidelines provide more consistent protection and coordinated management of rare species, reducing potential conflicts and supporting current land use and resource management planning efforts in the state. The NMRPCS promotes stewardship of New Mexico’s rare and endangered plants and provides conservation tools to document current

population status, address population declines and habitat loss, and provides management tools and actions required to preclude the need for federal listing under the Endangered Species Act and to achieve recovery of some of the most imperiled species in the state.

The Division developed the NMRPCS in coordination with the New Mexico Rare Plant Conservation Partnership (NMRPCP) which includes state, federal, and tribal agencies, non-governmental organizations, and interested citizens. The NMRPCS aims to achieve results through a collaborative approach that is based on the best available science, close coordination, data sharing, and taking strategic action.

Most of New Mexico’s rare and endangered plants are considered rare because they are restricted to very specific, narrowly distributed habitats. Some species have such small distributions that they are highly vulnerable to stochastic extinction events

<sup>3</sup> Mapped as not recovered from a recent disturbance such as wildfire.

which may be caused by flooding, fires, invasive species, predation, or human caused disturbances. Primary human caused threats include habitat destruction and alteration, climate change and related ecological changes, resource extraction, (e.g., energy development, mining, water development), urban development and expansion (including road construction and maintenance), recreation, and livestock overgrazing.

Most of New Mexico's rare plants occur in mountainous ecoregions (71%), primarily in the AZ/NM Mountains ecoregion (55%). These ecoregions support large concentrations of highly endemic plant species and include many of New Mexico's most highly ranked Important Plant Areas (Map 56). Many of these species are restricted to the high elevations of sky islands, isolated mountain ranges surrounded by radically different lowland environments. These include the Mogollon Mountains, Black Range, White Mountains, San Andreas Mountains, Organ Mountains, and Sacramento Mountains of southern New Mexico, which contain the largest number of endemic plant species in the state. High elevation species with

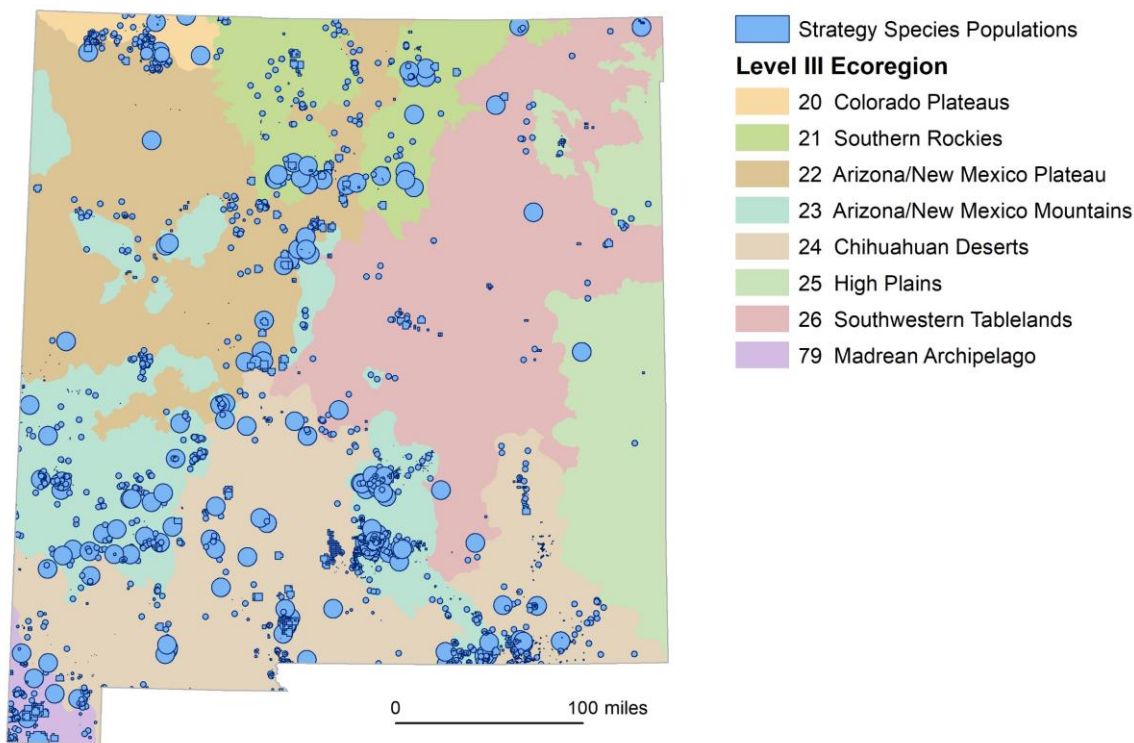
restricted ranges are considered most vulnerable to impacts associated with climate change, including prolonged drought, increases in fire frequency and severity, invasive species, and changes in community composition.

Thirty-four percent of Strategy Species occur in the Chihuahuan Deserts Ecoregion. Deserts are highly vulnerable to habitat alterations caused by climate change and associated impacts, livestock grazing, and water and energy development projects. The Chihuahuan Deserts Ecoregion is the most human impacted ecoregion in New Mexico, altered by urban expansion and development, livestock grazing, water development, agriculture, landscape wide herbicide treatments, and oil and gas development.

*Table 9. Distribution of Strategy Species in New Mexico by land ownership. See Acronyms list for full agency names. Element Occurrences (EOs) are groups of species locations that act as operational populations or sub-populations for tracking species-specific changes in distribution and population status and trends.*

Ownership	Land		
	Number of Strategy Species	Percent of all Element Occurrences	Ownership in New Mexico (acres)
BLM	114	20.98%	13,485,536
BOR	5	0.18%	54,483
DOA	1	0.04%	109,464
DOD	33	12.04%	2,515,789
DOE	4	0.14%	36,491
USFS	130	27.02%	9,217,460
USFWS	17	1.26%	383,163
Tribal	65	8.89%	8,228,727
NPS	26	1.94%	475,185
Private	156	20.73%	34,019,743
SLO	57	5.86%	8,983,019
NMDGF	8	0.40%	199,577
NMSP	10	0.47%	118,917





Map 56. Distribution of Strategy Species across New Mexico's 8 Ecoregions.

Climate change is not only expected to affect species directly, but also to have significant impacts on their habitats and the ecological systems on which they depend. This is likely to exacerbate the effects of other human activities on plants. Impacts associated with climate change include prolonged droughts, increased fire frequency and severity—including severe habitat alteration caused by megafires—and increases in invasive species (plants and animals); all of these can alter associated plant communities. The impacts are especially significant for small populations with restricted ranges, including many of the species endemic to New Mexico.

One of the central issues impeding conservation of New Mexico's rare plant species is a general lack of baseline information (species abundance, distribution, and status) in addition to a lack of knowledge about the basic biological requirements (pollinators, seed dispersal, seed bank viability, etc.) of rare taxa. Without such documentation, land managers and regulatory agencies are not able to make meaningful decisions to protect and conserve New Mexico's most rare and endangered plant species.

Strategy 5 in this document, in concert with the NMRPCS, serves as a reference for priority actions needed to maintain and improve the status of rare plants in New Mexico and to strategically guide future plant conservation actions.

## Forests of New Mexico

The woodlands and forests of New Mexico are extremely complex and difficult to accurately describe in a few paragraphs. This simple overview separates forests into life zone categories based on dominant trees starting from the top of the mountain with spruce-fir forests to mixed conifer, then ponderosa pine (Transition Zone), piñon-juniper woodlands, and ending with discussions on the bosque, which are the gallery forests along rivers, and the urban forests. Elevation, aspect and latitude influence where these types are most likely to occur as depicted in Figure 4.

The following brief descriptions include general information intended to whet the reader's appetite for deeper study. For almost every statement found in this section, there is an example somewhere of a site where that statement isn't true—a wonderful aspect of working in a diverse natural environment.

Understanding basic observations that hold true for most of the forest in each life zones presented here can help the manager recognize those locations where something different is occurring.

### High Elevation Forests or Spruce-Fir Zone

Starting at the highest elevation forests which form the tree line on peaks high enough to include alpine tundra, generally include Engelmann spruce, subalpine or corkbark fir, bristlecone pine, aspen, and limber pine. Engelmann spruce spans the broadest elevational range of these trees and can be found in pure spruce stands at elevations too high for corkbark fir, as well as in wet mixed conifer stands to low for corkbark fir that may even contain some ponderosa pine. In contrast, corkbark fir has a narrow elevational range; at its lowest elevation, it is found in the coolest of the wet mixed conifer stands and higher up it grows in stands with only Engelmann spruce. Bristlecone pine is generally limited to microsites and is the characteristic stunted Krumholtz tree (though any species can have this form) found at tree line in severe wind-blown locations; however bristlecone pine is often mixed with spruce-fir in early to mid-successional

high elevation forests. Aspen is common in the lower reaches of this life zone but tends to have a lower upper elevational limit than any of the other trees in this life zone.

One of the unique features of these forests are shallow root systems that often become interlaced with each other (see photos). In general, this feature makes this forest rather windfirm when left intact, and prone to blowdown if some trees are removed or killed. Therefore, most management in this type avoids activities that thin trees in preference for removing patches of trees. However, in areas such as high mountain subdivisions, thinning has been successful when done over time, removing a small number of trees, allowing time for root systems to stabilize before removing a few more, until over time, a more open stand density is reached.



This group of trees blew down on the Brazos Box Ranch showing the interconnected root systems. © Mary Stuever/NMFD

Spruce-fir forests, where snowpacks linger into early summer, are the source of much of New Mexico's water. Historically, they have been less likely to experience wildfires, and the fire return intervals are reported in hundreds of years, and fire, which only occurs under the driest conditions, usually results in stand-replacing events.

These forests are vulnerable to changing climate conditions. Recently, outbreaks of Spruce Bark Beetle, Spruce Budworm, Fir Engraver, and various pests and diseases on aspen have been more widespread, lasted longer, and caused more extensive mortality than previously experienced. These outbreaks are linked to drier, warmer conditions. The impact of increased fuel loads from this mortality on fire behavior and post-fire effects is yet to be widely understood.

