

# Issues Pertaining to Forest Health and Management

## **Climate Change**

### THE POTENTIAL IMPACTS OF GLOBAL WARMING ON AMERICA'S FORESTS

Critical Findings for Forest Lands from the First National Assessment of the Potential Consequences of Climate Variability and Change

--An Overview prepared by Janine Bloomfield, Ph.D. (Environmental Defense) –

Climate and changes in it - regardless of their cause -matter to people, communities and businesses. Global warming is likely to bring many changes to the nation. The United States as a whole is in a strong economic position to adapt to many of these changes, but adaptation is often expensive, not always possible or successful, and during transitions ecosystems, communities, and individuals could suffer. Moreover, national impact summaries disguise local dislocations and disruptions to the ways we live, work and recreate. Climate change adds a serious stress to our already threatened resources and treasured places. Overall impact statements also mask significant opportunities. To minimize the negative changes and make the most of the positive changes, we need to take a close look at how climate change will affect each region.

### **Summary**

With over twenty major forest types across the continental US, forest ecosystems will respond to global warming in a variety of ways. The projected increase in temperature will likely shift the ideal range for many forest species by about 200 miles to the north. If the climate changes slowly enough, warmer temperatures may enable southern tree species to colonize to the north. Many factors, including the pace at which different species colonize new areas, determine the future composition of forestlands. Where species move into new areas more slowly than other tree species migrate out, the species previously common will still grow, but likely at a different density. In addition, cities, highways, agricultural fields and other human activities limit available habitat and create barriers to the migration of plants and animals. Forests in protected areas like national parks and national and state forestlands were established without considering the possibility of changing climates. Rapid climate shifts may reduce appropriate native habitats within protected areas while development outside the boundaries of the protected areas makes adjacent new habitat unavailable and limits the creation of migration corridors. In some US temperate forests, rapid climate change and accompanying extreme events, such as droughts, floods, and wind storms could lead to increased disease, insects, landslides and wildfires that could increase tree mortality and, in some cases, replace forests by grasslands. Some of the models used in the National Assessment indicate that forest

productivity overall is likely to increase, leading to increased supply of certain types of timber, though possible interactions with extreme events and other disturbances could reduce these gains.

## Key Findings

Water use in forests may increase as atmospheric carbon levels and forest productivity increases, pest and disease infestations and fire, recreation and tourism will likely be impacted by changes in biodiversity, and biodiversity will shift to fast-adapting, heat-loving species with corresponding changes in wildlife.

## Resources

(1) <http://www.climatehotmap.org/impacts/forests.html>

- News articles on climate change and forests  
<http://www.sciencedaily.com/releases/2001/11/011127004952.htm>

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## Forest Fragmentation

There is a finite amount of land in the United States. This simplistic and intuitive statement carries a great burden with it because as our nation reaches new population highs, the demand on natural resources becomes more intense. One of the impending results of growth and development to our forests is this process called 'fragmentation.' There is a wealth of information that has been researched and produced regarding forest fragmentation. There are studies about the effects of fragmentation on wildlife habitat, biodiversity, and communities.

The definitions of fragmentation are as diverse as the subject itself. Publications incorporate the issues of land-use planning, biodiversity, or wildlife habitat as the qualifying indicators of fragmentation. For instance, a definition which uses habitat as the qualifier is "The splitting or isolating of patches of similar habitat, typically forest cover, but including other types of habitat...Habitat can be fragmented naturally or from forest management activities, such as clearcut logging" ([Forest Service website](#)). In another example, the definition is empirically linked to population growth, "Fragmentation is a complex phenomenon resulting from dynamic interactions between the natural landscape and society's ever-increasing demands on the land, creating a mosaic of natural and human-modified environments." (Tyrrell). However, the single tie that links these definitions together is the idea of fragmentation referring to the process of a contiguous land base being divided into smaller pieces. In one definition the author sums this idea, "Fragmentation has been defined as the conversion of large areas of contiguous native forest to other types of vegetation and /or land use leaving remnant patches of forest that vary in size and isolation" (Sallabanks (FF book p192).

