National Park Service
U.S. Department of the Interior

Rocky Mountain National Park
Colorado

Bark Beetle Management Plan
Environmental Assessment

William S. Ciesla photo

May, 2005

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Summary

Bark beetle infestations are killing ponderosa, lodgepole, and limber pine trees and spruce trees in Colorado forests and elsewhere in the western United States. Infestations, due in large part to continuing drought, are increasing in Rocky Mountain National Park (RMNP). Areas of concern include the park's southwest corner near Grand Lake, where a significant pine beetle infestation is moving into the park, and localized infestations in developed areas of the park that are affecting trees in campgrounds and around visitor centers. Trees that have been killed by bark beetles can become safety hazards for visitors and park employees, reduce aesthetic values, contribute to forest fuels that can influence wildland fires, and may cause property damage within the park and on adjacent private property.

RMNP proposes a proactive approach to manage two genera of native bark beetles, *Dendroctonus* and *Ips*. This plan identifies RMNP bark beetle management goals as well as strategies to protect high-value trees in developed areas of the park and cooperate with private inholders within the park and adjacent landowners to accomplish common goals.

Two alternatives are presented: 1) the No Action Alternative is the continuation of current bark beetle management using Integrated Pest Management (IPM) techniques such as the removal of beetle infested trees, removal of hazardous trees, tree thinning, watering, mistletoe removal, and prescribed fire; and 2) the Preferred Alternative, which includes the above techniques as well as the use of an insecticide applied to trees as a bark beetle repellant to protect certain high-value trees. Pheromone use would also be permissible if proven effective. A third alternative, which would have expanded the area to be treated, was considered but dismissed.

The Preferred Alternative would have negligible, minor, or moderate impacts on soils and vegetation, natural soundscapes, aquatic, wetland and riparian communities, endangered, threatened and rare species, wildlife, wilderness, air quality, archeological resources, cultural landscapes, visitor experiences, park operations, and human health and safety. Long-term benefits derived from the protection of high-value trees under the Preferred Alternative outweigh short-term adverse impacts. Alternative 2 is the environmentally preferred alternative.

Public Comment

If you wish to comment on this Plan or EA, you may mail or deliver comments to the addresses listed below. You can also submit comments via the new National Park Service Planning, Environment and Public Comment (PEPC) web page (listed below). **Written comments are due by 5:00 p.m. MDT on Friday, June 3, 2005**. Our practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents may request that we withhold their home address from the record, which we will honor to the extent allowable by law. We will make all submissions from organizations or businesses available for public inspection in their entirety.

Mail: Superintendent, Rocky Mountain National Park, Estes Park, CO 80517
Hand delivery: Rocky Mountain National Park HQ, 1000 Highway 36, Estes Park or Kawuneeche Visitor Center, 16018 U.S. Highway 34 Grand Lake
E-mail: romo_superintendent@nps.gov
Fax: 970 586-1359
PEPC web page: http://parkplanning.nps.gov

Abbreviations and Definitions

Abbreviations

ATV	All Terrain Vehicle
CDOW	Colorado Division of Wildlife
CE	Categorical Exclusion
CNAP	Colorado Natural Areas Program
CNHP	Colorado Natural Heritage Program
DBG	Denver Botanical Gardens
DBH	Diameter at Breast Height
EA	Environmental Assessment
ESA	Endangered Species Act
FWS	U.S. Fish and Wildlife Service
HTP	Human Toxicity Potential
IPM	Integrated Pest Management
LC50	Lethal Concentration 50
LD50	Lethal Dose 50
MCS	Multiple Chemical Sensitivity
MSDS	Material Safety Data Sheet
NEPA	National Environmental Policy Act
NPS	National Park Service
NRCS	Natural Resources Conservation Service, U.S. Department of Agriculture
PPE	Personal Protective Equipment
RFD	Reference Dose
RMNP	Rocky Mountain National Park
USDA	United States Department of Agriculture
USFS	United States Forest Service
WUI	Wildland-Urban Interface Fuels Management areas

Definitions

Beetle-infested Tree – A green (live) coniferous tree that is the site of a bark beetle attack. The external symptoms of beetle infestation include popcorn-like masses of resin called "pitch tubes" on the trunk and boring dust in bark crevasses and at the tree base. In early summer, about nine to ten months after being attacked, the needles of infested pines will turn reddish-brown.

Internal symptoms, visible only by removing a portion of bark with a hatchet, include the beetle's distinctive tunnel system (called galleries), wood which is stained bluish-gray, and live eggs, larvae, pupae and/or adults in the phloem layer of the tree. (Colorado State University Cooperative Extension 2003).

Beetle-killed Tree – A coniferous tree that has succumbed to a pine bark beetle attack. Discolored foliage in early summer, in conjunction with the other signs of a beetle attack (see above), is evidence that a coniferous tree has been killed by bark beetles.

High-value trees – Living pine and spruce trees that have the following characteristics:

- Provide shade for campgrounds, picnic areas, parking lots, structures or other facilities
- Provide visual screening for campgrounds, picnic areas, parking lots, structures or other facilities
- Have cultural significance
- Provide exceptional and irreplaceable habitat for wildlife
- Provide exceptional and irreplaceable seed source
- Have outstanding visual quality

Hazardous tree – A tree that may fail within three years with the potential to cause personal injury or property damage.

Cultural landscape – A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with an historic event, activity, or person or exhibiting other cultural or aesthetic values (NPS 2004).

Exotic plants and animals – The NPS defines exotic species as those species that occupy or could occupy park lands as the result of deliberate or accidental human activities. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place (NPS 2001).

Native Plants and Animals – The NPS defines native plants and animals as all species that have occurred or now occur as a result of natural processes on lands designated as units of the national park system. Native species in a place are evolving in concert with each other (NPS 2001).

Native pests – Native species that may have a negative impact on natural or cultural resources. The National Park Service may control native pests to conserve and protect plants, animals, and facilities in developed areas (NPS 2001).

Insecticide – A chemical repellant used to prevent bark beetles from entering a host tree.

Integrated Pest Management (IPM) - A decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage, by cost-effective means, while posing the least possible risk to people, resources, and the environment (NPS, 2001). IPM techniques are aimed at:

Prevention – using long-term techniques, such as thinning and prescribed fire to improve the ability of trees to withstand bark beetle outbreaks;

Suppression – applying direct control techniques such as removing infested trees to address short-term needs during a bark beetle outbreak; and

Restoration – maintaining the bark beetle's role in the natural process and ecosystem integrity by allowing them to continue unchecked.

The specific IPM techniques follow:

Integrated Pest Management Techniques:

Mechanical: Using handsaws or chainsaws to remove pine or spruce trees that contain live beetle eggs, larva, pupae or adults to prevent beetles from spreading to nearby high-value trees. Insects in cut trees can be killed/removed using one of the following methods:

- **Solarizing –** Wrapping cut trees in 6-mil clear plastic which is sealed around the edges with soil.
- **Burning –** Removing freshly cut slash from Wildland Urban Interface (WUI) areas from the vicinity of high-value trees to a central location for burning.
- **Chipping –** Chipping branches and logs into small pieces with powered equipment.
- **Stripping –** Removing the bark completely from cut logs to expose beetles to the elements.
- **Hauling –** Removing infested trees from the park and hauling them to a location where they cannot spread to nearby healthy trees.

Mechanical treatment can be used selectively as in:

- **Sanitation –** Removing individual beetle-infested trees to reduce beetle populations and prevent further mortality.

Mechanical treatment can be used more broadly as in:

- **Thinning –** Selectively removing trees to modify the stand environment and eventually increase residual tree vigor so that they are better able to withstand bark beetle attacks.

Cultural:

- **Watering –** Watering high-value trees during drought conditions
- **Mistletoe control –** Removing mistletoe from high-value trees to improve tree vigor.

Prescribed Fire: Using prescribed fire in fire-adapted ecosystems of RMNP.

Chemical:

- **Insecticide –** Using a chemical such as Sevin® brand XLR plus Carbaryl sprayed on the trunks and larger branches of important high-value trees as a pine beetle repellant.
- **Pheromone –** Chemical attractants have been artificially synthesized and are commercially available as lures specific to individual species of bark beetles. The lures are effective attractants for some species of bark beetles that serve to concentrate attacking beetles on suitable pheromone traps, but are not yet effective against bark beetles that occur in RMNP.

LC50 – Lethal Concentration 50. The concentration of a material in air which causes the death of 50% (one half) of a group of test animals.

LD50 – Leathal Dose 50. The dose of a chemical which kills 50% of a sample population.

RFD – Reference Dose. The estimated dose of a substance that can be consumed daily for life without adverse health effects, even in sensitive populations.

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CHAPTER 1 PURPOSE AND NEED

Park Mission

The mission of Rocky Mountain National Park (RMNP) is rooted in its enabling legislation. The 1915 Act (38 Stat. 798) creating RMNP states that regulations governing the use of the park are to be "*primarily aimed at the freest use of the said park for recreation purposes by the public and for the preservation of the natural conditions and scenic beauties thereof.*"

As a unit of the National Park System, legislation mandates that park resources are to be managed in such manner as will leave them unimpaired for the enjoyment of future generations (NPS Organic Act of August 25, 1916). RMNP's mission is the care, protection, management, improvement, understanding and interpretation of park resources while maintaining positive visitor experiences.

Location and Access

RMNP, located in north central Colorado, encompasses 265,780 acres. The park lies within Larimer, Boulder, and Grand Counties and is bordered by the towns of Estes Park, Allenspark, and Glenhaven on the east and Grand Lake on the west. The park is surrounded by federal, state, local, and privately owned lands. About 62 percent of the park boundary is bordered by national forest land, most of which is managed as wilderness. Nearly 60 percent of the park is forested, dominated by lodgepole pine and spruce/fir trees.

The park is easily accessible from the Denver metropolitan area, 65 miles to the southeast. Interstates 25, 70 and 76, which converge in Denver, provide access for visitors coming from all regions of the United States. Local thoroughfares that provide access to the park include State Highways 7, 34, and 36. RMNP is located near populous Front Range communities and receives about 3 million visitors annually.