### Mixed Conifer Forests

Mixed conifers forests are generally found below the spruce-fir belt and above ponderosa pine, though aspect and drainages are likely to trump this pattern in various locations. Most mixed conifer stands contain white fir, douglas-fir and aspen. In the wetter, higher stands, Engelmann spruce is a frequent component, and subalpine fir is added with an increase in elevation. On the lower end of the zone ponderosa pine, oak, rocky mountain juniper, and occasional piñon pine are also found. Generally scattered through the stand, but rarely a dominant tree species, are the white pines. Limber pine is primarily found in the northern part of the state and southwestern white pine in the southern part, but both have been found to have rather broad ranges. Blue spruce also occurs in this zone and generally occurs in cold drainages and lower slopes where cold air gathers.

Aspen is a common and complex component of many mixed conifer stands. In fact, some aspen stands are considered stable, and do not have any conifer trees in them at all. In most stands, though, aspen is an early successional tree that thrives in sunlight. It regenerates from established root systems through suckering, or it can become established by seed. Trees that share the same root system are clones. These stems share similar properties such as resistance or susceptibility to insects and disease, timing and coloration of fall foliage, and similar branching patterns.

The distinction between wet and dry mixed conifer forests is a continuum with many acres and plant associations being between classic dry and classic wet mixed conifer. The concept is useful, though, to distinguish fire regimes between the classic types and then interpolate potential fire activity for those stands that fall in the ecotone between the classic types.

Wet mixed conifer stands have a strong affinity to the spruce-fir forests found just above them in elevations. They often contain both subalpine fir and Engelmann spruce, as well as the suite of

typical mixed conifer trees (white fir, Douglas-fir, limber or southwestern white pine, blue spruce), and if ponderosa pine is present, it is clearly a seral tree decreasing in abundance as the forest canopy becomes dense. Aspen is the more common deciduous tree in wet mixed conifer stands. The understory typically forms a luxuriant herb-dominated carpet. Mid-story trees such as maple and forest willow may be common.



Aspens in the fall along the Cumbres & Toltec Scenic Railroad  
© Mary Stuever/NMFD

Ponderosa pine and Douglas-fir are more dominant in the overstory of dry mixed conifer stands.



Subalpine fir is absent, or if present, is in microsites; Engelmann spruce, however, may be present. In stands where fire has been excluded, white fir is typically dominant. Oak is the more common deciduous tree in dry mixed conifer stands.

Understory species are varied, but often bunchgrasses and/or shrubs such as Gambel or wavyleaf oak (other oaks in southern New Mexico),

### **Ponderosa Pine Forests**

Like all of these broad forest types, ponderosa pine forests are extremely diverse, despite this zone being less complex than either the woodlands below or the mixed conifer above. For example, there are 19 described plant associations in the Southwest region just within the ponderosa pine series, which does not include many mesic ponderosa pine types that are described in the douglas-fir and white series. Much of the research in ponderosa pine has been centered around Flagstaff, Arizona—home to Northern Arizona University’s College of Forestry—and primarily focused in five of these plant associations.

The transition zone, dominated by ponderosa pine forests in the Southwest, is representative of the fire exclusion legacy that is core to stand density issues in forests throughout the west. This situation is further discussed in the next section on fire.

Today, most forest management activities in the ponderosa pine dominated forests are designed to restore forest stand densities to pre-settlement

### **Piñon-Juniper Woodlands**

Piñon-juniper woodlands are the largest forest type in New Mexico (over 13 million acres). There are 68 woodland plant associations described in the Southwest. Although this moderate climate zone includes the most human habitation, it is the least studied of our forest types. There are several ways to define and classify p-j woodlands (for example grass-dominated versus shrub dominated) but a useful classification based on historical stand structure, disturbance regimes, and landscape dynamics include this breakout: 1) persistent piñon-juniper woodlands, 2) piñon-juniper savannas and 3) wooded shrublands.

New Mexico locust, or buckbush. Most of these stands, under a natural fire regime, are dominated by ponderosa pine, and in the bunchgrass or oak understory-dominated plant associations may resemble plant communities in the ponderosa pine zone. However, these stands are generally more mesic (wet) and productive.

levels and patterns. Ponderosa pine historically grew in open stands, but also with trees in groups and clumps. The management goal often is to maintain these stand densities by restoring fire, either through managing wildfire or using prescribed burning, to avoid treated stands returning to dense, overgrown condition which occurs when fire is excluded.



Restoration project in winter in the Zuni Mountains © Clayton Benton/NMFD

In general, woodlands with both piñon and juniper trees are at higher elevations than woodlands where only junipers occur. Within these juniper savannas, alligator juniper is typically higher than Utah juniper which is typically higher than one-seed juniper. Rocky Mountain juniper is typically found at higher elevations, but since it is generally found with other conifer species from the piñon-juniper zone up through mixed conifer, it rarely forms pure juniper savannas except at higher latitudes.

Drought conditions in the last two decades have increased piñon pine mortality rates to about 8%.

## VI. Background

That includes mortality from insects, but also more fires are burning large landscapes in the woodlands than previously recorded in recent times.

One of the key concerns for management in woodland habitats are the numerous bird species of concern, including (in priority order) Pinyon Jay, Juniper Titmouse, Virginia's Warbler, Woodhouse Scrub Jay, and Gray Vireo. The Pinyon Jay is listed by the New Mexico Department of Game and Fish as a Species of Greatest Conservation Need, having experienced an 85% population loss (1970-2017), with an additional 50% of the global population estimated to be lost by 2035. The greatest threats to piñon-juniper habitats and the bird species which depend on them have included clearing for livestock grazing and extractive uses, tree cutting and thinning, and climate change impacts (drought, insects, disease).

### **Bosques or Gallery Forests**

Stands of large trees that grow along rivers and streams in an otherwise open landscape are referred to by ecologists as gallery forests. In New Mexico, the Spanish name for forests—*bosque*—is applied to these ribbons of vegetation. Historically the dominant tree of New Mexico's bosque is the Rio Grande cottonwood, although the species of cottonwood varies geographically. Today, non-native shrubs often dominate, primarily Russian olive and saltcedar, though in places Siberian elm and tree-of-heaven can also dominate. Although cottonwood is a thick-bark tree, the bark is sensitive to fire. Meanwhile saltcedar thrives in fire environments by resprouting prolifically. With regulation of river flows via upstream dams, bosque conditions are now more prone to fires than in pre-settlement times when the major disturbance events were typically flooding.



Woodland near Mountainair, Torrance County © Clayton Benton/NMFD

Saltcedar and Russian olive require cross-boundary coordination to control them adequately. In addition, Early Detection and Rapid Response (EDRR) should be emphasized with external partners. EDRR requires (1) early detection, (2) rapid assessment, and (3) rapid response. EDRR helps to stop establishment of invasive species before eradication becomes impossible and management expenses become unreasonable. Even the best restoration efforts may not return a site or ecosystem infested with invasive species to its desired condition as these species can overwhelm or interfere with natural processes associated with ecosystem recovery. Therefore, it is ideal to prevent or control invasive species before rehabilitation or restoration is required.





Bosque on the Bernalillo District © Clay Benton/NMFD

### Urban and Community Forests

The community forest includes all trees, woody vegetation, and associated natural resources within and around the inhabited area of a community. Community trees include those found in parks, on streets, in neighborhoods and yards, at schools or commercial/industrial areas, and any trees within the wildland-urban interface between communities and adjacent forests.

While urban and community lands and their corresponding forests account for just 2% of New Mexico's total land area, close to 80% of New Mexicans live in these areas. The urban forest provides essential benefits such as carbon sequestration, air pollutant removal, oxygen production, stormwater runoff reduction, water pollution filtration, and temperature regulation resulting in the reduction of greenhouse gases through energy savings.

Healthy urban forests help solve many community problems. Urban forests create safer and more sociable communities, reducing physical and mental stress, improving local economies, decreasing noise, and providing a sense of place.

### Fire's Role on the Landscape

Ecologically, disturbances naturally provide conditions that favor the success of seral species over climax species. When disturbances, such as insect outbreaks or fire, occur over time and in scattered locations, the landscape hosts a mixture of diverse ecosystems and niches, representing many different expressions of plant communities and habitats across the landscape. In contrast, when a disturbance impacts a large landscape, such as a megafire that burns dozens of watersheds contiguously, this diversity of ecosystems is greatly reduced.

Megafire is a recent term used to describe very large fires that burn at a high intensity over a significant

portion of landscape. Mega-fire as a term is recent because the phenomena is recent. Scientists believe the size of fires today is not too different from fires that burned across the landscape in pre-settlement times, but the intensity of these fires is much greater over more area. This shift in intensity is tied to the exclusion of fire as a natural disturbance activity over the past century.

This legacy of fire exclusion is best identified by studying fire scars in tree rings. Fire scars in tree rings have been studied throughout the Southwest. This data indicates that low intensity surface fires occurred quite frequently, sometimes annually for several years in row, and then possibly skipping



several decades. The average fire return interval in most ponderosa pine stands was around 6-10 years between fires in the eighteenth and nineteenth centuries. There are very few fire-scarred trees that record fires in the twentieth century.

The fire scars studied indicate that, before European settlement, fires occurred throughout the seasons, indicating that fires were not only naturally ignited. Indigenous burning may have included intentional burning as well as accidental fire starts. Early newspaper accounts captured conflict between European settlers' desire to avoid fire and native burning practices.



Researcher examining fire-scarred sample at Bandelier National Monument  
© Susan Rich/NMFD

With the introduction of the railroads, access to markets allowed for extremely large numbers of sheep and cattle to graze forests, reducing grass cover that had been carrying fires across the landscape. Later, with numerous uses of aircraft for firefighting developing in the mid 1940s, effective firefighting continued this pattern of keeping fire off the landscape. In the absence of fires, stand density increases, and where site conditions allowed, shade tolerant trees such as white fir and douglas-fir became more dominant.

Tree seedlings experience high mortality under frequent, low intensity fire conditions. Through evolutionary pressure where fires were quite common, many Southwestern conifers developed mechanisms for prolific regeneration. When human activity on the landscape created conditions where fires were no longer widespread, seedling survival increased exponentially. Space between trees filled

in with new recruitment over the decades, transitioning stands from open grown trees with grassy understories to dense, multi-layered carpets of trees filling in meadows and covering hillsides.

This story applies to ecosystems that previously experienced frequent fires, but not to all New Mexico forests. Foresters can use historic fire pattern and severity information to design treatments that can restore forest stands to more natural conditions or restore grasslands where woodland trees or shrubs have encroached. Lower elevation montane forests typically experienced higher frequency, less severe fires. These forests include most ponderosa pine stands, drier mixed conifer stands, and various, but certainly not all, regions of piñon-juniper woodlands.