One reason for the variation in definition is that no one has been able to decide on a universal set of quantifying factors which would conclusively delineate fragmentation. The causal factors of fragmentation are limitless; one expert remarked that, "The question of how to define and measure fragmentation is...complex it can be anything from a road bisecting a forest to suburban sprawl" (Tyrrell). The complexity is further enhanced by geographic location. For instance, areas in the West are now experiencing

a population growth which in turn leads to a greater demand on the land. They now have to consider issues such as increased road construction and service facilities which ultimately will lead to fragmentation of the current land base. In the Northeast, the major factor leading to fragmentation is urban sprawl. More and more people are moving or desiring to move into the unique area between the city and the country, a phenomena known as *ex-urbanization*. In this urban-rural interface, fragmentation is becoming a major factor. Finally, in the South, a certain type of fragmentation is starting to develop, one which divides the landscape not by roads or structures, but by people. This type of fragmentation is termed *parcelization* and is often confused or used interchangeably with fragmentation. However, parcelization is distinct in concept and introduces another set of complications.

Fragmentation, as communities continue to grow and develop, will be an issue of increasing importance. Through education and understanding, it is a force that can be withstood. (1)

**Resources:**

(1) Sustainable Forest Partnerships website  
<http://sfp.cas.psu.edu/fragmentation/what.htm>

**Extra Resources**

- SFP website <http://sfp.cas.psu.edu/fragmentation/fragmentation.html>
- The State of the Nation's Ecosystems  
<http://www.heinzctr.org/ECOSYSTEMS/forest/frgmnt.shtml>
- Birds in a Forested Landscape  
[http://www.birds.cornell.edu/bfl/gen\\_instructions/fragmentation.html](http://www.birds.cornell.edu/bfl/gen_instructions/fragmentation.html)

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## Air Quality

Overall, forests improve air quality through respiration. Through this process trees intake carbon dioxide and release oxygen. They also clean ozone (a major component of smog) out of the air. However, when forests are burned (either by prescribed burning or in unplanned wildfires), smoke is created that releases carbon dioxide back to the atmosphere as the carbon that composes the trees is burned. Typically, the quantity of smoke created during a catastrophic wildfire event is much greater than that created during a controlled burn where conditions have been monitored to ensure the best dispersion of smoke and the cleanest combustion of materials. Nonetheless, smoke creates health problems for humans, causes safety issues with smoke on roadways, and impacts the global carbon balance. In New Mexico foresters and land owners must follow the State's air quality rules and regulations on outside burning when planning or conducting a prescribed burn. (NMED)

The article found in the link below goes into greater detail on the research being done to try to determine the balance between prescribed burning to reduce fuel loads in forests and the negative effects of smoke.

<http://ff.org/centers/csspp/misc/CSPPforeststudy.pdf>

Additional resources:

- USFS website on air quality: <http://www.fs.fed.us/air/>

NM's Smoke Management website  
[http://www.nmenv.state.nm.us/aqb/SMP/smp\\_index.html](http://www.nmenv.state.nm.us/aqb/SMP/smp_index.html)

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## Biodiversity

From: NM Biodiversity and Collections Consortium  
<http://nmbiodiversity.org/nmbiodiversity.php>

New Mexico is enormously rich in biodiversity. Across plants and vertebrate animals, ***New Mexico has the 4th highest native species richness of any of the U.S. states***<sup>1</sup>. The large size of our state and nearness to the U.S. southern border are major contributors to our species richness. Another important factor is that several ecoregions converge in New Mexico including the Colorado Plateau, the Southern Rocky Mountains, the Arizona-New Mexico Mountains, the Central and Southern Short-grass Prairies, the Chihuahuan Desert, and the Apache Highlands. While these factors contribute to New Mexico's large species richness, the level of endemism (species found only in New Mexico) is relatively low. New Mexico ranks 11th in endemism<sup>1</sup>.

Among U.S. states, New Mexico has the 4th highest diversity of plants, 3rd highest diversity of mammals and of reptiles, and the 2nd highest diversity of birds<sup>1</sup>. At this time, we do not know invertebrates well enough to say how many species we have in New Mexico or to compare quantitatively against other states ([See our page on NM Invertebrate Biodiversity](#)). Nevertheless, it seems quite likely that the species richness of insects, spiders, and other arachnids is quite high in New Mexico. As expected for a dry state, our species richness for amphibians and freshwater fishes is relatively low compared to other states<sup>1</sup> (27th and 38th respectively).