Purpose

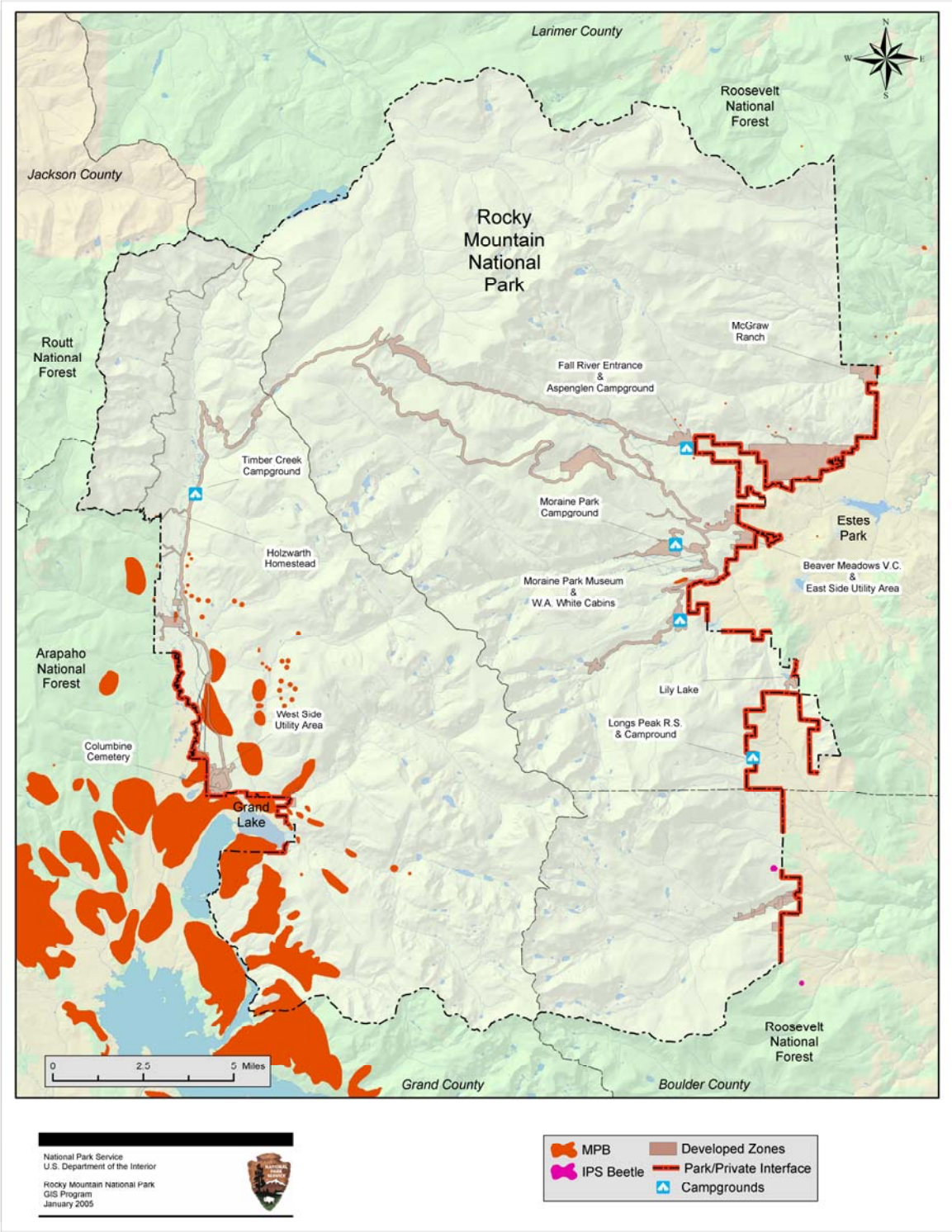
The purpose of the Bark Beetle Management Plan and EA is to protect the visual character, screening, and other important qualities that trees provide RMNP, particularly in developed and culturally significant areas. Healthy trees near visitor centers, campgrounds, picnic areas, employee housing areas and national historic districts within the park are especially valuable and should be protected. The Plan also aims to reduce or remove hazardous trees infested with, or killed by, bark beetles to reduce safety hazards. The Plan will examine ways to manage bark beetle infestations that pose a threat to adjacent private lands and private inholdings within the park. Equally important is the preservation of natural processes related to native bark beetles throughout the rest of the park, including recommended or designated wilderness, which comprises about 95 percent of total park lands. The National Park Service proposes a proactive approach in managing bark beetles in specific areas of the park.

Need

During the last three years, bark beetle infestations have increased tenfold throughout the western U.S., largely in response to a continuing drought. The number of beetle-infested and killed trees within the park has steadily increased within the past two years. Removing affected trees and preventing additional infestations in certain locations is needed in order to minimize adverse impacts.

A severe bark beetle outbreak near Grand Lake, Colorado, which is contiguous to the southwest border of RMNP, is posing an immediate threat of mortality to dense lodgepole pine forests on the west side of the park. On the park's east side, increasing populations of the *ips* beetle could affect high-value trees in developed, high use areas, such as the Moraine Park Campground. Spruce, ponderosa pine, and lodgepole pine are all at risk (Jeff Witcosky, personal communication, 10/2003).

Figure 1 - Areas within and adjacent to the park affected by bark beetles as of August 2004



Bark beetle Background

Bark beetles (*Dendroctonus* and *Ips*) are native species that have evolved with local forest ecosystems. Periodic outbreaks of native bark beetles have occurred for thousands of years. Though pine beetles cause a substantial loss of trees, they are recognized as part of "*natural conditions*." Preservation of natural conditions is specifically mentioned within RMNP's enabling legislation. Infested and dead standing trees are valuable to wildlife. However, in certain locations, beetle-infested and beetle-killed trees can cause serious problems:

- Trees infested with live beetle larva are the hosts from which a new brood of beetles will spread. These trees, and the beetles they harbor, are a threat to nearby healthy trees.
- Dead standing trees can blow over and pose safety risks to people and property within developed areas of the park.
- Dead trees can compromise the integrity of cultural landscapes, where it is important to maintain large mature trees.
- Dead trees can decrease private property values within and surrounding the park.
- Dead trees contribute to forest fuels and can influence wildland fire behavior.

There are 16 species of bark beetles currently attacking evergreen trees in Colorado. All have potential to infest trees within RMNP (Appendix A). Bark beetle susceptibility is determined by stand structure, age of stand, forest density, tree diameter, proximity to existing infestations, elevation, and the general forest health (stress due to drought, dwarf mistletoe, fire, etc.). Presently, RMNP forests meet all of the criteria for a major outbreak to occur.

RMNP has been managing bark beetle infestations for several years. Recent activities have focused on removing hazardous trees and protecting high-value trees in the Moraine Park and Timber Creek campgrounds. Monies collected from entrance fees were used to conduct the work, which was performed by park staff, fire crews, the Colorado Mountain Club, and volunteers. Infested live trees are the first priority for removal, followed by beetle-killed hazardous trees.

Female bark beetles seek live green trees and typically attack on the lower 30 feet of the trunk. Females initiate a "mass attack" on a tree by means of a pheromone (a message-bearing chemical) that attracts mates and other females. A successfully attacked tree will be the starting point of what may become a group of beetle-killed trees. Infestations can include individuals or groups of trees depending upon the health of the stand, environmental conditions, and nearby populations of beetles. Once bark beetles infest a tree, nothing practical can be done to save it.

Beetles will generally attack live trees in July or August. During an attack, the adult beetles will seek cracks and crevasses between bark plates where they bore through the bark to gain access to the phloem (or vascular system) of the tree. Once they've entered the tree, the beetles will bore tunnels (or galleries) within the phloem where they will lay their eggs. An individual female may lay more than 100 eggs.

Adult mountain pine beetles that enter a tree carry the spores of a fungus called "blue stain." The fungus rapidly multiplies within the tree and within a short time will disrupt the vascular system of the tree, preventing the exchange of nutrients between the tree's roots and crown. While the beetles themselves may weaken a tree, it is the blue stain fungus that actually kills the tree. The timeframe between the initial beetle attack and the death of the tree is usually less than one year. (Degomez and Young 2002, Hastings et al. 2001, Dave Leatherman, personal communication).

Beetle eggs hatch during the fall. The larvae spend approximately 8 months feeding within the tree before transforming into pupae. New adults emerge July through September, when they repeat the process. One infested tree can produce enough mature beetles to infest one to three more trees, and perhaps as many as eight trees. Healthy trees within approximately ¼ mile of a beetle infested tree are at risk from a new attack when the adults emerge.

Scoping

Scoping is an open process that helps identify environmental issues and alternatives. RMNP participates in an informal network with experts in the NPS, United States Forest Service (USFS), Colorado State Forest Service and nearby counties along with bark beetle experts, adjacent landowners, local communities, and the Colorado Coalition for Alternatives to Pesticides to address bark beetle management. Park staff conducted/attended the following meetings:

February 10, 2004 RMNP Biologist met with the Grand Lake Landowners to discuss mountain pine beetle management. The 2-hour meeting was attended by 60 participants.

February 17th, 2004 RMNP Chief of Natural Resource Management and the park's Fire Education, Prevention and Information Specialist attended the Grand Lake Fire Protection District Public Education series, hosted by the Grand Lake Fire Department, the USFS, and private mitigation contractors. The group addressed forest health and bark beetle management.

February 24, **2004** RMNP Biologist presented bark beetle management information in RMNP's "Resource Rendezvous," a monthly newsletter on natural and cultural resources distributed to all employees.

March 19, 2004 Park officials met with NPS Regional Entomologist, Bob Cain, to evaluate bark beetle activity on the Colorado River District of the park. Cain confirmed the high risk of this area for beetle infestations due to high density and large diameter of trees and close proximity to an ongoing outbreak in the Arapaho National Recreation Area.

June, 2004 The "Resource Rendezvous," containing bark beetle information related to RMNP was distributed to members of the U.S Senate and House, Colorado State Legislators, conservation agencies, federal and state agencies, local community leaders, research cooperators, intergovernmental managers, fire cooperators, special interest groups, RMNP concessionaires, and Rocky Mountain Nature Association Board of Directors/staff.

August, 2004 Park officials met with congressional staff members, state, county and USFS officials to visit and discuss bark beetle management throughout the upper Colorado River Basin.

November, 2003 and June, 2004 RMNP biologists conducted two training sessions with park employees and volunteers on all aspects of bark beetle management.

Through meetings and scoping, the following issues surfaced:

- The use of chemicals (insecticides) in RMNP
- Timing of chemical application to achieve maximum effectiveness while avoiding peak visitation
- Cost of spraying insecticides, ranging from $4,000-$10,000 per year during an attack
- Additional cost of removing infested trees and hazard trees by seasonal work crews ($25,000 - $30,000 per year)
- Increased slash pile burning of infested trees during the winter months

Impact Topics Retained for Further Analysis / Affected Environment

The following impact topics were raised and will be analyzed in this EA.