Higher elevation forests experienced less frequent and often more severe fires, which created small to large openings where young conifers or aspen regenerated over time. Insect outbreaks have also been a significant driver of disturbance cycles in high elevation forests. Although fire exclusion may not be as significant, changing climate conditions are radically influencing insect outbreaks resulting in widespread tree mortality in geographic scales that are outside of historic experience. Since the return interval of stand replacing fires is quite long, managers are just beginning to witness the impacts of large fuel loadings from insect killed trees on landscapes that subsequently burn. One major concern is post-fire erosion on these vulnerable landscapes.

Piñon-juniper woodlands are quite diverse, and do not share a common history in terms of fire from both geographical and structural lenses. As these stands occur in the most temperate regions of our forest ecosystems, human occupation in this zone has been a strong influence for thousands of years. Some stands are thought to have a frequent fire history, though not as frequent as ponderosa pine. In other stands, scientists have found no evidence of fire having occurred in the area.

Although fire is common today in cottonwood bosque, fire was probably quite rare in the past, and flooding, which is rare today due to major river regulation, was the dominant disturbance factor. Non-native woody species, especially saltcedar, seem to thrive when burned and to generate a frequent fire cycle. Meanwhile, the native cottonwood, even though it does sprout after fire, is often reduced in dominance.

Although it may take centuries for forests to return after intense crown fires, managers are even more concerned about the tens of thousands of years necessary to replace soil that is lost in post-fire flooding and debris flows. The shift from large fires of low intensity to large fires of high intensity has exponentially exposed soils to landscape scale movement after mega-fires. Most mega-fires are mapped for burn severity into three categories- low, moderate, and high.

The low category of soil burn severity indicates that there was only partial consumption of fine fuels and litter coverage, to some extent remains, on the soil surface. Residence time at the soil surface in low burn severity areas was short, leaving root systems and structure intact. Recovery time in the low category will vary based on ecological community but is expected to be relatively short.

A moderate category of soil burn severity indicates consumption of litter and fine fuels at the soil surface. In forested communities, the heat from moderate severity fire will result in water repellent conditions at the mineral soil surface. The canopy in the moderate forested system is browning and it is expected that although there is high mortality in the trees in this area, they will drop needles and leaves that can provide some litter cover at the soil surface. In these systems, recovery can take longer for tree species to reestablish.

## Economic Role of Forest and Woodlands

New Mexico's forests and woodlands play an important role in providing the state with economic commodity and non-commodity benefits. Economic commodity benefits from forests include traditional wood products such as timber, vigas, latillas, firewood and biomass. Non-commodity benefits, often referred to as ecosystem services, cover the broad range of benefits from forests that currently do not have market

A high soil burn severity category is the result of higher intensity fire behavior or longer residence time at the soil surface. This category is found in forested or dense woodland communities and the litter and fuels, including an overstory canopy, was consumed. The soil structure is weakened, roots are charred, and water repellent soil conditions persist through the upper horizon of mineral soil. Recovery time in the conifer systems can be significant.

Many recent fires have seen 25-60% of the area in the moderate and high severity categories, although the Ute Park Fire (2018) near Cimarron, New Mexico was around 85% moderate and high severity. This fire provides a good example of the threat of flooding and debris flows when the summer rains follow a wildfire (see photo). Often communities and homeowners find that post-fire impacts are a greater catastrophe to manage than the wildfire itself. Information on responding to the post-fire environment can be found on the [After Wildfire NM website](#).



The New Mexico Department of Transportation utilized concrete K-rails to reduce sediment washing off the Ute Park Burn on Highway 64 west of Cimarron, NM. © Mary Stuever/NMFD

values such as the production of clean water, recreation and scenic values, and the sequestration of carbon. Below is a summary of current research and data for timber, biomass, non-timber forest products, outdoor recreation, hunting and fishing, water and carbon in New Mexico.

### Timber

New Mexico's timber harvest volume and processing capacity has continued a steady decline since its peak in the latter part of the last century and since the last Forest Action Plan. While the latest science along with landscape -scale disturbances in the last 30 years has driven New Mexico to prioritize a forest restoration economy, timber harvesting still provides real economic value to the state and its capacity to offset restoration costs is an important tool in achieving successful strategy outcomes as detailed in this plan. A recent study by the USGS and The Nature Conservancy has shown that every one million dollars spent on landscape-scale forest restoration treatments in western states supports an estimated 26 jobs, \$1,274,000 in labor income, \$1,549,000 in value added, and \$2,231,000 in economic output.

The most recent census of the primary forest products industry in New Mexico conducted in 2012 showed a 27 percent decline in timber harvest volume since the last census in 2007, which in turn was approximately half of the 2002 harvest numbers. The economic value of New Mexico's timber harvests in 2012 across all lands was \$37.1 million in sales of finished wood products and mill residues from a harvest of 22.9 MMBF Scribner, including 0.4 million board feet from Colorado and Montana that were processed in New Mexico. The resulting products and sales include the following:

- Lumber, mine timbers, and other sawn products (\$10.7 million)
- Vigas/Latillas (\$3.7 million)
- Log homes, log furniture, post, poles, firewood, and bark products (\$22.7 million, 19%)

### Woody Biomass

Woody biomass can offer environmental and societal benefits. When used for renewable energy it can reduce the dependence on fossil fuels, increase energy security, decrease disease and insect outbreaks,

Ponderosa pine was the leading species harvested, accounting for 54 percent of harvest volume, followed by Douglas-fir (19 percent), other species (15 percent), true firs (8 percent), and Engelmann spruce (4 percent).



Vigas coming off the sawmill. © Carmen Austin/NMFD



lower carbon footprint, and help reduce severe wildfire hazards. However, there are still significant hurdles to overcome before its financially sustainable.

A study conducted by the USFS Rocky Mountain Research Station and University of Montana found commercial timber harvesting sites in Arizona and New Mexico was conducted from 2012 to 2017 to estimate growing-stock removals, characterize current tree utilization and logging operations, and assist with estimating the amount of wood biomass left on-site after harvesting. Different harvesting prescriptions and mill infrastructure contributed to the utilization differences between the two States. Remarkably, New Mexico's growing-stock residue factor was discovered to be 170% greater than Arizona's in the study, which is largely due greater quantities of upper tree bole material left unutilized on New Mexico treatment sites as compared to Arizona's sites.

Biochar is an emerging new industry that is dependent on consistent supplies of woody biomass. A 2018 Market Analysis by the Council of Western State Foresters found biochar markets can help support rural economic development as capacity is built to create value from under-utilized forest biomass. Possible uses for biochar include soil restoration, farm and garden applications, and filtration.

Firewood is a staple for many rural families that rely on wood for heating and cooking. The gathering of firewood is often tied to seasonal family outings, and firewood sales also provide an income source in subsistence economies.

### **Non-timber Forest Products**

New Mexico's forests provide cultural ecosystem services that are culturally important, and contribute to traditions, livelihoods, and well-being of social groups including, but not limited to, indigenous and Hispanic communities. Tribes, nations, and pueblos continue to depend on non-timber forest products such as piñon and sagebrush for food, materials, and medicines to support subsistence and ceremonial activities. Osha has a long history of use by the Hispanic community as its roots are used to treat the common cold, flu, sore throat, and other ailments. Firewood is commonly used to heat homes and cook meals, especially in northern NM. Other notable products include Christmas trees, post and poles, tree sap, and wildflowers. Harvesting and the use of non-timber forest products provide powerful ways for indigenous, Hispanic and other communities to reconnect with or maintain cultural heritage, lands, and resources.

### **Outdoor Recreation**

Outdoor recreation is a diverse field that includes hunting and fishing, camping, hiking, floating rivers, sailing, paddle boarding, rock climbing, driving scenic byways, and much more. Often New Mexico's forests are key to these activities. Residents and tourists alike spend money on equipment, access, meals and lodging in pursuit of their favorite activities.

The outdoor recreation economy in New Mexico currently makes up approximately 2.5% of the total state Gross Domestic Product (GDP)—or \$2.3 billion. Over 33,500 people are employed in this field, more than in either farming or manufacturing. New Mexico established an Outdoor Recreation Division within the state's Economic Development Department in 2019 to developed coordinated efforts to make this sector a powerhouse of the state's economy. Efforts include developing secure, stable, well-paying jobs and building pathways from pre-Kindergarten through higher education to develop student interest in working in and for the outdoors. The Outdoor Recreation Division measures success by impacts to five key areas: sustainable economic development, conservation and access, equity, education, and health and wellness.

New Mexico is home to many stellar outdoor recreation facilities, including New Mexico's 35 state parks, 5 national forests, 2 national parks, 2 national historical parks, 1 national heritage area, and 11 national monuments. There are many stellar privately owned properties catering to outdoor recreation such as the

Boy Scouts of America's Philmont Scout Ranch, a high adventure base that hosts over 25,000 visitors each summer.

This Forest Action Plan is coordinated with strategies of the Office of Outdoor Recreation and provides strategy around educational outreach and engaging private landowners in developing outdoor recreation opportunities.

### **Hunting, Fishing, and Wildlife-associated Recreation**

One of the largest economic impacts involving people in the outdoors is hunting, fishing, and trapping. In New Mexico in 2013, the New Mexico Department of Game & Fish estimated that over 200,000 people participated in hunting, fishing and trapping (over 3 million days involved) and spending over \$600 million. This study also estimated the multiplier impact of these activities employed nearly 8,000 workers and generated \$454 million in State GDP and \$106.5 million in tax revenues. Generally, there are more than two times as many anglers in the state as hunters, but hunters spend more per day than anglers.

Another wildlife-associated activity is birding. A 2006 study conducted by the U.S. Fish and Wildlife Service identified birders nationwide as generally white (85%), average age of 50 years old, and better than average income and education. Participation was greater by women than men (54%/46%). In New Mexico a little over 1/5<sup>th</sup> of the population participated that year in bird watching. This study estimated the national economic impact of bird watching in 2006 as \$82 billion.

### **Water Quality and Water Supply**

The value of water in New Mexico is difficult to quantify because some of those values are intangible and because the tangible values are highly variable by region and use. However, nobody argues the fact that water is among the most precious commodities in a state that receives, on average, only 13.5 inches of annual precipitation.

Forests are key determinants of water supply, quality, and quantity. In the Western U.S., approximately two-thirds of the water supply comes from forested regions, and the majority of snowmelt originates from mountain forests. The Rio Grande Basin, which provides drinking water to the cities of Albuquerque and Santa Fe and irrigation water to much of the state, receives 29 percent of its water from National Forest lands alone.