(from Pennsylvania's Envirothon website:  
[http://www.envirothonpa.org/documents/Undrstnd\\_Biodvrsty.pdf](http://www.envirothonpa.org/documents/Undrstnd_Biodvrsty.pdf) )

### Understanding biological wealth in our forests

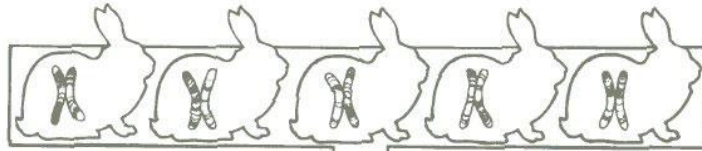
No resources about the value of forests would be complete without addressing the issue of biodiversity. Biodiversity, a term used interchangeably with biological diversity, is often confusing and sometimes controversial. In general, biodiversity refers to the richness or variety of animal, plant, and other life in a given area, from the tiniest snail or moss to the largest predator. More comprehensively, biodiversity encompasses not only the species themselves, but also the complex interactions between species and the natural communities and ecosystems that they form. These interacting plant and animal species are like strands of a spider web, each adding to the delicate balance that fosters environmental stability. This rich and complex composite of life is our biological wealth, for it forms the living part of the natural resource base upon which humans depend and of which humans are an integral part. As new technology allows us to exert more and more control over our environments to suit our needs, it is important to keep this connection in mind (see the figure below.) On a global level, the way we manage our biological diversity may, in the long run, determine our biological destiny. It is not likely that the actions of any one individual will cause a large-scale environmental catastrophe. But it is possible that the collective actions of people across the world will effect a gradual erosion of environmental stability and hence create an environment in which humans, among other species, would be unable to survive. To some, this view

might seem alarmist, but it is important to see how individual actions contribute to the whole. The forest management section focuses on the need for individuals to make environmentally responsible decisions in the area in which they live or own land. It also provides suggestions on how biodiversity can be incorporated into long-range management planning.

Figure 1. Levels of biodiversity

#### Genetic Diversity

The variation in genetic composition of individuals within and among species (e.g., variation within a population of rabbits).



#### Species Diversity

The variety of different species found in an area (e.g., the variety of species found in a prairie).



#### Ecosystem Diversity

The variety of physical environments and biotic communities over a landscape (e.g., the variety of forests, grasslands, wetlands, and aquatic systems over a region).



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## UNDERSTANDING BIODIVERSITY

Because individual life-forms do not exist in a vacuum, we need to expand our concept of diversity to include more than just numbers of particular species. By examining the interactions between species at various levels, we can learn more about how natural communities function. In turn, we can learn how to influence these processes so that we can meet our growing needs in sustainable ways. Because the idea of biodiversity is so complex, it is useful to ask ourselves about this variety of animal and plant life, and why we are managing for it. The variety of biological diversity includes genetic diversity, species diversity, and ecosystem diversity.

### GENETIC DIVERSITY

This is the level of biodiversity most people have difficulty understanding. Each individual organism is a unique chemical and genetic factory unlike any other of its species. No two humans are alike, for example, as demonstrated by our ability to identify specific human beings using DNA or fingerprints. This reservoir of information has taken centuries to develop; it cannot be duplicated or retrieved once it has been lost. A diverse or varied gene pool provides a hedge against an unknown future. It allows a species to adapt to constantly changing environmental conditions.

### SPECIES DIVERSITY

This is the level of biodiversity that usually receives the most attention. It is the many different kinds or varieties of plants, fungi, fish, amphibians, reptiles, mammals, birds, and other organisms that make up the living world around us.

### ECOSYSTEM DIVERSITY

This kind of diversity involves the various species living in an area, the ecological processes that link them together, and the soil, air, and water that support the living organisms constituting the ecosystem. Many different kinds of ecosystems occur in different physical settings, and within each ecosystem many tiers exist that support additional diversity. We know ecosystems as a pine forest, a wetland, a prairie, a cave,

or a stream, to name just a few. The multiple layers of plant growth in a pine forest, from herbaceous to shrub to the forest canopy, are an example of the tiers within an ecosystem. All these components of biodiversity, genetic, species, and ecosystem diversity, are interconnected. As we begin to better understand the complex processes that occur at these different levels, we need to consider how our management decisions affect each of these biodiversity components. Since ecosystems rarely, if ever, follow management boundaries or property lines, the issue of scale becomes especially important in this process.