Soils – Affected Environment

The park features an exceptionally scenic and ecologically typical portion of the Southern Rocky Mountains. The mountains were formed by a series of granitic batholiths intruded into precambrian micashists and pegmatities. The geology associated with the park is generally igneous and metamorphic rock and glacial till. Periods of glacial activity, as recent as 12,000 years ago, have created much of the landforms evident today (Emerick 1995). Glacier-carved valleys are present along the St. Vrain River, Big Thompson River and the Colorado River and their tributaries. Several lateral moraines are present within the park. Moraine Park is the remnant of a glacial lake formed by the Thompson Glacier, and the fine

sediments deposited in the lake now support wetland and grassland meadows. The numerous moraines within the park are composed of rock and debris from the scouring action of glaciers. This unconsolidated material carried by glaciers is referred to as till and includes all sizes of rocks, boulders, gravel, sand and clay.

Soils within the park were developed from the weathering of glacial and alluvial granites, schist, and gneiss parent material (Natural Resource Conservation Service 2000). Soils are typically deep and excessively drained except in wetland areas and floodplains, which are poorly drained. Soil textures are primarily sandy loams with a high amount of coarse rock fragments. Gravels and cobbles often comprise more than 40 percent of the soil profile.

The revegetation potential of soils is low to moderate due to the low fertility and low water holding capacity of the coarse-textured soils. The erosion potential for most soils is low to moderate and the potential for erosion increases with the steepness of the slope. The high percentage of rock in the soil helps to armor the soil and reduce erosion, but increases the difficulty in topsoil salvage and reapplication.

The Continental Divide bisects the park, dividing it into two distinct drainages. Steep cliffs and U-shaped valleys characterize the eastern slope. The eastern slope receives about 15 inches of precipitation annually, and is subject to high Chinook winds throughout the winter. On the western slope, mountains fall away more gradually to the Kawuneeche Valley. This side of the Continental Divide receives about 20 inches of precipitation annually, and typically receives more snow than the eastern slope in winter.

Nearly one-third of the park lies above treeline (above 11,500 feet in elevation). In the alpine tundra, precipitation falls as snow for about nine months of the year. Snow can occur any month of the year.

In 1998, an Order 2 soil survey was completed in the lower elevations of the park and an Order 3 soil survey was completed for other areas of the park (Natural Resources Conservation Service 1999). Most soil series in the park are classified in the cryic soil temperature regime. Data suggest that soils at high elevations and under spruce-fir forest meet the requirements of the isofrigid soil temperature class. Soil types generally include Cryochrepts, Cryoboralfs and Cryaquepts. The Cryochrept type is well drained with moderate permeability and slow runoff. Cryochrepts are generally in the glacial till areas and are deep to very deep. They may have large stones and boulders on the surface as well as in the profile. The erosion hazard is slight to moderate. The Cryoboralfs are moderately well drained with moderate permeability and moderate runoff. The erosion hazard is slight. The Cryaquepts are poorly to very poorly drained, with slow to moderate permeability and slow runoff. They are found in the wetter, flatter areas, such as the Kawuneeche Valley. Erosion is slight unless slopes are denuded of vegetation.

The application of an insecticide to healthy trees as a bark beetle repellant has the potential to affect soils. Spray drift or spills could end up in the soil. This topic will be retained for analysis.

Vegetation – Affected Environment

Due to the variation in elevation, climate, and soils, RMNP contains nine distinct vegetation types. These range from grass/shrub meadows at 7,800 feet to alpine tundra above 11,500 feet in elevation. Most forested communities that could be affected by bark beetles are dominated by ponderosa pine, lodgepole pine, or spruce/fir trees.

Approximately 60% of the park is forested, 13% is located above treeline, 18% consists of exposed rock, and 9% is a mixture of other habitat types. Major vegetation types consist of ponderosa pine and grass/shrub habitat between 7,800 ft. to 8,500 ft., lodgepole pine between 8,500 ft. to 9,500 ft, spruce/fir between 9,500 ft. to 11,500 ft., and alpine tundra above 11,500 ft. The west side of the park is characterized by lodgepole pine and spruce/fir. The Kawuneeche Valley is the largest riparian meadow in the park and is about nine miles long and ½ mile wide. The valley is composed of marshes, bogs, ponds, and wet meadows dominated by sedges and willow.

There are approximately 1,000 known vascular plant species in RMNP. Of these, 115 are exotic.

Human activity has altered native vegetation. Prior to the establishment of RMNP in 1915, mining, logging and livestock grazing activities introduced exotic plants into the area. Building the infrastructure of the park, as well as increasing visitation, has further contributed to the establishment and spread of exotic plants in RMNP.

Fire plays a significant role in altering native vegetation and soils. Fire is the major agent in initiating and terminating forest succession; it controls the age, structure, species composition and physiognomy of the vegetation; it influences nutrient cycles, energy flows, productivity, diversity, and stability throughout the ecosystem (Heinselman 1981). Fire occurs about once every 300 to 700 years in spruce/fire forests, once every 100 to 150 years in lodgepole pine forests, and once every 22 to 308 years in ponderosa pine forests (Jesse Duhnkrack RMNP, personal communication, and Baker and Ehle, in press).

According to the National Park Service*'s 2001 Management Policies,* the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2000).

Sixty percent of RMNP is forested. Lodgepole pine and ponderosa pine trees are the primary hosts of bark beetles in RMNP. On the west side, dense stands of lodgepole pines are at great risk of mortality due to infestations spreading north from the Arapaho National Recreation Area. Infested lodgepole pines are located in the Kawuneeche Valley area, including the Kawuneeche Visitor Center, Timber Creek Campground, Holzwarth Ranch and along roadsides. On the east side of the park, ponderosa pine trees are affected in developed areas, such as Moraine Park Campground, Beaver Meadows Visitor Center, the utility area, McGraw Ranch, and along roadsides.

Other host trees in the park include limber pine and Colorado blue spruce and Engelmann spruce trees, but threats to these species are currently within the natural range of variability. Generally, bark beetle outbreaks in RMNP are likely to occur in:

- Lodgepole pine stands that contain well-distributed, large-diameter (8" or more) trees;
- Dense stands of pole-sized ponderosa pine;
- Limber pine colonizing areas such as ridgetops; and
- Drought-stressed Colorado blue spruce.

Plants and grasses at the base of infested trees requiring bark beetle management are also affected. These effects are primarily related to trampling during the cutting and removal of infested or beetle-killed trees. Drift from insecticide spraying can also land on plants growing at the base of healthy trees. Typical plant species include, but are not limited to, mountain muhly, june grass, antelope bitterbrush, and cinquefoil. This topic will be retained for analysis.

Natural Soundscape

In accordance with National Park Service *Management Policies* (2001) and Director's Order #47, *Sound Preservation and Noise Management*, preservation of the natural soundscape is an important mission of the NPS. Natural soundscapes occur in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all natural sounds within the park, together with the physical capacity for transmitting natural sound through air, water, or solid material. RMNP strives to preserve the natural soundscape associated with the physical and biological resources of the park. From elk bugling to thunderous waterfalls, the natural sounds of RMNP contribute to a sense of wilderness and solitude that are important to park visitors and are therefore critical to protect. Bark beetle management activities, such as removing trees using chainsaws, have the potential to affect the natural soundscape. Therefore, this topic will be retained for analysis.

Aquatic, Wetland, and Riparian Communities

RMNP contains the headwaters of four major river basins. These are the Big Thompson, North Fork of the Colorado, North Fork of the St. Vrain, and the Cache La Poudre Rivers. The Continental Divide bisects the park into two distinct watersheds. Water flowing west drains into the Colorado River. Water flowing east empties into the Missouri and Mississippi Rivers.

RMNP contains 147 lakes and 473 miles of stream. Visitor use and atmospheric depositions alter water quality. Many high elevation lakes and streams were originally without fish life. Today at least 51 of the lakes sustain trout populations, some due to stocking by settlers or early park managers. Until 1969, lakes were stocked with exotic trout, which displaced native trout species. In the late 1970's park managers stopped stocking exotic trout and began to reintroduce native trout.

Aquatic/riparian areas contain some of the greatest diversity of habitat for flora and fauna in the park. These areas are quite sensitive to environmental stresses.

Beaver have influenced streams and lakes in the park. Their populations have fluctuated over time. Today, the beaver population is considerably smaller than it was 150 years ago. This is due to a variety of reasons, some of which are not fully understood.

Executive Order 11990 *Protection of Wetlands* requires federal land management agencies to avoid, where possible, adversely affecting wetlands. NPS policies for wetlands, stated in *2001 Management Policies and Directors Orders* and Director's Orders 77-1, *Wetlands Protection*, strive to prevent loss or degradation to wetlands and to preserve and enhance the natural and culturally beneficial values of wetlands.

Pine trees susceptible to bark beetles are usually located in upland habitat, but may be near or adjacent to aquatic, wetland and riparian communities. Colorado blue spruce, though currently not threatened by bark beetles, can be found in moist environments adjacent to aquatic, wetland and riparian habitat. Wetland communities provide habitat for a wide variety of flora and fauna in the park. Though these areas will be avoided, the potential exists for chemical repellants to enter open water through runoff, spray drift, and spills. This topic will be retained for analysis.

Threatened, Endangered and Rare Species (T&E and rare species)

The Endangered Species Act (1973) requires an examination of impacts on all federally-listed threatened or endangered species. NPS policy also requires examination of impacts on federal candidate species as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species. (NPS Management Policies § 4.4.2.3).

In December of 2004, RMNP developed a list of threatened and endangered species that is specific to the park. The list includes species that are known to occur in the park or could potentially occur in the park, and species that occur outside the park, but could potentially be affected by actions within the park. The list can be found in Appendix B. The U.S. Fish & Wildlife Service (USFWS) has concurred with the RMNP list (Appendix C). Appendix D is the list of State Endangered, Threatened, and Rare Species for RMNP. Appendix E is a list of sources used by RMNP to identify Endangered, Threatened, and Rare Species. All of the listed species were considered during the development of this EA.

No federally endangered and threatened plants or insects are known to occur in proposed bark beetle treatment areas, however potential exists to encounter them.

There are four state-imperiled butterflies in Colorado (Appendix C), but none are known to exist within bark beetle project areas.

The Canada Lynx, which is federally listed as a threatened species, has been recently reintroduced into southwestern Colorado. The Colorado Division of Wildlife has 19 records of 4 radio-collared lynx moving north from their release site and spending some time in or near RMNP between Oct 8, 1999 and April 28, 2000. Since April 2000, there have been other documented occurrences of lynx in the park with the latest noted on October 6, 2004. RMNP provides prime habitat for the Canada lynx and future sightings are expected. Extensive surveys have not documented a relic population of the lynx or a permanent population within park boundaries.