New Mexico relies on approximately 3.8 million acre-feet of surface water and groundwater combined to supply its water needs. Most of the state's surface water originates in high elevation watersheds and is utilized by withdrawals from a heavily regulated system of dams, reservoirs and diversions. A 2014 New Mexico First report on New Mexico water contends "It is not an understatement to say that New Mexico's entire economy and current way of life relies on this...system."

Recognizing the importance of healthy forests and watersheds to New Mexico's water supply, the State Water Plan recommends that state, tribal, federal, and private land managers intensify efforts to manage these areas in order to improve resilience to drought and fire, and that funding entities prioritize funding for planning and implementing forest treatments, particularly in watersheds that impact streams which supply or deliver surface water to public water systems. A 2019 analysis by the USFS Rocky Mountain Research Station indicates that treating areas prioritized for protecting water quality and water supplies in New Mexico had correlated reduction in wildfire risk to communities.

### **Carbon**

Carbon, or CO<sub>2</sub>, can remain in the atmosphere for up to 200 years once emitted—unless another process removes it. Removing CO<sub>2</sub> from the atmosphere is known as sequestration. Our forests, grasslands, and

agricultural lands have a large part to play in absorbing CO<sub>2</sub> even as we work towards fewer emissions. We must also reduce emissions produced *from* these natural and working lands—for example, by reducing wildfire risk and managing our forests through prescribed burns. Greenhouse gas emissions reductions from natural and working lands climate strategies can be variable, depending on local conditions and long-term land management practices.

Many of the strategies in this Plan improve cross-boundary, landscape -scale ecosystem management and bolster the sequestration capacity of state's forests, including four key approaches. The first (see Strategy 1) is to reduce wildfire risk by enacting landscape-scale fire mitigation treatments and use the biomass removed from forests through these treatments in low-carbon bioproducts. The second (see Strategy 6) is to create reforestation policies to use existing science and expert advisors to develop a state strategy to collect, grow and incorporate drought tolerant plants in reforestation efforts. The third area (see Strategies 2 & 3) is managing smoke emissions by encouraging prescribed burning that will ultimately reduce emissions from catastrophic wildfires. Forestry Division is establishing policies and programs to give private landowners the ability to conduct prescribed burning on private lands. These efforts focus on limiting landowners' liability while maximizing training and providing a qualified prescribed burner network throughout the state. The division will ensure that all prescribed burn plans, policies and regulations include a section for smoke management and human health considerations. Finally, the Urban and Community Forest Strategy (Strategy 7) addresses carbon both through the reduction of emission by lowering cooling and heating costs, but also sequestration of carbon in the urban forest.

Through its Healthy Soils Program launched in 2019, NMDA is partnering with New Mexico State University's Cooperative Extension Service (NMSU Extension) to conduct education and outreach on best management practices to enhance carbon sequestration established by that Natural Resource Conservation Service (NRCS) for agricultural producers. The Healthy Soils Program projects also work with NRCS to develop carbon farm plans. NMDA and the NMSU Extension are identifying partners and support to develop science-based inventory methods for understanding how land produces and absorbs carbon. Over the next five years, this effort will create a working lands data repository which will include forests, using data collected on the ground and with remote sensing imagery to assess and document factors such as land use and land cover, primary and cover crop types, and soil type and moisture content.

## Estimating Restoration Needs

This section describes the thinking and background information utilized to estimate treatment goals identified in Strategy 1.1. of 300,000 acres/year collectively treated on all lands, and 140,000 acres/year of treatments on state and private lands. Estimating how much restoration work is needed for New Mexico forests to be resilient for future climate conditions and to temper extreme fire behavior resulting from a legacy of fire exclusion is challenging. The Division utilized available research and data, but also relied on internal and external professional opinion to develop the estimate presented in the strategy. The recommendation to annually revisit this estimate stems from the continual increases in knowledge, including new research, new data and data modeling capabilities, and increasing collaboration on tracking treatments and treatment needs. This discussion is included to explain how this value was estimated and calculated, and to provide a springboard for continued work toward identifying the extent of the need for forest management activities.

This estimate builds on previous efforts to identify the extent of work ahead of us. Given the century plus of large-scale fire exclusion in western forests, the goal of restoration is enormous. The Rio Grande Water Fund Comprehensive Plan (2014) suggested that 1-2% of fire adapted forest landscapes would need to be treated each year to change fire behavior over a 20 year period, which, if this estimate did not include maintenance



entries on already treated acres, would suggest treating 20-40% of the landscape that has a frequent-fire history. The Forest and Watershed Restoration Institute prepared an estimate that included costs in the March 2015 newsletter, *Forests and Watersheds: A Newsletter for Decision Makers*. Previous estimates tend to factor in the current and practical potential capacity for agencies so that estimates have a realistic expectation of accomplishment. Although this is a useful process for determining agency targets, the goal for this strategy is to provide an estimate of the number of acres throughout the state (all landowners and land managers) that need to be treated each year in order to achieve and maintain resilient forests across the landscape. This number can then be compared with number of acres treated, with a goal of continually closing the gap between need and accomplishment.

The key questions that inform an estimate of annual target for acres treated are:

- How much forest land needs to be treated for a landscape to be resilient?
- How often does a stand need to be treated to maintain resilience?
- How does prioritization influence success?
- What kind of treatments are being used, and how do those treatments influence return intervals for additional treatments?

If costs are also being estimated, then an estimate needs to be made on how much of the treatments are mechanical (more expensive) versus burning or herbicide treatment (less expensive).

If every acre of forest in New Mexico was covered by a forest management plan that identifies what treatments are recommended to achieve or maintain forest resilience, the practical approach to this problem would be to sum the totals of all the plans. At some point in the future, a shared database of various forest plans may produce an accurate accounting of forest management needs. In the meantime, this estimate provides a reach goal and establishes a challenge for re-imagining how forest managers and society can work together to reach this goal.

### **Estimate for all jurisdictions**

The first step is to determine the number of acres of forests in New Mexico to consider for forest restoration work that involves the management of tree density through either mechanical (and hand) treatments or fire. As discussed earlier in this chapter, there is not consensus among existing databases for initial numbers. For this analysis, the Forest Inventory and Analysis data was used. Since this estimate is based on ecological needs, rather than specific agency objectives, forest types were used to stratify the initial database. Initial data on acres by forest type was derived from tables generated with most current FIA collections including plot data collected from 2010-2018. (Table 10). FIA utilizes group names applied nationally which, in New Mexico, can cause some confusion because species that appear in group names such as mountain hemlock and hickory do not occur naturally in the state.

Most estimates of work needed have focused on frequent fire ecosystems—primarily ponderosa pine forest, and a portion of piñon-juniper woodlands and mixed conifer forests. Since the intention for this estimate is to compare it with the number of acres treated, and treatments occur in a wider range of ecosystems, this estimate includes all forest types including bosque and spruce-fir. The mesquite brush, which is represented in the Table 10 under woodland hardwoods group, was not considered for this analysis, although fire management in this type may increase as utilizing fire as a tool becomes more accessible to private landowners in the state.

Table 10. Acres by FIA forest group types for all jurisdictions. USDA Forest Service, Forest Inventory and Analysis Program, Tue Dec 17 17:43:29 GMT 2019. Forest Inventory EVALIDator web-application Version 1.8.0.01. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://apps.fs.usda.gov/Evalidator/evalidator.jsp>].

Forest Type Group	Total	Stand Origin	
		Natural stands	Clear Evidence of artificial regeneration
----- Acres -----			
Total	24,625,323	24,606,200	19,122
Pinyon / juniper group	13,668,376	13,668,376	-
Douglas-fir group	907,608	901,844	5,764
Ponderosa pine group	2,615,857	2,602,498	13,358
Fir / spruce / mountain hemlock group	822,608	822,608	-
Other western softwoods group	104,343	104,343	-
Oak / hickory group	4,307	4,307	-
Elm / ash / cottonwood group	74,095	74,095	-
Aspen / birch group	422,667	422,667	-
Other hardwoods group	1,436	1,436	-
Woodland hardwoods group	4,391,607	4,391,607	-
Exotic hardwoods group	24,464	24,464	-
Nonstocked	1,587,954	1,587,954	-

Utilizing the FIA data above, overall values were compiled for these five forest/woodland groups (Table 11). This value accounts for 18.6 million acres of the 24.6 million acres of forests and woodlands in New Mexico. What is not accounted for are non-stocked areas (which are addressed in Strategy 6—Reforestation), mesquite woodlands, oak woodlands, and other hardwoods.

Table 11. Total forest acres in New Mexico for 5 forest types based on FIA data in Table 10.

Forest Type	FIA Forest Type Group	Area (acres)
Bosque	Elm.Ash,Cottonwood; Exotic hardwoods	98,559
Piñon-juniper woodland	Pinyon/juniper group	13,668,376
Ponderosa pine forest	Ponderosa Pine group	2,615,857
Mixed conifer forest	Douglas-fir, aspen/birch, other western softwoods	1,434,618
Spruce-fir forest	fir/spruce/hemlock group	822,608
Total		18,640,018

The next step is to estimate how much of these forest areas need to be treated to create a resilient landscape, and how often each location needs treatment in order to maintain that resilience. To account for differences in ecosystems, a percentage of area needed to treat for each of these forest types was developed and then multiplied by the total acres for that group (Table 12). The rationale for these values follows.

## Rationale for Percent of Forest Type to Treat

### Bosque

As described earlier, the bosque is not thought to be fire adapted, although fire now is a major threat to the native species of this forest type as well as to human development within these areas. Both Russian olive and saltcedar spread prolifically where present. Removing these species from a property is not a long-term solution as long as the seed source remains upstream. Therefore, the ultimate solution to ecosystem health is to remove all of the invasive shrubs. Since wildlife are often dependent on this shrub layer, it is important to restore the native shrubs at the same time, and pace this work to allow native habitats to become

established as exotic habitats are removed. This process would eventually move the region from an invasive shrub dominated component to a native shrub dominated component.

These treatments have proven quite effective in slowing bosque fires and aiding fire suppression efforts. A primary justification for this work may be hazardous fuels mitigation in urban and suburban areas to protect life and property.

The value of treating 50% of bosque stands is an estimate, but admittedly open to change based on better information expected to be available in the near future. The rationale is that priority areas for treatment would be concentrated in order to develop geographic areas of successful exotic shrub eradication. Also prioritizing projects from upstream to downstream, stopping the expansion of these invasive plants into new areas.