The species most in danger of being lost to changes in their habitat, thus reducing biodiversity, are those considered rare or endangered. Read the lists below to get a sense of how many plant species that New Mexico hosts could easily lose their tenuous foothold in the evolutionary chain due to poor land management, climate change, or a host of other factors.

Rare Plants of New Mexico: <http://nmrareplants.unm.edu/rarelist.php>

Endangered Plant Species of New Mexico  
<http://www.endangeredspecies.com/states/nm.htm>

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## Fire

One of the main factors that have led to catastrophic wildland fire has been the fire suppression efforts over the past century. We have limited fires by our quick responses and kept them from their normal burning cycle. Thereby, fuel loading has increased in nearly every ecosystem in the West beyond the natural range of variability. This contributes to an increase in fire intensity and challenges researchers and land managers to come up with solutions. These problems are complex, and new information is coming out every day to try to help improve the way forests are managed. (*JRO – January 2007*)

Resources:

Fire and Forest Health

[http://www.fs.fed.us/rm/pubs/rmrs\\_gtr75.pdf](http://www.fs.fed.us/rm/pubs/rmrs_gtr75.pdf)

[http://www.rms.nau.edu/publications/rm\\_gtr\\_295/](http://www.rms.nau.edu/publications/rm_gtr_295/)

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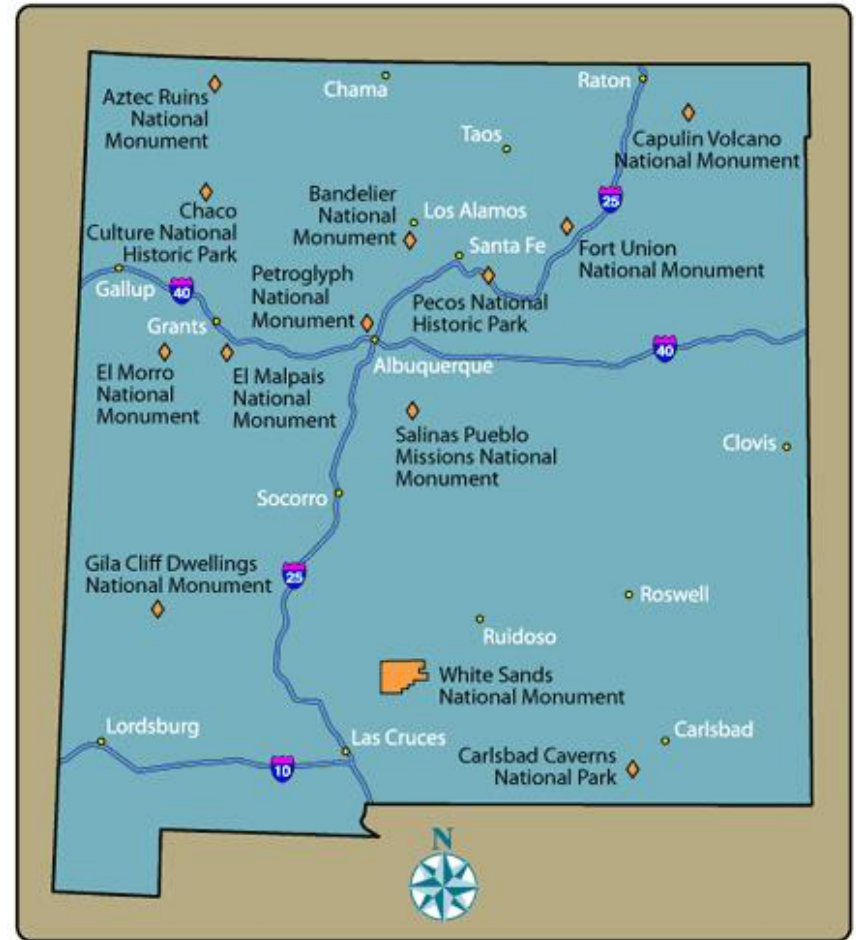
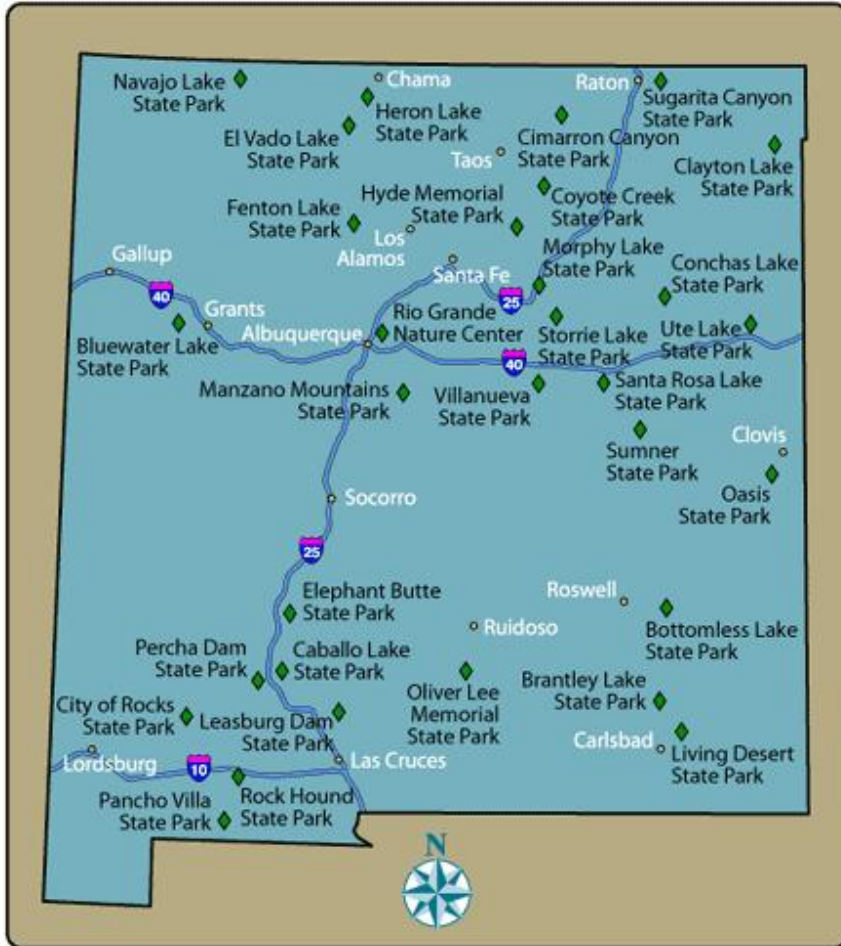