The northern goshawk, listed by the state as vulnerable during its breeding season, hunt and forage in dense lodgepole pine forests where beetle management activities would occur.

Three endangered, threatened or rare species reside within RMNP, but do not occur in areas proposed for bark beetle management. These include: 1) Bald eagle, *Haliaeetus leucocephalus* – federally and state listed as threatened, 2) Boreal toad, *Bufo boreas* – candidate for federal listing and state-listed as endangered and critically imperiled; and 3) Greenback cutthroat trout, *Onocorhynchus clarki stomias* – federally listed as threatened and state listed as imperiled and vulnerable. These species will not be affected by bark beetle management activities and no further analysis of these three species will be included in this EA. However, the topic as a whole will be retained for analysis.

Wildlife

RMNP is home to a variety of wildlife species. About 280 species of birds, 66 species of mammals, 11 species of fish, 5 species of amphibians, and one specie of reptile reside within the park. The distribution of species within the park varies by season, elevation, and varieties of habitats present.

Birds in the park include year-round residents, seasonal migrants and breeders, and occasional visitors. Three life zones (montane, subalpine, and alpine) support a diversity of avian populations. Common species of birds in RMNP include the American robin, broad-tailed hummingbird, red-tailed hawk, black-billed magpie, Stellar's jay, dark-eyed junco, pine siskin, Lincoln's sparrow, Wilson's warbler, green-tailed towhee, and mountain chickadee. RMNP was designated a Globally Important Bird Area in 2000 due to the diversity of birds and breeding habitat for species of high concern.

Elk, bighorn sheep, moose, and deer are the large ungulates found within the park. Bighorn sheep are particularly sensitive to human disturbances. The montane life zone (7,800 to 9,000 feet in elevation) provides the primary winter range for deer and elk. Moose are found west of the Continental Divide, particularly in the Kawuneeche Valley. Other common mammals in RMNP include the chickaree, coyote, bobcat, mountain lion, chipmunk, Wyoming ground squirrel, yellow-bellied marmot, and golden-mantled ground squirrel.

Three exotic bird species, three exotic trout species, and one exotic squirrel specie reside in the park. Occasionally, a mountain goat or domestic sheep may wander into the park. When encountered, mountain goats are removed.

The National Park Service's *2001 Management Policies* direct national parks to maintain all components and processes of naturally evolving ecosystems, including the natural abundance, diversity, and ecological integrity of plants and animals (NPS 2000).

Bark beetles provide benefits for some mammals. Infested trees provide food, roosting, and nesting sites for cavity-nesting birds, such as woodpeckers, swallows, bluebirds, chickadees, and nuthatches. These trees also create habitat for snowshoe hare, Nutall's cottontail, and other small mammals. These animals may be disturbed by beetle management activities. This topic will be retained for analysis.

Wilderness

Wilderness management programs and policies apply to parks that have designated wilderness, potential wilderness, and recommended/study wilderness (NPS-41). NPS policies state: "*The NPS will take no action that would diminish the wilderness suitability of an area recommended for wilderness study or for wilderness designation until the legislative process has been completed*." (USDI-NPS Management Policies Chapter 7:2, 2001, NPS-41). RMNP manages most of its land as though it was designated as wilderness, even though only a small part of the part has been actually designated as wilderness. Management areas within the park include recommended wilderness (94 percent of the total park area), designated wilderness (1 percent of the total park area), and administrative areas (5 percent of the total park area). Most bark beetle management would occur within the administrative area of the park, which lies outside recommended or designated wilderness.

Bark beetle management activities would occur in wilderness only when infestations within the park threaten high-value trees on adjacent private lands. Control work would be limited to 150 feet within the park boundary, would only be undertaken upon the request of adjacent landowners, and would only occur under certain conditions specified in this plan. This topic will be carried forward for analysis.

Air Quality

The Clean Air Act (42 Section 118 of the 1963 Clean Air Act (42 U.S.C. 7401)) requires a park unit to meet all federal, state, and local air pollution standards. Further, it provides that federal land managers have an affirmative responsibility to protect air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts. RMNP is designated a mandatory Class I area. Visibility is noticeably impaired in the park 90% of the time. Pollutants can be traced to the populated Front Range of Colorado, but possibly as far away as Mexico, Texas, and California.

Research indicates that nitrate levels are increasing at Loch Vale, one of the park's high elevation lakes. Atmospheric deposition (acid rain or acid deposition) occurs in the park, particularly during the summer months. Precipitation measured near park headquarters and at Loch Vale has an average pH below 5.0 during the summer. This pH is below natural levels (Keigly and Porter, 1986, Baron, 1991).

RMNP monitors ambient ozone (O_3), sulfur dioxide (SO_2) and associated meteorological data for the NPS National Ambient Air Quality Monitoring Program. In 2002 the monitoring station at RMNP detected six exceedences of the Environmental Protection Agency (EPA) 8-hour ambient air quality standard for ozone. On at least half of these exceedence days at RMNP, the Denver Metropolitan area also monitored levels of ozone that exceeded the 8-hour standard. Preliminary assessment of meteorological data during these time periods indicates that winds were coming from the southeast, essentially from the direction of the Denver metropolitan area.

The EPA revised the national ambient air quality standard (NAAQS) for ozone in 1997 from a one-hour average of 0.12 parts per million (ppm) to an eight-hour average of 0.8 ppm. Ozone is generally formed from chemical reactions between volatile organic compounds and nitrogen oxides in the presence of sunlight, usually during the warm summer months. Ozone is the prime ingredient of smog in cities and other areas where there is an abundance of precursor emissions (fossil fuel burning, oil and gas operations, chemical process industries, etc.). Ozone can be harmful to people and damaging to some species of plants (Peterson and Arbaugh, 1989). Levels above 0.08 ppm can damage sensitive plant and animal species.

Bark beetle management activities will occur in developed areas, where use of chainsaws, prescribed burns, and chemical application can affect air quality. This topic will be carried forward for analysis.

CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act, as amended in 1992 (16USC 470 *et seq,*) and Director's Order *2*8 *Cultural Resource Management Guidelines* require the consideration of impacts on historic properties that are listed in or are eligible to be listed in the National Register of Historic Places. They also require federal agencies to coordinate with State Historic Preservation Officers regarding the potential effects their actions could have on historic properties listed in or potentially eligible for listing in the National Register of Historic Places. For the purposes of this discussion, cultural resources include: archeological resources, cultural landscapes and historic structures.

Archeological Resources

To date, archeological surveys of about 17 percent of the park (43,865 acres) have located about 300 prehistoric and 700 historic archeological sites. The area that now comprises RMNP has been occupied by human beings for some 10,000 years. Archeological sites include prehistoric occupation sites, high altitude game drives, culturally-peeled trees, six prehistoric trails, vision quest sites and other Native American religious sites, and the remains of historic ranches, resorts, mines, sawmills and two mining towns.

All developed areas in the park have been surveyed and no archeological resources are known to occur in areas proposed for bark beetle management activities, though potential exists for them to be encountered. Mitigation measures will ensure that if archeological resources are found within beetle management areas, activities will cease until a qualified archeologist determines that it is okay to proceed.

Cultural Landscapes

According to the National Park Service Director's Order 28 *Cultural Resource Management Guidelines,* a cultural landscape is a reflection of human adaptation and use of natural resources and is expressed in the way land is organized, patterns of settlement, land use, systems of circulation, and types of structures that are built. Cultural landscape features include buildings, structures (roads, trails, bridges, ditches, and fences), native vegetation, historic plantings, ponds, wildlife, and viewsheds.

While the park has only one designated cultural landscape at McGraw Ranch (10 acres), the park's historic districts are viewed as cultural landscapes for management purposes, including: Utility Area, William Allen White cabins, Deer Haven, Holzwarth Homestead/Never Summer Ranch, McGraw Ranch, Fall River Entrance, and Green Mountain/Onahu Ranches. Similarly, road corridors and trails should be managed to protect historic landscape features.

Historic Structures

There are more than 450 historic structures remaining in the park. Historic resources relate to mining, ranching, logging, tourist activities, and to facilities associated with early development of the park. Mining, ranching, logging and many facilities predating the park's establishment in 1915 have been removed. Many areas disturbed from the mid-1800's to the early 1900's have been restored to natural conditions. While the areas around many historic structures are not considered cultural landscapes, the trees surrounding them often define the setting and feeling of the building, two important aspects of National Register properties.

A main feature of the Bark Beetle Management Plan is to protect high-value trees in historic areas throughout the park. The top priorities for control include: McGraw Ranch, William Allen White cabins, the Beaver Meadows Visitor Center, and the Holzwarth Homestead/Never Summer Ranch. Other control activities would occur in the Utility Area, near Deer Haven and near the Lieffer Cabin.

Bark beetle management will continue during the life of this plan in culturally-significant areas as listed above. The significance of trees to the cultural landscape in these areas would be carefully considered and documented before removal or other control activities take place to maintain forest health. This topic will be retained for analysis.

SOCIAL CONSIDERATIONS

Visitor Use and Experience

According to *2001 Management Policies,* the enjoyment of park resources and values by people is a part of the fundamental purpose of all park units (NPS 2000). This policy also states that scenic views and visual resources are considered highly valued characteristics that the National Park Service should strive to protect. The NPS is committed to providing high quality recreational opportunities, appropriate to the superlative natural and cultural resources in RMNP.

Recreation has been a popular pursuit in RMNP for over 90 years. Annual park visitation is approximately 3 million people. Camping and picnicking are prime activities in the park and sites fill up from Memorial Day to Labor Day. Protection of high-value trees in campgrounds and picnic areas is important to visitors as trees provide shade and screening from nearby sites. Bark beetle management activities are proposed in all campgrounds, picnic areas and visitor centers. Proposed insecticide application would take place in late summer, after peak visitation, and could last through December. Slash removal and burning would follow. Ideally, all slash piles infested with pine beetles would be burned before June of each year to prevent further infestations from occurring. Pine beetles typically fly to new host trees starting in mid-June.

A yearlong visitor survey revealed that scenery, tranquility, clean air, clean water, and wildlife viewing are extremely important attractions for RMNP visitors (Valdez, 1996) and these qualities will be carefully considered prior to and throughout bark beetle management activities. This topic will be carried forward for analysis.