### **Piñon-juniper woodlands**

The piñon–juniper forest type is the most complicated and has the least research to inform decisions. Clearly paired photos of historic and current conditions show multiple instances where there is a clear trend towards denser tree densities today, which may imply an aborted fire regime. However, other woodland types have no evidence at all of previous fire. Meanwhile, in today's conditions, fires frequently burn at high intensities in this type. As a placeholder, the value of 25% was selected for this type, yet additional research and understanding may allow for adjustment in future estimates.

### **Ponderosa pine forests**

Although an ideal goal would be to restore all the acres of ponderosa pine, the intermediate objective is to reduce the catastrophic fire behavior on the landscape. Various modeling efforts have demonstrated that treatments on the landscape can moderate fire intensity if 40% of the type is treated. Some models (see the work of Mark Finney) have inferred that careful placement of treatments on the landscape can reduce the percentage of the landscape treatment needed to maintain a fuel modified condition. The 40% value was used here to estimate number of acres that need to be in a resilient status.

### **Mixed conifer forests**

As discussed earlier, dry mixed conifer stands were included in the above modeling exercises and thus acres would be calculated using the value 0.4. Wet mixed conifer stands are more like spruce/fir which has a value of .1, although the average fire return interval is around 25-40 years and fire intensity is varies from low to high. Since our data set includes both dry and wet mixed conifer, and the ecotones in between, the value of 25% of the forest type treated was utilized for this analysis.

### **Spruce-fir forests**

Ecologists generally agree that fires in this type are generally stand replacement fires that occur in terms of a few centuries between fires. Therefore, these stands have been less affected by the legacy of fire exclusion. However, as mentioned earlier, expansive insect outbreaks are creating areas of high mortality. With watershed and wildland urban interface concerns, there are situations where treatments in this vegetation type make sense, especially from economic and social standpoints. For this analysis, a value of 10% was used.



Table 12. Total estimate of acres managed for restoration by life zone classes to meet landscape restoration goals on all jurisdictions.

Forest Type	% of Type in restored acres	Total acres in type	Total restoration acres
Bosque	0.5	98,559	49,280
Piñon-juniper woodland	0.25	13,668,376	3,417,094
Ponderosa pine forest	0.4	2,615,857	1,046,343
Mixed conifer forest	0.25	1,434,618	358,655
Spruce-fir forest	0.1	822,608	82,261
Total		18,640,018	4,953,632

## Return Interval Rationale

Each of these practices needs to be maintained, and the interval between maintenance treatments also varies by forest type. To arrive at a value of annual acres treated, the total managed acres needed for landscape resiliency from Table 11 was divided by the average treatment return interval to arrive at an estimate of the annual acres needing treatment (Table 13). The rationale for the return intervals used for each forest type follows:

### Bosque

Bosque treatments are almost all focused on the removal of exotic species which typically regenerate from sprouting and suckering. The common treatment regime is to remove these species on the initial entry and, at that time, spray the stump with an herbicide. However, treated areas are usually followed up for 2-5 years with an herbicide sprayed on re-sprouts to achieve effectiveness. Until these exotic species are removed from the system, there are opportunities for reseeding, so an area with species removed through three entries (initial removal + 2 follow up visits) may still need to be retreated regularly if these trees are still in the area. Considering the need for continued herbicide treatment until the seed source has been eradicated, an approximate 7-year return interval was selected as an average over the life of the stand.

### Piñon-juniper woodlands

Piñon and juniper are both slow growing trees and regeneration is dependent on special conditions for both bumper crops of seed and ideal conditions for seedling establishment. Meanwhile, many of the piñon-juniper chaining projects from the 1960's and 1970's are now nearly fully stocked with trees again. Add to this discussion the previously mentioned diversity of this type. The value of 25 years between treatments was used for this analysis, but further study and data may allow for a more precise estimate in the future.

### Ponderosa pine forests

The average fire return interval in pre-settlement times in ponderosa pine is variable but generally reported with a wide range of 5-25 years or a shorter range of 6-10 years. The Collaborative Forest Restoration Program has been monitoring some projects 5, 10, and 15 years post treatment. In general, treatments appear to be effective still at 5 years, but are approaching conditions when another treatment is needed at 10 years, and for the limited available data seem to need treatments at 15 years. Assuming much of the future treatments are achieved with fire which has naturally mixed effects on the landscape, a value of 8 years was used as the return interval for this type for this analysis.

### Mixed conifer forests

Assuming that the majority of treatments in this type are in the dry mixed conifer, the pre-settlement average fire return interval would be in the range of 8 to 30 years. Fire exclusion however have left many stands today with overstories dominated by shade tolerant trees such as white fir and douglas-fir when

previously the dominant tree was ponderosa pine. Therefore, to keep the shade tolerant regeneration in check, treatments may need to occur more frequently. Many dry mixed conifer mechanical treatments call for a broadcast burn to occur within several years of the initial entry. With these considerations, a 15 year average return interval was selected for mixed conifer.

### Spruce-fir forests

Although the fire regime does not biologically suggest regular and repeated entry into spruce fir stands, climate driven events including widespread insect outbreaks and socio-economic factors such as water protection and community protection are creating compelling situations for management in this type. As the climate continues to warm, these pressures may increase. The value of 50-year average reflects the recognition that more treatment may be necessary as climate change impacts this forest type.

*Table 13. Total estimate of acres to be treated annually on all jurisdictions.*

Forest Type	# of years between entries	Total restoration acres	Annual treatment acres
Bosque	7	49,280	7,040
Piñon-juniper woodland	25	3,417,094	136,684
Ponderosa pine forest	8	1,046,343	130,793
Mixed conifer forest	15	358,655	23,910
Spruce-fir forest	50	82,261	1,645
Total		4,953,632	300,072

Based on all the uncertainty in this analysis, and to not imply accuracy, these figures are rounded off for the statement that approximately 5 million acres of New Mexico's 18 million acres in these five forest types should be under management which will require treating around 300,000 acres per year with either an initial entry or a maintenance treatment. This number should be feasible to track because it does not require information on whether a treatment is an initial entry or a follow-up maintenance.

This analysis does not try to add the dimension of costs; however, maintenance costs (for example fire use in ponderosa pine forest or spot herbicide treatments in the bosque) are generally one tenth to one quarter of the costs of an initial entry. Therefore, with time, annual costs should go down as more of the targeted 5 million acres come into management. For example, if the priority need on the landscape was for maintenance by fire, many of these acres might be achieved by managing wildfires and utilizing prescribed burning.

These numbers are admittedly much larger than the current combined activity in the state. To increase activity to match need, much capacity needs to be developed: industry to do the work and utilize excess forest biomass, funding to pay for projects, and administration of projects in a manner that provides an even stream of opportunity that supports and maintains this increased capacity. Tracking the percentage of acres of treatment achieved vs. acres of treatment needed may be a useful measure. Success can be measured in the growth of this percentage.

As better data and science emerge, this estimate should be adapted to reflect this knowledge, which will help guide big picture goals on the landscape.

## Estimate for non-federal lands (State, Tribal, Local, Private)

New Mexico Forestry Division's mission includes providing technical assistance to state and local governments as well as private lands. The Forest Inventory and Analysis Program combines private and tribal acreages in Table 14. The next step is to follow the above process to estimate the need for restoration on tribal, state, local and private lands. From this table, the FIA national forest type categories are sorted into five ecosystem type categories for making general approximations (Table 15). Using the same rationale presented above, Table 16 calculates the estimated number of acres needed to treat to reach landscape restoration goals.

Table 14. Total acres by jurisdiction of FIA forest types. USDA Forest Service, Forest Inventory and Analysis Program. Forest Inventory EVALIDator web-application Version 1.8.0.01. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://apps.fs.usda.gov/Evalidator/evalidator.jsp>].

Ownership Class	Ownership Group						SLTP totals
	Total	National Forest	Other Federal	State and Local	Private		
----- Acres -----							
Total	24,625,323	7,749,958	3,787,854	2,251,514	10,835,997	13,087,511	
Pinyon / juniper group	13,668,376	3,591,182	1,676,704	1,165,774	7,234,716	8,400,490	
Douglas-fir group	907,608	584,012	-	30,132	293,464	323,596	
Ponderosa pine group	2,615,857	1,581,804	92,636	68,485	872,932	941,417	
Fir / spruce / mountain hemlock group	822,608	594,915	17,686	24,248	185,760	210,008	
Other western softwoods group	104,343	63,736	-	-	40,607	40,607	
Oak / hickory group	4,307	4,307	-	-	-	0	
Elm / ash / cottonwood group	74,095	6,005	-	23,569	44,522	68,091	
Aspen / birch group	422,667	291,237	5,676	6,026	119,728	125,754	
Other hardwoods group	1,436	-	-	1,436	-	1,436	
Woodland hardwoods group	4,391,607	804,745	1,271,777	752,372	1,562,713	2,315,085	
Exotic hardwoods group	24,464	-	-	-	24,464	24,464	
Nonstocked	1,587,954	228,015	723,375	179,473	457,091	636,564	

Table 15. Grouping of FIA forest types into life zone classes for tribal, state, local and private lands.

Forest Type	FIA Forest Type Group	Area (acres)
Bosque	Elm.Ash,Cottonwood; Exotic hardwoods	92,555
Piñon-juniper woodland	Pinyon/juniper group	8,400,490
Ponderosa pine forest	Ponderosa Pine group	941,417
Mixed conifer forest	Douglas-fir, aspen/birch, other western softwoods	489,957
Spruce-fir forest	fir/spruce/hemlock group	210,008
Total		10,134,427

Table 16. Estimating acres managed for restoration by life zone classes to meet landscape restoration goals for tribal, state, local and private lands.

Forest Type	% of Type in restored acres	Total acres in type	Total restoration acres
Bosque	0.5	92,555	46,278
Piñon-juniper woodland	0.25	8,400,490	2,100,123
Ponderosa pine forest	0.4	941,417	376,567
Mixed conifer forest	0.25	489,957	122,489
Spruce-fir forest	0.1	210,008	21,001
Total		10,134,427	2,666,457



Using the same rationale presented above, Table 17 calculates the estimated number of treatment acres needed to reach landscape restoration goals, including both initial entry and maintenance activities.

Table 17. Total estimate of acres to treat annually for tribal, state, local, and private lands.