## Recreation

More and more demands are being placed on forests, especially as sites of recreation. In 2006 the 34 New Mexico State parks were visited by 3.9 million people. Each of these people has a different, and sometimes conflicting, idea of how they want to use the forest and its resources. Their preferences range from wilderness hiking to off-road vehicle use, hunting and fishing to bird watching in wildlife preserves, minimal impact camping to developed/paved campgrounds, no wake lakes to marinas with speed boats. Managing for multiple and often incompatible uses creates tension that has led to many lawsuits. Forests have been divided up to identify specific areas for specific uses, i.e. wilderness, off-road vehicle use, trails for hikers only, horse trails, star gazing, no wake lakes, wildlife habitat, and endangered species areas.

As more people use our forests and lakes as recreational sites, the impacts left behind are marring the natural beauty. Campsites are worn bare by increased foot traffic.

Many sites are picked clean of firewood so people are cutting and chopping nearby trees for firewood. Initials and names are carved into trees, especially aspens, damaging the bark and the health of the tree. Trash left behind is a nuisance and a hazard, and it is also expensive to remove and dispose of. Inconsideration by a few campers - often late at night - has led to an unpleasant night for some. But these are OUR public lands, they belong to us all. It is up to us to enjoy them and, more importantly, use them appropriately, so that our child and grandchildren will have a place to go to enjoy the beauty of the outdoors. We should all follow the motto "Leave no trace" when visiting these special places.

New Mexico's State Parks



New Mexico's National Parks and Monuments