Human Health and Safety

Bark beetle-infested and killed trees can become weakened and may blow down or topple over, which is a safety hazard. Beetle killed trees can add to forest fuel loads which can influence wildland fire behavior. Wildland fires near developed areas are a public safety concern.

Public health and safety are a primary concern associated with the application of insecticides, especially related to human exposure through respiratory, dermal or dietary routes (touching or eating berries with residues) when insecticides are released into the air and water. This topic will be carried forward for analysis.

Park Operations

The superintendent at RMNP is responsible for the full scope of managing the park, its staff and residents, all of its programs, and its relations with people, agencies, and organizations interested in the park. This includes a variety of activities to accomplish management goals and meet requirements in law enforcement, emergency services, public health and safety, research and science, resource protection and management, visitor services, interpretation and education, community services, utilities, housing, fee collection, and administrative support.

RMNP has committed funding, staff, and resources to inventory, monitor, and maintain resources contributing to the overall health of forest ecosystems, including exotic plant management, fuel reduction, and bark beetle management. These activities will continue, in concert, to accomplish the mission of RMNP, which is the preservation of resources and providing for the enjoyment of those resources for present and future generations of park visitors. A key component of managing bark beetles is also fostering cooperation with adjacent landowners and park inholders to achieve mutual goals. This topic will be carried forward for analysis.

Impact Topics Dismissed From Further Analysis

Prime and Unique Farmland

In August, 1980, the Council on Environmental Quality (CEQ) directed that federal agencies must assess the effects of their actions on farmland soils classified by the U.S. Department of Agriculture's Natural Resource Conservation Service as prime or unique. Prime or unique farmland is defined as soil that particularly produces general crops such as fruits, vegetables, and nuts. According to the Colorado Department of Agriculture, the soils comprising RMNP are used for wildlife habitat and are not considered to be prime or unique farmlands. Thus, prime and unique farmland is not addressed as an impact topic.

Floodplains

Executive Order 11988 *Floodplain Management* requires all federal agencies to avoid undertakings within the 100-year floodplain unless no other practical alternative exists. The National Park Service under *2001 Management Policies* and Director's Order 77-2 *Floodplain Management* strives to preserve floodplain values and minimize hazardous floodplain conditions.

Bark beetle management activities will not occur within a 100-year floodplain; therefore a Statement of Findings for floodplains will not be prepared and the topic has been dismissed.

Natural Lightscape

In accordance with *2001 Management Policies,* the National Park Service strives to preserve natural ambient landscapes, which are natural resources and values which exist in the absence of human caused light (NPS 2000). Bark beetle control activities will have no impact on the natural lightscape since all work will occur during daylight hours. This impact topic is dismissed from further consideration.

Ethnographic Resources

According to Director's Order 28 and Executive Order 13007 on sacred sites, the National Park Service should try to protect ethnographic resources – any site, structure, object, landscape, or natural feature assigned traditional significance in a cultural group traditionally associated with it. Ethnographic

resources are not known to exist in the areas proposed for bark beetle management activities. Therefore, this topic has been dismissed from further consideration.

Museum Collections
According to Director's Order 24, the NPS requires the consideration of impacts on museum collections. The park's museum collection is housed in the east side utility area in a location where no bark beetle management activities will occur. These resources are dismissed from further consideration.

Topography and Geology
The topography and geology of Rocky Mountain National Park will not be affected by bark beetle management activities because no earth-moving activities will occur. This topic is dismissed from further consideration.

Socioeconomic Effect
Bark beetle management activities in RMNP would not change local and regional land use or appreciably impact local businesses, tourism, or employment. It is unlikely that the minimal use of an insecticide as a last resort will deter park visitors from entering the gateway communities leading into RMNP, thereby not affecting the local economies. Any increase in workforce (i.e., contractors hired to apply the insecticide) would be negligible and last only as long as treatment occurs. Because the impacts to the socioeconomic environment would be negligible, this topic has been dismissed.

Environmental Justice
Executive Order 12898 *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires all federal agencies to incorporate environmental justice into their missions by addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Because Integrated Pest Management (IPM) techniques would be executed by park staff regardless of race or income, and contractors would not be hired based on their race or income, the proposed action would not have disproportionate health or environmental effects on minorities, low-income populations or communities. Therefore, environmental justice has been dismissed as an impact topic.

Relationship to Other Plans
This Plan, which proposes using the full range of IPM techniques to manage bark beetles in RMNP, is consistent with the following park documents and other agency plans.

- Master Plan (1976)
- Land Protection Plan (1985/1991)
- Resources Management Plan (1998)
- Backcountry/Wilderness Management Plan (2001)
- Fire Management Plan (1992, updated in 2004)
- Vegetation Restoration Management Plan (1994)
- Wildland-Urban Interface Fuels Management Plan (2002)
- Exotic Plant Management Plan (2003)
- Elk and Vegetation Management Plan (in preparation)
- 2001 National Park Service Management Policies
- **Forest Health and Fuel Reduction Project – Arapaho National Recreation Area (ANRA) EIS** The USFS plans to improve forest health, reduce fuels contributing to extreme wildfire behavior, and preserve and improve scenic quality by limiting the amount of bark beetle infestation and fuels accumulation. The USFS preferred alternative calls for a variety of treatments in about 2,678 acres of USFS land. Temporary roads and trails would be constructed during implementation that would later be returned to their original character. Proposed treatments include thinning, seed tree cuts, clear cuts, hazardous tree removal, and preventative insecticide spraying of trees in high visitor use areas.

CHAPTER 2 BARK BEETLE MANAGEMENT PLAN

Bark Beetle Management Goals

The National Park Service (NPS) proposes a proactive approach in managing bark beetles in specific areas of the park. The goals of the Bark Beetle Management Plan in RMNP are to:

- Protect high-value trees in developed high-use areas of the park
- Protect the safety of park visitors and employees from hazardous trees killed by bark-beetles
- Reduce fire risk by removing beetle infested and beetle killed trees ancillary to ongoing WUI hazard fuels management
- Allow natural forest processes, including the spread of pine beetles, to occur unhindered in natural zones in the park
- Cooperate with adjacent landowners and inholders to protect high-value trees on private property by removing infested trees on nearby park land.

High-value trees have one or more of the following characteristics:

- Provide shade for campgrounds, picnic areas, parking lots, structures or other facilities
- Provide visual screening for campgrounds, picnic areas, parking lots, structures or other facilities
- Have cultural significance
- Provide exceptional and irreplaceable habitat for wildlife
- Provide an exceptional and irreplaceable seed source
- Have outstanding visual quality

The area considered for bark beetle control represents about 1,000 acres of park land. Of these, 300 acres contain high-value trees in developed areas and identified national register historic districts. RMNP proposes to manage about 88 acres using the full range of IPM techniques. In the 95 percent of RMNP recommended or designated as wilderness, natural processes prevail and bark beetles will not be managed unless they threaten trees on adjacent private land.

Proposed Strategies

The Plan calls for seven proactive strategies to achieve bark beetle management goals. These include:

Strategy 1 - Inventory and monitor bark beetle infestations in RMNP
Strategy 2 - Prioritize areas for bark beetle control
Strategy 3 - Identify and apply control techniques most appropriate for bark beetle species
Strategy 4 - Monitor effectiveness of control efforts
Strategy 5 - Prevent loss of high-value trees by monitoring bark beetle pathways
Strategy 6 - Inform the public about RMNP bark beetle control methods
Strategy 7 - Work with adjacent landowners, inholders, and local, county, state and federal agencies

These strategies, which constitute the Bark Beetle Management Plan, are detailed below.

Strategy 1 – Inventory and monitor bark beetle infestations in RMNP
Continue a rigorous inventory and monitoring program in RMNP, with emphasis on developed, high-use areas, and areas adjacent to private land. Evaluate and integrate this information into the bark beetle management program.

Inventory and Monitoring

- Park staff and volunteers and USFS entomologists conduct bark beetle surveys each year, and document the size of infestations. Park staff will continue to survey developed high-use areas of the park where infestations are evident. The USFS conducts an aerial survey each summer over

RMNP and the adjacent Arapaho-Roosevelt National Forest, and provide maps where heavy infestations are occurring (Figure 1).

- RMNP's Vegetation Map, scheduled for completion in 2005, will be updated as needed to account for patches of beetle-killed pine and spruce trees. This map is maintained in the Division of Natural Resources Management.

- RMNP continues to monitor developed high-use areas where beetle-infested trees have been removed. Hazardous tree inventory forms are used to document the number of trees removed each year. For example, 200 bark beetle-infested or killed trees were removed from the Moraine Park Campground during the winter of 2003-2004.

Inventory Techniques

Trees larger than 8 inches DBH should be carefully evaluated. The mountain pine beetle begins attacking most pine species on the lower 30 feet of the trunk. There are several symptoms to look for when surveying trees to determine if they are infested with live bark beetles.

- **Pitch Tubes** – When trees are not under stress, they will generally respond to a beetle attack by producing moderate to copious amounts of resin or pitch which flows out of the bark from the entrance holes produced by attacking beetles. Attacking beetles are often able to work their way through the pitch and to successfully attack the tree. Evidence of a successful attack is often a hole (or tube) that passes through the pitch to the tree. Pines under stress or suffering from drought may produce no pitch at all. Pitch tubes should not be used as a sole indicator of an infested tree.

  Upon careful examination, pitch tubes may reveal the presence of adult beetles, which indicate that the tree was able to dispel at least some of the attackers. Depending on the health of the tree and number of attacking beetles, a tree may be successful in warding off an attack. A tree can be attacked over several years and still be successful in warding off these multiple attacks. This can be seen in different ages of pitch tubes. If there are a large number of fresh pitch tubes on the trunk of a tree there is a high probability that the tree will die from the attack.

  If pitch tubes are hard to the touch and crumble when crushed in the hand, the tree has not been recently attacked. If the tree's foliage is still green in early summer, then the attack may have been unsuccessful (i.e., the beetles failed to kill the tree), particularly if the pitch tubes are hardened.

- **Boring dust (frass)** – Frass in bark crevices and around the base of a tree is often the sign of a bark beetle attack. A large amount of frass is an indication of a successful attack. However, frass does not necessarily mean the tree contains live bark beetles, and other symptoms should be checked to verify if live bark beetles exist. Also, frass can be created by other species of beetles. Trees that contain other species of beetles should not be removed.

- **Holes in the bark of the tree** – Adult beetles entering a tree will bore a hole through the bark to reach the phloem. These holes are typically located in cracks and crevasses between bark plates where the bark is thinnest. In healthy trees, these holes will usually include pitch tubes.