Forest Type	# of years between entries	Total restoration acres	Annual treatment acres
Bosque	7	46,278	6,611
Piñon-juniper woodland	25	2,100,123	84,005
Ponderosa pine forest	8	376,567	47,071
Mixed conifer forest	15	122,489	8,166
Spruce-fir forest	50	21,001	420
<b>Total</b>		<b>2,666,457</b>	<b>146,273</b>

As with the estimate for all jurisdictions, there is much uncertainty in this analysis. To avoid implying accuracy, these figures are rounded down for the statement that approximately 2.6 million acres of non-federal forest lands (of a total of 10 million acres in these five forest types) should be under management to achieve landscape scale resiliency. This will require treating 145,000 acres per year with either an initial entry or a maintenance treatment. This number should be feasible to track because it does not require information on forest type or whether a treatment is an initial entry or a follow-up maintenance.



Firefighters on the Bernalillo District © Marcos Montoya/NMFD

## NM Forestry Division

The Energy, Minerals and Natural Resources Department, Forestry Division (Forestry Division) provides leadership in New Mexico’s management of these complex ecological ecosystems. Although the Forestry Division’s primary responsibility is to sustain healthy and productive forests, it recognizes the interconnection between forest lands and other vegetated landscapes, of watersheds and waterways, of land management practices, and of the many entities that are responsible for stewardship of the land. This understanding provides the foundation for the Forestry Division’s efforts, which are collaborative, interdisciplinary, and focused on long-term sustainability.

Established as the Forest Conservation Commission in 1957 to address fire protection on state and private land, the Forestry Division’s mission soon expanded to include timber management and conservation efforts. The Forestry Division’s role has increased in the areas of technical forestry assistance to private and state landowners, conservation of forest lands through easements, encouragement of forest industries, inmate forestry work programs, heritage of native plants and many other programs that support healthy ecosystems in New Mexico.

The Forestry Division places the importance of proper watershed management as a top priority to achieve overall ecosystem health. To achieve this goal, the Forestry Division has taken a leadership role in crafting

collaborative efforts with local, state, federal and tribal agencies, as well as private landowners, businesses and non-governmental organizations.

This Forest Action Plan contributes to the EMNRD Strategic Plan, primarily in support of Initiative 4: Addressing Climate Change through commitments to resilient forests, flora/fauna biodiversity, proactive wildland fire programs and mitigation of post-fire responses. The Forestry Division also contributes to Initiative 5: Building EMNRD's professional capacity.

With an emphasis on private and state lands, the Forestry Division:

- Provides technical assistance and promotes sound forest and watershed management toward statewide ecological balance.
- Supports the development of community-based resource management plans and facilitates acquisition of forest health project funding.
- Regulates the harvest of forest products through permits and law enforcement on state and private forestland.
- Conducts habitat protection projects by studying plant species abundance, defining rare and unique ecosystems.
- Administers numerous land conservation programs ranging from buying lands and easements to be held in perpetuity.
- Implements the federal Forest Legacy Program, which purchases conservation easements from private forest owners to perpetually protect forest values such as wildlife habitat, watershed, and wood production.
- Oversees the New Mexico Endangered Plant Species Act by determining which plants are threatened or endangered, monitoring rare plant populations, and coordinating state and federal projects for research and recovery of New Mexico's endangered plants.

Additional information about the Division is available in the [EMNRD Annual Report](#) and on the [Division's website](#).

## Semi-Annotated References List in Support of the New Mexico Forest Action Plan

Many references were used in the development of both this background section and the strategies. A semi-annotated reference list of these documents as well as additional background information is accessible on the Division website. The Semi-Annotated Reference List in Support of the Forest Plan is stored there, so it can be regularly updated as new information becomes available. This list is a starting point for learning more about ecosystems, forests, and forestry in New Mexico. The references are organized by topics, and topics are presented alphabetically. Links are included where possible.

# Appendix A. Guidance for State Forest Action Plans

## Statewide Forest Resource Assessments and Strategies (State Forest Action Plans) Requirements Checklist for

State Forest Assessments and Strategies must be updated at least every 10 years and submitted to the relevant USDA Forest Service (FS) Region or International Institute of Tropical Forestry (IITF) with this checklist signed by the State Forester. Federal review will focus on these requirements as outlined in the [Cooperative Forestry Assistance Act](#) SEC. 2A. [16 U.S.C 2101a] (amended by the 2008 and 2014 Farm Bills).

### Submitted by the State Forester:

State Forester certifies the required elements below are included. FS Region or IITF fills out the checklist.

### Statewide Forest Resource Assessment Includes:

- The conditions and trends of forest resources in the state ..... Yes  No
- The threats to forest lands and resources in the state consistent with national priorities ..... Yes  No
- Areas or regions of the state that are a priority ..... Yes  No
- Any multi-state areas that are a regional priority ..... Yes  No

### Statewide Forest Resource Strategy Includes:

- Long-term strategies to address threats to forest resources in the state\* ..... Yes  No
- Description of resources necessary for state forester to address statewide strategy\* ..... Yes  No
- Strategy addresses national priorities for state and private forestry ..... Yes  No

\* Can be presented in a strategies matrix with columns for (a) programs that contribute, (b) resources required, (c) national priority(ies), and (d) performance measure(s) that will be used for each strategy (optional).

### Stakeholder Groups Coordinated with for the Statewide Assessment and Strategy:

Note: this can be identified in the body of the documents or in an appendix.

- State Forest Stewardship Coordinating Committee (required) ..... Yes  No
- State Wildlife Agency (required) ..... Yes  No
- State Technical Committee (required) ..... Yes  No
- Lead agency for the Forest Legacy Program (if not the state forestry agency) (required) ..... N/A  Yes  No
- Applicable Federal land management agencies (required) ..... Yes  No
- Military installations (as appropriate and feasible) ..... Yes  No

### Other Plans Incorporated in the Statewide Assessment and Strategy:

- Community wildfire protection plans (required) ..... Yes  No
- State wildlife action plans (required) ..... Yes  No
- Other ..... Yes  No

### Forest Legacy Program (FLP) Requirements Included (for States with FLP) ..... N/A Yes No

See [Forest Legacy Program Implementation Guidelines](#). Some options include:

- All required Forest Legacy components are integrated into the State Forest Action Plan (Assessment and/or Strategy), including Eligibility Criteria to identify Forest Legacy Areas, delineation of Forest Legacy Areas, and outline of the State's project evaluation and prioritization procedures. These elements are reviewed by the FS Region or IITF FLP staff as part of the assessment and strategy certification process. It is helpful to provide a crosswalk to identify location of FLP components in the State Forest Action Plan.
- A separate Forest Legacy Assessment of Need document (with above Forest Legacy requirements) is included as an appendix of the State Forest Action Plan. This document has been previously approved by the FS Region or IITF Forest Legacy Program staff. Documentation of FS approval and most recent review by the State Forest Stewardship Committee review should also be provided.

### Review by FS Regional Forester or IITF Director (as relevant):

**Deemed Sufficient (all requirements met)**

Comments:

**Deemed Not Sufficient (missing one or more requirements)**

Corrective Action(s) Necessary to Meet Sufficiency Requirement:

**Certified by Regional Forester or IITF Director:** Name:

### RECOMMENDATION BY UNDER SECRETARY, DEPARTMENT OF AGRICULTURE:

Approval authority delegated from the USDA Secretary.  
Under Secretary, Natural Resources and Environment:

Approve:  Disapprove:

Name:



# Appendix B. Crosswalk between 2020 New Mexico Forest Action Plan Strategies and National Priorities for State and Private Forestry

2020 New Mexico Forest Action Plan Strategies and Sub-Strategies	National Priorities for State and Private Forestry		
	Conserve Working Landscapes	Protect Watersheds from Harm	Enhance Public Benefit from Natural Resources
<b>Strategy 1: Restore Forests and Watersheds</b>	X	X	X
Sub-strategy 1.1 - Conduct appropriate treatments in large-scale priority areas identified collaboratively using the FAP risk assessment models.		X	X
Sub-strategy 1.2 - Conduct collaborative planning and build collective capacity to increase the pace and scale of forest and watershed restoration.		X	X
Sub-strategy 1.3 - Track activity to report progress and evaluate outcomes to inform continuous planning.		X	X
Sub-strategy 1.4 - Based on the science-based statewide assessment and utilizing best available knowledge about natural resource conditions and social/economic opportunities, review and confirm or update priority areas identified in the FAP.	X	X	X
Sub-strategy 1.5 - Develop collaborative strategies to promote a dynamic patchwork mosaic of riparian and wetland vegetation and habitat as water availability and community priorities allow.			X
Sub-strategy 1.6- Conduct restoration activities in a manner that minimizes impacts to native and sensitive plants, animals, and their habitats by using the most current and up-to-date tools and resources available.		X	
Sub-strategy 1.7 - Support and expand public outreach and education to foster a society that supports watershed restoration activities and values resilient and healthy forest ecosystems.	X	X	X
<b>Strategy 2: Fire Management</b>		X	X
<i>Part 2.1: RESTORE ECOLOGICAL ROLE OF FIRE TO FOSTER RESILIENT LANDSCAPES AND WATERSHED HEALTH</i>			
Sub-strategy 2.1.1 - Improve ability to make planning and fire management decisions by assuring that all fire organizations have access to spatial fire management tools to support pre-fire planning and co-management of fire.		X	
Sub-strategy 2.1.2 - Identify priority locations to facilitate safe and ecologically appropriate fire reintroduction (e.g. managed fires, prescribed burning).		X	X
Sub-strategy 2.1.3 - Increase the access to fire training implementation and monitoring to build capacity, including more sessions offered and reducing the cost of training, and expanding topics to include utilizing fire and fire management in addition to fire suppression.		X	X
Sub-strategy 2.1.4 - Support the development of legislation to expand the use of prescribed fire in New Mexico.		X	
<i>Part 2.2: WILDFIRE RESPONSE ON STATE AND PRIVATE LANDS</i>			