  Adult beetles feed within the tree before they emerge; when several feeding chambers coalesce, adults occur in groups under the bark. One or more beetles will then make an exit hole from which several adults will emerge. Exit holes are about 3/32 inch in diameter, they do not exude pitch and can occur anywhere on the trunk of the tree. Holes located on the bark surface and not between bark plates will almost always be exit holes. The presence of exit holes is a sign that the adult beetles have left the tree and the tree may no longer be infested.

- **Foliage** - A healthy tree will have dark green needles whereas a tree that is dying will have light green to yellow needles. In late spring or early summer, trees with pitch tubes, boring dust and yellowing needles are usually infested and contain live beetles. Trees with brown needles and no

green foliage may no longer contain live beetles. Further evaluation, such as debarking a small part of the tree, will verify if there are live beetles.

- **Debarking** - If there is still uncertainty if a tree contains live bark beetles, a hatchet, machete or drawknife can be used to remove a piece of bark to check for eggs, larvae, pupae and/or adults in the phloem layer of the tree and also look for the blue stain indicating the tree is infected with blue stain fungus and will die.

  A sustained cold spell during the winter can kill pine beetles and may signal the end of an infestation. If temperatures below zero degrees Fahrenheit have been sustained over a period of several days during the winter, several trees should be checked the following spring to determine if they contain live bark beetles. If the bark beetles have succumbed to the weather, infested trees need not be removed.

- **Blue Stain** – An associate of pine bark beetles is a fungal microorganism better known as "blue stain." During colonization, female beetles tunnel throughout the phloem tissue of the tree where they lay their eggs. As carriers of blue stain, the beetles induce thousands of low dosage fungal inoculations over a large portion of the tree bole allowing the fungus to become well established throughout the phloem before invading the sapwood (xylem). Sapwood occlusion by the blue stain fungus contributes to the quick death of beetle-attacked trees. Trees containing blue stain fungus will usually die within one year of being infected.

  The presence of eggs, larvae, pupae and/or adults and blue stain fungus under the bark are definite signs that a tree has been successfully attacked by bark beetles and will not survive. The presence of blue stain fungus alone does not warrant the removal of a tree, as the beetles may have already emerged.

Strategy 2 – Prioritize areas for bark beetle control
Prioritize bark beetle control based on four management criteria within six management zones.

Management Criteria

A . Increased risk of hazardous trees in developed areas
Developed, high-use areas, such as visitor centers, employee housing, campgrounds, picnic areas entrance stations, utility areas, and parking lots where people and property are at risk, are high priorities for bark beetle control.

B. Infestations threatening cultural sites and landscapes
Trees contributing to a cultural site or landscape are a high priority for bark beetle control. These landscapes include national register historic districts such as the Holzworth Ranch, William Allen White Cabins, McGraw Ranch, the Utility Area, and the Beaver Meadows Visitor Center National Historic Landmark. Cultural sites include the Grand Lake Cemetery.

C. Threat to private land
Beetle infestations that threaten adjacent private properties or private inholdings are high priorities for bark beetle control.

D. Increased risk in fire severity
Beetle-killed trees along power lines will be a high priority for control as fallen trees can lead to power outages and increased risk of wildland fires.

Ongoing hazard fuel reduction work in WUI areas is expected to improve forest health and resistance to beetle infestations over time. Removal of beetle infested trees and beetle killed trees in WUI areas will normally be ancillary to hazard fuel reduction projects. Severe pine beetle infestations in WUI areas could become a high priority for control depending on location, proximity to developed areas, tree density and other factors.

Management Zones

Six land management zones will also be used to prioritize where bark beetles would be managed:

A. **Natural Zone:** This zone, where natural and ecological processes prevail, comprises undeveloped areas of the park, including 248,464 acres or 93 percent of the park that has been recommended as wilderness. An additional 2,917 acres is designated as part of the Indian Peaks Wilderness. This zone is a low priority for bark beetle control and no insecticide applications would be used.

   Beetle-infested trees would only be removed if they contain live larva and pose an immediate threat to high-value trees. Beetle-killed trees would only be removed if they pose a threat to property or human safety. Dead trees no longer containing live beetles would remain for wildlife (i.e. cavity nesting birds and habitat for mammals that use cavities) if they are not considered a threat to human life or property.

B. **Historic Zone.** This zone includes the William Allen White cabins (5 structures on less than 3 acres), McGraw Ranch (11 structures on 10 acres), Holzwarth Historic District (12 structures on 75 acres), and the Utility Area (81 structures on about 100 acres), and Deer Haven (4 structures on 2 acres) national register historic districts, the Beaver Meadows Visitor Center National Landmark, and the potentially eligible Lieffer Cabin (1 structure). Protecting high-value trees within historic zones is a high priority.

   All trees within a ¼-mile radius of the Historic Zone will be surveyed each year. If beetle infestations are found, chemical treatment may be warranted to protect high-value trees. After documentation, those trees containing live beetle eggs, larva, pupae or adults within this zone or buffer area would be removed to minimize the risk of beetles spreading to non-infested high-value trees. Beetle-killed trees not containing live bark beetles would be analyzed. If hazardous, they would be removed. Non-hazardous trees would remain for wildlife purposes. A non-hazardous beetle-killed tree no longer containing live larva may be retained and would only be removed to improve the aesthetic value of the zone as determined by the park's management team.

C. **Developed Zone.** This zone includes 768 acres of park land where development and intensive use substantially alter the natural environment. Areas include campgrounds, picnic areas, park housing, visitor centers, parking lots, utility areas, trailheads, liveries and private inholdings. This zone is managed for administrative and recreation purposes and is disturbed with visitor use and maintenance activities. Protecting high-value trees in developed zones would be a high priority. Removing infested trees with live beetle eggs, larva, pupae or adults that could spread to high-value trees on private park inholdings would be a high priority.

   Trees within a ¼-mile radius of this zone will be surveyed each year. If beetle-infested trees are found, chemical treatment would be warranted to protect uninfested high-value trees. Trees containing live beetle eggs, larva, pupae or adults would be removed to minimize risks to uninfested high-value trees within the park or on private inholdings. All hazardous trees are a high priority for removal. Non-hazardous trees could remain for wildlife purposes. Removal of non-hazardous beetle-killed trees no longer containing live beetles would only be done if it improves the aesthetic values of a Developed Zone as determined by the park's management team.

D. **Wildland Urban Interface Fuels Management Zone.** The Wildland-Urban Interface (WUI) Fuels Management Plan (NPS 2002) is a separate plan that addresses the removal of woody fuels, including live and dead standing trees and dead and down woody fuels in seven areas along the eastern boundary of the park. The seven treatment areas are located near developments within the park and neighboring private properties. These seven treatment areas comprise approximately 3,670 acres.

Bark beetle infestations can occur within WUI fuels treatment areas. Because of the proximity of WUI fuels treatment areas to developed areas both inside and outside the park, bark beetle management within these areas is important. However, WUI fuels management projects are not designed to specifically address bark beetle infestations and beetle management in these areas would typically not be a high priority. Removal of beetle infested and beetle killed trees would occur ancillary to WUI fuels management activities. Over time, WUI fuels management activities are expected improve forest health. Trees that remain after thinning operations will be more vigorous and can better withstand bark beetle attacks. Pine beetle infestations in WUI fuels treatment areas could become a high priority for control depending on location, proximity to developed areas, tree density and other factors.

E. **Road Corridors and Power Line Zone.** This area includes 75 miles of paved roads, 20 miles of unpaved roads, 28.8 miles of above-ground power lines and a number of miles of below-ground power lines. Beetle-killed trees along road corridors can become hazardous, threatening vehicles and human lives. Accordingly, road corridors are surveyed each year and hazardous trees are removed as necessary. Removing hazardous trees within or adjacent to parking areas is a high priority. Removing hazardous trees along road corridors outside of parking areas would be a low priority and would be managed through the annual hazard tree evaluation program.

   Hazardous trees along power lines within the park can be removed by utility companies when conducting routine maintenance, or by NPS employees if identified as an immediate fire risk. The Town of Estes Park and Mountain Parks Electric have approval to remove hazardous trees within rights-of-way. Hazardous trees outside the right-of-way would be removed by NPS personnel. Trees falling across underground power lines are not considered a risk and would not be removed unless the utility company needs to maintain access. Removing hazardous beetle-killed trees along above-ground power lines constitutes a high priority.

F. **Recommended or Designated Wilderness Areas Adjacent to Private Property.** Approximately 40 percent of the park boundary is contiguous with forested private lands. Beetle infested trees containing live beetle eggs, larva, pupae or adults that could spread to trees on adjacent private land will be a high priority for removal. Within recommended or designated wilderness, the park will remove infested trees with live beetles when they are located within 150 feet of the park boundary, when notified by an adjacent landowner that there is a problem, and under certain conditions specified in this plan. Within recommended or designated wilderness, a Minimum Requirement Analysis would be conducted.

Table 1 - Priorities for Bark Beetle Management

Zone	High Priority	Low Priority
Natural	Removal of hazard trees or trees with live beetles that pose a risk of spreading infestation to high-value trees.	
Historic	Removal of hazard trees or trees with live beetles that pose a risk of spreading infestation to high-value trees.	Removal of trees that are not infested and are not considered hazardous.
Developed	Removal of hazard trees or trees with live beetles that pose a risk of spreading infestation to high-value trees.	Removal of trees that are not infested and are not considered hazardous.

WUI		Removal of beetle-infested trees and beetle-killed trees to reduce fire risk ancillary to WUI fuels management. This could become a high priority based on the extent of the infestation and relationship to developed properties.
Road & Utility Corridors	Removal of hazardous trees.	Removal of trees that are not infested and are not considered hazardous.
Recommended or Designated Wilderness	Removal of hazardous trees or infested trees within 150 feet of the park boundary when notified by an adjacent landowner.	

Strategy 3 – Identify and apply control techniques that are most appropriate for each species. Control techniques will be selected that achieve maximum effectiveness in protecting high-value trees while minimizing risks to natural resources, cultural resources, and humans.

Several IPM control techniques are available to managers. This plan calls for using individual and/or combined techniques, including:

Mechanical – Using tools such as chainsaws for tree removal to: (1) prevent beetles from infesting other high-value trees; (2) establish healthier forests that can withstand a bark beetle outbreak; and (3) remove hazardous trees in developed high-use areas of the park. Once trees have been cut down, live beetle eggs, larva, pupae or adults remaining in the trees can be killed by burning, chipping, stripping the bark or solarizing the wood by wrapping it in 6-ml clear plastic sealed around the edges with soil. Cut trees can also be removed from the park and hauled to a location where live beetles cannot spread to healthy trees.

Hazard Tree Removal – Cutting and removing individual trees that present a risk to property or public safety. Hazard trees may contain live beetle eggs, larva, pupae or adults, but more frequently will have been killed by beetles and there are no living insects present within the tree.

Sanitation – Cutting and removing individual beetle-infested trees to improve stand health, stop insect spread, and prevent further mortality in the area. Beetles can bore into a tree just above the soil line, so trees must be cut flush with the ground whenever possible. This technique will primarily be used in or near developed areas within the park to protect high-value trees in campgrounds, picnic areas, around visitor centers, and employee housing areas. This technique would not ordinarily be used in WUI fuels management areas, but can be employed when the extent of the infestation, proximity to developed areas, tree density and other factors warrant. This technique will also be used if nearby landowners or inholders notify the park that there are infested trees with live beetle eggs, larva, pupae or adults located on park land near private properties. This technique will only be used when live insects are present, and therefore tree felling, chipping, burning, stripping the bark, solarizing or hauling from the park must be accomplished before mid-June before adult beetles fly and spread to other sites. This cost-effective technique has been used successfully in Timber Creek and Moraine Park campgrounds. Pile burning must follow prescribed fire protocols (1992 Fire Management Plan as amended and 2002 Wildland Urban Interface Fuels Manage-ment Plan).

Thinning – Selectively removing trees to increase the vigor of the remaining trees and their ability to withstand bark beetle attacks. Thinning will primarily occur in conjunction with and ancillary to WUI hazard fuel reduction projects, but can be employed elsewhere when warranted. The sap from freshly-cut spruce and pine trees contains turpentine, which can attract pine beetles. The slash piles themselves can become infested, which can lead to the spread of bark beetles. For this reason, tree thinning should occur when trees are driest (August through December). To prevent the spread of mature beetles, burning must occur before the beetles fly, usually in June.

WUI fuels reduction projects are not specifically designed to address bark beetle management, but can help to reduce the spread of beetles. The burning of WUI-generated slash piles may not always be completed by June of each year.

Cultural: *Watering and Mistletoe control* – Watering high-value trees during drought helps reduce stress and increase their ability to repel bark beetles. Another stress-reducing technique is to remove branches that contain mistletoe. Only large mature trees within William Allen White, McGraw Ranch, Holzwarth Ranch, and the Utility Area national register historic districts would be culturally treated if warranted.

Chemicals/Insecticides – Used only as a last resort or when high-value trees are at great risk, insecticides would be applied to high-value trees in specific locations on park land to repel bark beetles. Use of insecticides is not intended to kill insects, but to prevent bark beetles from attacking trees, thereby protecting them from infestations. After careful evaluation of several preventative chemicals, RMNP proposes the application of Sevin® brand XLR Plus Carbaryl. If new chemicals become available, they will be evaluated for effectiveness and environmental and human safety. New chemicals will be considered for use if they prove to have distinct advantages over Carbaryl.

Spraying would occur in spring or late summer and only on trees located on park-owned land. Treatment areas would be closed off and reopened as necessary to ensure visitor safety. The insecticide would be sprayed on the trunk from ground level up to a point where the diameter of the trunk is less than 6 inches. It must be applied in advance of a beetle attack to serve as a repellant. Application would be restricted to selected high-value trees in developed areas or cultural landscapes due to cost, safety, and accessibility. No insecticides would be used in recommended or designated wilderness.

By April 30 of each year, NPS staff would identify locations in the park where insecticide applications are warranted. The Communication Plan outlined under Strategy #6 would be implemented. Trail segments, trailheads, picnic areas, parking lots, campsites, and visitor and employee facilities located within or adjacent to planned treatment areas will be posted prior to spraying. Signs would remain in place for 60 days afterwards. All chemical-free campgrounds would be advertised to the public via the RMNP website and other media.

Pheromone Use – Pheromones, which are message-bearing chemicals emitted by bark beetles, can be artificially synthesized and are commercially available as lures to attract specific beetles. Artificial pheromones can be used to bait a tree. Beetles concentrated within the baited trees can then be removed or destroyed. Pheromone traps can also be used to capture flying beetles. Presently there is no effective pheromone for the bark beetle species that are present in RMNP. If research proves their effectiveness, pheromones could be evaluated and used in the park in the future. Pheromones cannot be analyzed in this plan until an effective product is found.

Prescribed Fire – Prescribed fire is a preventative strategy used to meet resource objectives and maintain healthy forests that are better able to withstand beetle outbreaks. This technique must mimic the integrated role fire played within each ecosystem. Prescribed fire for resource benefit can occur when naturally-ignited wildland fires are allowed to burn under carefully monitored conditions or when fire management staff initiate and monitor the entire event. This strategy is most appropriate in undeveloped areas where motorized access is prohibited. Prescribed fire is included as a part of the WUI Fuels Management Plan (2002) and the RMNP Fire Management Plan (1992 as amended).

In some cases, a combination of treatments is necessary to meet bark beetle management goals. For example, thinning and prescribed fire in WUI fuels treatment areas can reduce forest fuels and improve forest health. Healthy forests are less susceptible to bark beetle infestations. Watering, mistletoe removal, and insecticide application are effective at protecting high-value trees in developed and historic zones.

In all cases, the selected control technique(s) must:

- **Pose little or no risk to human health and safety**. IPM techniques can harm humans. Injuries can occur with the use of chainsaws, crosscut saws, and prescribed fire. Insecticides can affect human health, particularly those with Multiple Chemical Sensitivity (MCS). RMNP proposes insecticide use only if other control techniques prove ineffective or when high-value trees are at great risk.

  RMNP evaluated several insecticides for protecting high-value trees from bark beetles (Carbaryl, cyfluthrin, chlorpyrifos and lindane) and determined that Carbaryl was the most effective. Carbaryl was found to prevent beetle attacks for up to two years while chlorpyrifos was effective for only about four months (Hall 1982).

- **Pose little or no risk to natural and cultural resources.** RMNP will continue to evaluate treatment options and ensure all environmental and cultural compliance is met. RMNP will review any new relevant scientific literature to ensure control techniques selected are sound.

- **Be cost effective to implement.** While cost is not the driving factor, it must be considered. Estimates completed in 2004 reveal that insecticide application by contractors ranges in cost between $10 and $25 per tree. Mechanical techniques cost $50 per tree.

Strategy 4 – Monitor effectiveness of control efforts.
Monitoring is essential in evaluating control techniques. RMNP will continue to monitor bark beetle infestations and control techniques, and update the information annually. If mechanical, cultural and prescribed fire techniques are adequately protecting high-value trees, insecticides would not be used. Monitoring conducted in 2003 and 2004 indicates that current IPM techniques have not been adequate to protect some high-value trees, and insecticide application is warranted in specific areas of the park.

RMNP will continue to monitor and report the location of infestations and numbers of trees removed or sprayed with insecticides.

Strategy 5 - Prevent loss of high-value trees by monitoring bark beetle pathways.
Bark beetles are naturally occurring species in Colorado forests. Under normal conditions they occur at low population levels, going unnoticed by humans. In recent years conditions have become favorable for bark beetle population growth, which ultimately led to the current outbreak. Outbreaks tend to occur in areas where trees are stressed due to stand density, drought or other environmental factors. During the peak of an outbreak, even healthy trees that would normally repel beetles are attacked. RMNP will continue to monitor bark beetle outbreaks, especially in the developed and historic zones.

Another potential pathway is the ongoing fuel thinning and slash piling operations in WUI areas. Turpentine from freshly-cut slash can attract beetles into areas where they previously may not have occurred.

Strategy 6 – Inform the Public about bark beetle management and control measures.
RMNP has developed a communication plan to inform the public about bark beetle management activities. The plan will:

- Inform the public about local, regional, and national issues regarding bark beetles.
- Inform the public about bark beetle control measures in RMNP, especially insecticide use.
- Inform people with Multiple Chemical Sensitivity (MCS) about upcoming chemical applications.
- Foster communication between the NPS and the public on bark beetle management in RMNP.
- Close and post areas where insecticides are to be applied, as necessary**.**

RMNP will inform the public in the following ways:

Programs to Inform the Public

- **Visitor Centers** – Information on bark beetle management would be available at visitor centers through site bulletins, bulletin board postings, and personal communication by rangers.
- **RMNP Information Office** – Information on insecticide type, location, and application schedules will be available for distribution by April 30 each year.
- **RMNP District Rangers** – Information on chemical application schedules, type of chemical and location will be available to District Rangers by April 30 each year.
- **Interpretive Programs** – Beetle management concerns and controls may be integrated into interpretive talks and walks, as appropriate.
- **Environmental Outreach Programs –** RMNP will integrate bark beetle management issues into current environmental education curriculum, as appropriate.
- **Press Releases** – The park will notify local media about bark beetle control activities, dates, locations and treatment methods, as necessary.
- **Mail –** Specific information on chemical treatment locations, dates and treatment methods would be mailed to park inholders and adjacent landowners within ¼ mile of a treatment site on, or about, April 30 each year. The park will develop a mailing list and inform stakeholders on bark beetle management activities at RMNP.
- **Internet –** Updated information about bark beetle control locations, scheduled treatment dates, and treatment methods would be posted on RMNP's web page.
- **Signs** – Insecticide treatment areas will be posted with bright yellow signs, stating the date of application and the chemical used. Signs will be posted two weeks prior to the chemical application date, and would remain in place for 60 days following application.
- **Resource Rendezvous** – The park's resource newsletter will continue to provide bark beetle management information to all employees and external interested parties, as necessary.
- **Yearly Update** – RMNP will provide annual opportunities for interested parties to meet and discuss the effectiveness of management strategies and to explore new techniques.

Strategy 7 – Work with inholders, adjacent landowners and local, county, state, and federal agencies.
RMNP will continue to join other federal, state and local government agencies, inholders, and adjacent landowners to achieve common goals for bark beetle management.

The park participates in an informal network of federal, state, county, and city officials and private citizens concerned about bark beetle epidemics. Meetings provide opportunities to develop local and regional strategies and coordinate bark beetle control efforts. RMNP will continue to exchange information with with the U.S. Forest Service, Bureau of Land Management, Bureau of Reclamation, United States Geological Survey (USGS), Colorado Department of Agriculture, the towns of Estes Park and Grand Lake, the Colorado State Forest Service and adjacent counties.