<b>2020 New Mexico Forest Action Plan Strategies and Sub-Strategies</b>	<i>National Priorities for State and Private Forestry</i>		
	<b>Conserve Working Landscapes</b>	<b>Protect Watersheds from Harm</b>	<b>Enhance Public Benefit from Natural Resources</b>
Sub-strategy 2.2.1 - Provide appropriate fire suppression response, either directly or through cooperative agreements, on wildland fires occurring on non-Federal, non-Municipal, non-Tribal lands within the State of New Mexico.		X	
Sub-strategy 2.2.2 - Provide leadership and build collaborative partnerships to reduce the vulnerability of at-risk communities to catastrophic wildfire events.		X	
Sub-strategy 2.2.3 - Coordinate fire preparedness and pre-planning activities to ensure the Division has adequate wildfire resources available for wildfire management and suppression and to improve firefighter safety, public safety, resource efficiency, and inter-jurisdictional relationships for cross-boundary fire management.		X	
Sub-strategy 2.2.4 - Foster a positive fire culture that is a model for compliance with state and federal policies and promotes diversity, equity and inclusion.			X
<i>Part 2.3: SUPPORT REGIONAL, STATE, AND NATIONAL WILDFIRE RESPONSE ON ALL JURISDICTIONS</i>			
Sub-strategy 2.3.1 - NMFD will coordinate fire preparedness/pre-planning activities to support national fire preparedness and response.		X	
<i>Part 2.4: COLLABORATE ACROSS PROGRAMS AND JURISDICTIONS ON POST-FIRE RESPONSE</i>			
Sub-Strategy 2.4.1 – Coordinate, implement and support post-fire response on public lands that qualify for local, regional, or national Burn Area Emergency Response (BAER).		X	
Sub-Strategy 2.4.2 – Coordinate existing programs in New Mexico that can or could help communities and landowners implement post-fire response on private, municipal and other lands that do not qualify for a local, regional, or national Burn Area Emergency Response (BAER).		X	X
Sub-Strategy 2.4.3 – Identify and fill gaps in authorities, funding and program direction to provide coordinated post-fire response on all lands and jurisdictions to protect lives, property and infrastructure; rebuild infrastructure resilient to post-fire conditions; and restore ecosystems after wildland fires.		X	
<b>Strategy #3: Private Land Stewardship</b>	<b>X</b>	<b>X</b>	<b>X</b>
Sub-strategy 3.1 - Strategically locate private land management actions to maximize landscape scale planning and restoration efforts.	X	X	X
Sub-strategy 3.2 - Provide technical and financial assistance to private landowners to increase active land management in high priority forests and watersheds with equitable access for all landowners.		X	X
Sub-strategy 3.3 - Increase the acreage and quality of forest management plans reviewed and created by NMFD.	X	X	X
Sub-strategy 3.4 - Support property tax laws that do not lead to forest fragmentation and promote Forest Legacy and similar land conservation programs to conserve high priority forest ecosystems and landscapes.	X		

2020 New Mexico Forest Action Plan Strategies and Sub-Strategies	National Priorities for State and Private Forestry		
	Conserve Working Landscapes	Protect Watersheds from Harm	Enhance Public Benefit from Natural Resources
Sub-strategy 3.5 - Ensure that restoration and management activities on private lands protect the state's most vulnerable resources.		X	
<b>Strategy #4: Utility Rights of Way</b>		X	
Sub-strategy 4.1 - Provide tool/toolkit to help rural electric cooperatives improve required vegetation management plans along utility rights of way in New Mexico.		X	
Sub-strategy 4.2 - Establish partnership between utilities and NMFD to assist with collaborative efforts for vegetation management and other risk reduction measures along utility rights of way.		X	
Sub-strategy 4.3 - Establish data sharing back and forth between utilities and NMFD for prioritization and partnerships for improving vegetation management along utility rights of way. There is a need to overcome barriers with data sharing in order to help identify priorities for accelerated vegetation management to reduce risk of wildfire.		X	
Sub-strategy 4.4 - Incorporate utility location data into the Wildland Fire Decision Support System (WFDSS) for fire management guidance as wildfires are occurring. WFDSS is an access-limited geospatial reference for fire managers engaged in fire suppression and management with critical information for influencing decisions taken during fire events. Develop methods for keeping data updated and relevant. Engage utility partners in identifying important intelligence for fire managers in advance of wildfires.		X	
Sub-strategy 4.5 - Ensure that ROW vegetation management activities do not impact the state's most vulnerable resources.		X	
<b>Strategy #5: Rare Plant Conservation</b>	X	X	X
Sub-strategy 5.1 - Inventory, research, monitor and model to inform management and regulatory decisions.		X	X
Sub-strategy 5.2 - Protect, manage, and restore Strategy Species and their habitats.		X	X
Sub-strategy 5.3 - Improve data management, storage and dissemination.		X	X
Sub-strategy 5.4 - Develop ex-situ conservation and recovery strategies for rare and endangered plants and implement where appropriate.	X	X	
Sub-strategy 5.5 - Improve laws, regulations, and policies to protect New Mexico's plant diversity.	X	X	
Sub-strategy 5.6 - Increase collaboration, education and outreach about rare and endangered plants.			X
Sub-strategy 5.7 - Improve funding, infrastructure and rare plant programs.		X	
<b>Strategy #6: Reforestation</b>	X	X	X
<i>Part 6.1: SEED COLLECTION AND STORAGE</i>			
Sub-strategy 6.1.1 - Establish a seed collection program and associated seedbank/cooperative among multiple agencies, tribes, landowners, organizations and states to ensure genetically diverse	X		X



<b>2020 New Mexico Forest Action Plan Strategies and Sub-Strategies</b>	<i>National Priorities for State and Private Forestry</i>		
	<b>Conserve Working Landscapes</b>	<b>Protect Watersheds from Harm</b>	<b>Enhance Public Benefit from Natural Resources</b>
and climate ready seedlings can be produced for reforestation of burned lands and other deforested areas.			
<b>Part 6.2: NURSERY CAPACITY AND SEEDLING PRODUCTION</b>			
Sub-strategy 6.2.1 - Expand nursery capacity in New Mexico, produce adequate number of high-quality seedlings to meet reforestation needs for burned areas and other reforestation opportunities.	X		X
<b>Part 6.3: LANDSCAPE ASSESSMENT AND SITE SELECTION</b>			
Sub Strategy 6.3.1 - Provide and develop data and information on both tree survival and climate models to improve the likelihood that trees planted in the next decade will survive and thrive throughout their lifetimes (Right Tree Right Place 2100 Strategy – RTRP 2100).		X	X
Sub strategy 6.3.2 - Identify and prioritize opportunities for reforestation to ensure future forests on moderately and severely burned lands.			X
Sub-strategy 6.3.3 - Develop climate-ready methods, strategies and a matrix for planting prescriptions considering future climate impact to seedling survival. This will require reforestation goals specific to each land managing agency and shall include mapping of all planting sites pre and post planting.			X
Sub-strategy 6.3.4 - Assess local site characteristics for reforestation success, including soil health/condition, reforestation potential, competition with other plants, herbivory effects and the potential need for soil micro-organism inoculation.			X
<b>Part 6.4: PLANTING PROJECTS AND STRATEGY</b>			
Sub-strategy 6.4.1 - Apply prescriptions from sub-strategy 6.3.4 with demonstration projects that illustrate the outcomes, success and vulnerabilities of planting seedling to survive in the future climate, and explore carbon offset program for New Mexico to help expand funding for future reforestation.			X
Sub-strategy 6.5.1 - Develop and implement monitoring protocols to track capacity in seed collection, nursery capacity, site preparation, seedling handling, planting and seedling survival.			X
<b>Strategy #7: Urban and Community Forests</b>	<b>X</b>		<b>X</b>
<b>Part 7.1: INCREASE A RESILIENT URBAN TREE CANOPY</b>			
Sub-strategy 7.1.1 - Identify and promote tree and shrub species for New Mexico urban environments that can survive both current and projected climates.	X		X
Sub-strategy 7.1.2 - Identify areas with specific challenges to urban forest biodiversity, age, health, and resilience to target replanting efforts.			X
Sub-strategy 7.1.3 - Integrate urban forestry into all scales of city and state-scale master plans, emphasizing the role of the urban forest as green infrastructure to mitigate heat and manage stormwater.	X		X
Sub-strategy 7.1.4 - Advance urban forest design principles that include appropriate soil volume and quality and make the greatest use of available water in supporting urban trees and landscapes.			X

2020 New Mexico Forest Action Plan Strategies and Sub-Strategies	National Priorities for State and Private Forestry		
	Conserve Working Landscapes	Protect Watersheds from Harm	Enhance Public Benefit from Natural Resources
Sub-strategy 7.1.5 - Increase urban tree and shrub canopy by strategically targeting planting in areas with the most human health and safety need.	X		X
Sub-strategy 7.1.6 - Integrate the urban forest into landscape scale efforts to create habitat, restore water cycles, and mitigate climate change.			X
<i>Part 7.2: MANAGEMENT, MAINTENANCE, AND STEWARDSHIP OF THE URBAN FOREST</i>			
Sub-strategy 7.2.1 - Expand collaboration between urban forestry and related fields, agencies, and sectors to diversify and leverage stewardship of the urban forest.			X
Sub-strategy 7.2.2 - Incorporate findings about urban tree and shrub survival in changing Southwestern climate in urban forest management practices and recommendations.			X
Sub-strategy 7.2.3 - Increase statewide training opportunities on proper tree care and maintenance practices.			X
Sub-strategy 7.2.4 - Provide communities with cost-saving tools to assist in management of the community forest.			X
<b>Strategy #8: Restoration Economy</b>	<b>X</b>	<b>X</b>	<b>X</b>
Sub-strategy 8.1 – Support community-based and industry wood utilization by assisting and encouraging private forest landowners to more actively manage their forest and related resources.	X		X
Sub-strategy 8.2 – Practice shared stewardship across landscapes to make strategic investments aimed at mitigating risk, improving forest health, and increasing resilience in New Mexico’s ecosystems.	X		X
Sub-strategy 8.3 - Support forest trade association and members. Promote sustainable utilization businesses and markets.	X		X
Sub-strategy 8.4 - Recruit and retain restoration workforce and increase capacity to conduct all aspects of forestry activities (fire suppression, fire management and application, forest management, forest industry, reforestation, urban & community forest projects, fuels reduction, burn restoration, and so forth).	X	X	X
<b>Strategy #9: Land Conservation</b>	<b>X</b>	<b>X</b>	<b>X</b>
Sub-strategy 9.1 - Develop and maintain a statewide land conservation strategy using relevant science to help guide conservation investments with state and federal funding. The conservation strategy should identify biodiversity hotspots and cultural resources including valuable riparian areas, wildlife corridors and pinch-points, and important public water source and working forests.	X		X
Sub-strategy 9.2 - Protect, enhance, and sustain the priority conservation lands identified in the FAP through conservation easement acquisition and public land acquisition and designations.	X	X	X
Sub-strategy 9.3 - Provide equitable access to land conservation tools including easements, acquisitions, and transfers to all New Mexico landowners.	X		

<b>2020 New Mexico Forest Action Plan Strategies and Sub-Strategies</b>	<i>National Priorities for State and Private Forestry</i>		
	<b>Conserve Working Landscapes</b>	<b>Protect Watersheds from Harm</b>	<b>Enhance Public Benefit from Natural Resources</b>
Sub-strategy 9.4 - Create a statewide land conservation marketing program targeting landowners who would benefit from the array of land conservation programs and opportunities.	X		X
Sub-strategy 9.5. The FAP land conservation strategy fosters dialogue between agencies, NGOs, industry and land trusts and county and municipal planning departments to increase protection of high value conservation areas and resources that are at risk from development.	X	X	
<b>Strategy #10: Outdoor Recreation</b>	<b>X</b>	<b>X</b>	<b>X</b>
Sub-strategy 10.1 – Provide outdoor recreation in forested areas on a variety of land ownership types.			X
Sub-strategy 10.2 - Develop a system and procedures for shifting outdoor recreation and tourism during wildfire and when post-fire risks are severe.		X	X
Sub-strategy 10.3 - Restore forests, woodlands and grasslands that are settings for high-volume recreation such as State Parks, ski areas, water recreation sites, and trail heads.			X
Sub-strategy 10.4 - Support and encourage outdoor recreational opportunities, businesses, and infrastructure on private lands.	X		X
Sub-strategy 10.5 – Public is engaged in outdoor recreation and understands fire-safe practices, climate change impacts, and understands the need for and practical implications of forest restoration activities.		X	X
Sub-strategy 10.6 – Youth are provided opportunities for outdoor careers.			X



# Appendix C. Shared Stewardship Agreement



**AGREEMENT FOR SHARED STEWARDSHIP**  
**Between The**  
**STATE OF NEW MEXICO,**  
**ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT,**  
**FORESTRY DIVISION**  
**And The**  
**UNITED STATES DEPARTMENT OF AGRICULTURE,**  
**FOREST SERVICE**

This Agreement for Shared Stewardship (Agreement) is hereby made and entered into by and between the State of New Mexico, Energy, Minerals and Natural Resources Department, Forestry Division (Forestry Division) and the United States Department of Agriculture, Forest Service (Forest Service).

## **BACKGROUND**

Managers and owners of forests across the nation face urgent challenges including wildfires, invasive species, drought, and epidemics of forest insects and disease. Longer fire seasons and the rising size and severity of wildfires are of special concern, along with increasing risk to communities, firefighters, and natural resources – especially water supplies.

Management of fire risk and protection of water are of utmost importance in New Mexico. The livelihoods and well-being of New Mexico residents depend more on scarce, and precious, surface and ground water supplies than on almost anything else. Many of New Mexico's water sources originate in high elevation forests on private, tribal, and public lands that are vulnerable to uncharacteristically large and catastrophic wildfire.

For more than a decade, key natural resource management agencies in New Mexico have been rethinking and retooling the approach to forest and watershed management. The approach recognizes the inseparability of ecological, social, and economic sustainability. The agencies strive to be collaborative, make science-based decisions, and coordinate plans and actions at the landscape scale. This approach requires inter-agency trust and up-front investment of time and energy and incorporates broad experience and knowledge. Through this Agreement, the Forestry Division and the

Forest Service commit to continue this path to improve outcomes and increase efficiencies through Shared Stewardship.

The Forestry Division and the Forest Service have worked together to coordinate forest management efforts since 1957 when the Department of State Forestry, the Forestry Division's predecessor, was established. The importance of this collaborative relationship was explicitly recognized by the leadership of both agencies in 2004 with the adoption of the New Mexico Forest and Watershed Health Plan (Plan) coordinated by the Forestry Division. The Forest Service is a co-author and signatory to that document, which lays out an integrated collaborative landscape approach to ecological restoration. The Plan outlines a framework for achieving a vision of forest and watershed health that incorporates ecological, social, and economic considerations. It requires working across agency jurisdictions, ownership boundaries, cultural divides, and ecosystem types; applying science-based ecological restoration methods; and using collaboration, teamwork, persistence, and continual learning. The Plan also expanded the partnership of New Mexico forest stewards to include other key federal, tribal, and state governmental entities and non-governmental organizations as signatories.

In 2006 the New Mexico Forest Restoration Principles were collaboratively developed by the Forestry Division, the Forest Service, and a team representing industry, conservation organizations, land management agencies, and independent scientists. These principles for restoration were created as guidelines for project development, and they represent the "zone of agreement" where controversy, delays, appeals, and litigation are significantly reduced. The principles were developed to promote projects driven primarily by ecological objectives while promoting economic and social benefits.

This vision and approach were incorporated into the Forestry Division's 2010 Statewide Natural Resources Assessment and Strategy and Action Plan, now collectively known as the New Mexico Forest Action Plan (FAP). The FAP is based on a complex analysis of over 80 datasets that informed natural resource issues on all jurisdictions. The FAP contains a set of objectives and strategies developed using information on programs and priorities of partner organizations gathered in a series of stakeholder workshops. In 2015, the Forestry Division added new material to the FAP in four addenda, including an updated strategies table. Two key objectives of the original FAP were to help natural resource agencies use their resources efficiently by identifying priority landscapes, and to identify resource programs where collaborative projects will benefit multiple partners. The New Mexico Forest and Watershed Management Coordinating Group, the Forestry Division's representative advisory group comprised of federal and state agencies and other essential stakeholders, recently confirmed that these objectives are still valid and will continue to guide the strategies moving forward.

#### **SHARED STEWARDSHIP APPROACH**

The Forest Service document "Toward Shared Stewardship Across Landscapes: An Outcome-Based Investment Strategy", released in August 2018, calls for the Forest



Service to work closely with states to set landscape-scale priorities for targeted treatments that manage risks and increase benefits in areas where they will have the greatest impact across broad landscapes. The Forest Service recognizes that, although this work has been going on for years, the objectives of Shared Stewardship elevate and formalize this work. The Forest Service and the Forestry Division are employing new tools, science, and authorities to make strategic investments aimed at mitigating risk, improving forest health, and increasing resilience in New Mexico's ecosystems, and are committed to an outcome-based investment strategy.

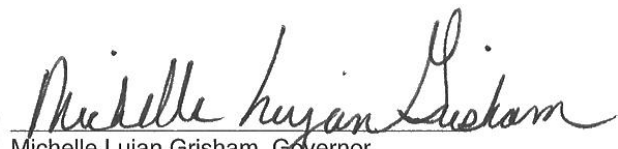
The Forestry Division and the Forest Service commit to the following actions as the basis of this agreement for Shared Stewardship in New Mexico:

1. The Forestry Division will take a leading role in convening collaborative groups and stakeholders to establish shared goals for forest and watershed management on all New Mexico lands, public and private.
2. The Forestry Division and the Forest Service recognize the interdependence of the three goals of the National Cohesive Wildland Fire Management Strategy and jointly commit to implement the strategy.
3. The Forestry Division and the Forest Service will jointly establish landscape-scale restoration priorities for targeted treatments.
  - The Forestry Division's State Forester and District Foresters and the Forest Service Regional Forester and Forest Supervisors will meet on a regular basis to review Forest Action Plan and National Forest Land and Resource Management Plan priorities and programs of work and develop shared goals and decisions for forest and watershed management on all lands, public and private.
  - Key issues to consider will be priorities for National Environmental Policy Act planning, appropriate uses of categorical exclusions, budgets, staffing, capacity, and implementation.
4. The Forestry Division and the Forest Service acknowledge that tribes and pueblos, as sovereign nations with continuing connections for spiritual and cultural uses to ancestral lands now managed by the Forest Service, are essential participants in implementing Shared Stewardship landscape and watershed restoration strategies in order to protect their cultural resources and access to such resources, and for the often interrelated benefits to their own lands and watersheds that are adjacent to Forest Service lands. The parties further acknowledge the Forest Service's trust responsibility to tribes and pueblos and Forestry Division's obligation to interact with tribes and pueblos on a government-to-government basis. The Forestry Division and the Forest Service will collectively use their respective authorities to conduct government-to-government consultation directly with the tribes and pueblos on implementing Shared Stewardship strategies and will seek to collaborate and partner with the tribes and pueblos when feasible.



5. The Forestry Division and the Forest Service recognize traditional Hispanic communities, land grants, and acequias as essential participants in Shared Stewardship in order to protect, preserve, and enhance their spiritual and cultural heritage and access to resources and land.
6. The Forestry Division and the Forest Service will focus available resources to implement projects in priority landscapes.
7. The Forestry Division and the Forest Service will track measurable outcomes across all lands.
8. The Forestry Division and the Forest Service will jointly communicate the benefits of landscape-scale forest and watershed restoration and the outcomes of Shared Stewardship to New Mexico citizens.
9. The parties agree this Agreement does not serve as an authorizing tool. The Forestry Division and the Forest Service will rely on all available authorities to implement priority projects, including, but not limited to Good Neighbor Authority, Farm Bill Authorities, Cooperative Forestry Assistance Act, and the New Mexico Forest and Watershed Restoration Act. Specific authorities for actions will be identified prior to project implementation and development.

  
Vicki Christiansen, Chief  
United States Department of Agriculture,  
Forest Service  
Nov. 14, 2019  
Date

  
Michelle Lujan Grisham, Governor  
State of New Mexico  
11/14/19  
Date

# Appendix D. Scenario Investment Planning Report

Priority locations for shared stewardship projects in New Mexico were identified using tools built by the Rocky Mountain Research Station as part of the Forest Service Scenario Investment Planning Platform (SIPP). The scenario planning system has been applied to several shared stewardship case studies around the western U.S. as tool to help prioritize cross boundary investment decisions directly with states.

Many risk reduction scenarios were modeled and the impact of priorities on the rate of achieving specific outcomes was examined. Tradeoffs among different types of risk management strategies were identified using the concept of production frontiers.

A General Technical Report from the Rocky Mountain Research Station documenting the shared stewardship prioritization process is currently in review and will be published online, accessible at [https://www.fs.fed.us/rm/publications/titles/rmrs\\_gtr.html](https://www.fs.fed.us/rm/publications/titles/rmrs_gtr.html).

Draft maps from the report are included in this appendix for reference.