RMNP will continue to work with volunteers in managing bark beetles. Volunteers have helped pile slash in WUI fuel reduction areas and remove beetle-killed hazardous trees from campgrounds in 2003-2004. Volunteers contributed more than 1,000 hours to this effort.

Cooperation with Adjacent Landowners
When notified by an adjacent landowner that beetle infested trees threaten to spread the infestation to healthy trees on nearby private land, the park will make a good faith effort to remove the infested trees. The following conditions will apply:

- Only trees that contain live bark beetle eggs, larva, pupae or adults or trees considered hazardous would be removed.
- Only infested trees located within the park and within 150′ of the park boundary would be removed.
- The trees at risk on adjacent private land must be located within ¼ mile of the infested trees within the park and must have a minimum DBH of 8".
- Infested trees within the park will only be removed if there is a commensurate written commitment to remove infested trees located on adjacent private property before adult beetles emerge in mid-June.

- Infested trees within the park will only be removed if the adjacent landowner is unable to protect trees using an insecticide, such as Carbaryl or permythrin.
- Infested trees must be capable of being removed without causing resource damage.
- When infested trees are located in recommended or designated wilderness, a Minimum Requirement Analysis must be completed.
- Requests to remove infested trees from the park will be handled on a first-come, first-served basis. Depending on the number and extent of requests, the park may not have the resources available to remove all infested trees before adult beetles emerge and fly. Trees will not be removed after the beetles have flown.

Cooperation with Inholders

When notified by a park inholder that beetle infested trees threaten to spread the infestation to healthy trees on a private inholding, the park will make a good faith effort to remove the infested trees. The following conditions will apply:

- Only trees that contain live bark beetle eggs, larva, pupae or adults or trees considered hazardous would be removed.
- Only infested trees located on park-owned land within 150′ of the inholding boundary would be removed.
- The trees at risk on private inholdings must be located within ¼ mile of the infested trees within the park and must have a minimum DBH of 8”.
- Infested trees within the park will only be removed if there is a commensurate written commitment to remove infested trees located on an inholding before adult beetles emerge in mid-June.
- Infested trees within the park will only be removed if the inholder is unable to protect trees using an insecticide, such as Carbaryl or permythrin.
- Infested trees must be capable of being removed without causing resource damage.
- When infested trees are located in recommended or designated wilderness, a Minimum Requirement Analysis must be completed.
- Requests to remove infested trees from the park will be handled on a first-come, first-served basis. Depending on the number and extent of requests, the park may not have the resources available to remove all infested trees before adult beetles emerge and fly. Trees will not be removed after the beetles have flown.

CHAPTER 3 ALTERNATIVES

Alternative 1 – NO ACTION

Under the No Action alternative, RMNP would continue to control bark beetle infestations and protect high-value trees using current management practices. These include: mechanical (hazard tree removal, sanitation and thinning), watering, mistletoe removal, and prescribed fire. No synthetic insecticide or pheromone traps would be used. Removal of hazard trees or trees infested with live beetle eggs, larva pupae or adults would occur when notification is received from an adjacent private landowner or inholder.

Alternative 1 provides partial protection for high-value trees in developed and historic zones. Control work would focus on treating or removing trees within high use areas such as the Moraine Park and Timber Creek campgrounds, around visitor centers and properties on the National Register of Historic Places, and along power lines.

Alternative 1 would slow the loss of high-value trees within the park, but not prevent it from occurring.

Alternative 2 – PREFERRED ALTERNATIVE

The Preferred Alternative provides the greatest long-term protection for high-value trees. The IPM techniques identified in Alternative 1 would be used to prevent loss of high-value trees. Alternative 2 adds the use of an insecticide to prevent tree loss in specific park areas, but only as a last resort if other control techniques are ineffective or when high-value trees are at great risk. Chemical application is not intended to kill insects, but to prevent bark beetles from entering and infesting trees. If research demonstrates the effectiveness of pheromone use, it may be used in place of insecticides in certain situations. When an effective pheromone product is found, it will be analyzed for affects on resources before use.

RMNP proposes the application of Sevin® brand XLR Plus Carbaryl to treat up to 1000 high-value trees each year. Carbaryl would only be used in developed areas of the park. All other park areas would remain insecticide-free. Effective for up to two years, trees may only require one application of Carbaryl every other year. By using an alternating schedule, up to 2,000 trees could be protected with Carbaryl at any given time. All Carbaryl applications would be done by a state-certified applicator. Once a pine beetle outbreak subsides, insecticide use would cease and other IPM techniques would continue as needed.

Under the Preferred Alternative, bark beetles would continue their life cycles naturally in most undeveloped areas (95 percent) of the park. No control techniques would be implemented in recommended or designated wilderness unless hazard trees or infestations threaten adjacent private lands or inholdings. In that case, only hazard tree removal and/or sanitation would be used in localized areas.

Table 2 identifies the location and strategy for bark beetle control under the Preferred Alternative:

Table 2 - Park Location and Bark Beetle Control Strategy for Alternative 2

Area	Infestation Potential	Control Strategy
Grand Lake Wildland/Urban Interface	High	Thinning and prescribed fire ancillary to WUI fuels management. Hazard tree removal and sanitation may be used when warranted
Aspenglen Campground	Moderate	Hazard tree removal, sanitation and insecticide

Area	Infestation Potential	Control Strategy
Timber Creek Campground	High	Hazard tree removal, sanitation and insecticide
Holzworth Ranch	Moderate	Hazard tree removal, sanitation and insecticide
Deer Haven Historic Site	Moderate	Hazard tree removal, sanitation and insecticide
McGraw Ranch	Moderate	Hazard tree removal, thinning, sanitation and insecticide
Colorado River District – Administrative Area	High	Hazard tree removal, thinning, sanitation and insecticide
Moraine Park Campground	High	Hazard tree removal, sanitation and insecticide
Glacier Basin Campground	Moderate	Hazard tree removal, sanitation and insecticide
East Side Utility National Historic District	Moderate	Hazard tree removal, sanitation and insecticide
East Side – Wildland/Urban Interface	Moderate	Thinning and prescribed fire ancillary to WUI fuels management. Hazard tree removal and sanitation may be used when warranted
East and West Side – Within 150 feet of the park boundary adjacent to private land	Moderate/West side, Low/East side	Sanitation and hazard tree removal when warranted
Adjacent to inholdings	Moderate	Sanitation and hazard tree removal when warranted
Other Historic Districts and High-Visitor Use Areas	Moderate	Hazard tree removal, sanitation and insecticide
Remainder of the park	Moderate	Hazard tree removal when warranted

Alternatives Considered and Dismissed

A third alternative was considered to control bark beetles in a larger area of the park. Alternative 3 would expand control techniques beyond developed areas and further into the park along the park boundary. Though useful for comparison with other alternatives, Alternative 3 was dismissed for the following reasons:

- Controlling native insects during natural climatic events such as drought in recommended or designated wilderness (95 percent of park) is not consistent with NPS management policies and would not meet the NPS mandates for preservation of native flora and fauna.
- Periodic bark beetle outbreaks have occurred for thousands of years and play a critical role in the development, senescence, and rebirth of forests within the park.
- Managing bark beetles across the larger landscape is not feasible due to substantial cost and impacts to natural resources.

Mitigation measures

The following mitigation measures have been developed to minimize the degree and/or severity of adverse effects, and would be implemented during beetle control activities, as needed:

Mitigation Measures Common to Alternatives 1 and 2

1. Conduct on-site field surveys prior to treatment to determine the presence and proximity of resources at risk from bark beetle treatments, including aquatic resources, T&E and rare species, and recommended and designated wilderness.
2. Bark beetle crews will contact the park Archeologist or Cultural Resource Specialist prior to any work to determine the presence of archeological resources in the area. If resources are identified, work will cease until documentation and cultural compliance has been completed.
3. The park Archeologist or Cultural Resource Specialist will inspect the area before any trees or stumps are removed. Removal will cease if archeological materials are found and will not resume until documentation and cultural compliance has been completed.
4. The park Cultural Resource Specialist will complete a written and photographic documentation of all trees located near historic structures and historic districts or cultural landscapes prior to any mechanical treatment or mistletoe removal.
5. Before a tree is removed in or near a designated historic district/site/landscape, the resource manager will contact the park's Cultural Resource Specialist, who will determine if any documentation needs to be completed. When beetle infested or beetle killed trees must be removed from the vicinity of historic structures, within historic districts or cultural landscapes, replacement trees shall be planted unless the park's Cultural Resource Specialist determines otherwise.
6. Exercise care when dragging logs or tree branches during slash piling operations to minimize impacts to soil and native plant loss. Damaged areas that will not recover within three growing seasons will be revegetated.
7. Work crews involved in the removal of beetle-killed trees shall be trained how to recognize trees important to wildlife, when to remove hazardous trees, and where to retain trees for wildlife benefit.
8. Avoid wetlands. Keep vehicles out of streams and swales. Do not use vehicles within 100 feet of a stream or in a wetland.
9. Trees shall not be removed from aquatic, wetland or riparian areas anywhere in the park unless they are hazardous trees. If a hazardous tree is located in an aquatic, wetland or riparian environment, every effort shall be made to remove the tree during the winter months when the ground is frozen in order to minimize impacts to sensitive resources.
10. Ensure that management techniques do not have an adverse impact on greenback cutthroat trout, Colorado River cutthroat trout, and boreal toad habitat.
11. Avoid work near birds of prey nests during the breeding season (March through July). Consult with the park's wildlife biologist, GIS specialist, or natural resources specialist for raptor nest locations.
12. Include a job hazard analysis for bark beetle control work. Ensure all employees and volunteers are given proper Personnel Protective Equipment (PPE) and safety instructions for all treatment methods.
13. Cut tree stumps flush with the ground whenever possible. Do not remove stumps from the ground except for aesthetic reasons in a cultural landscape or where stump removal is warranted, such as in a campground. Consult with the park Archeologist or Cultural Resource Specialist before removal. Revegetate affected area following RMNP's "Best Management Practices."
14. Maintain or add organic matter or soil inoculate to areas disturbed by mechanical treatments or pile burning to avoid invasive exotic plant infestations. Burned ground where slash piles existed should be scarified and inoculated with surrounding duff and soil by hand raking. The Moraine Park dump does not need revegetation since further burning will occur, but should be checked for invasive exotic plants.
15. Consult RMNP plant databases to identify rare plant locations. Conduct surveys when plants are flowering or have aerial stems or catkins to determine presence or absence of sensitive species in the project area prior to treatment.

16. The purpose for conducting sanitation operations is to remove trees infested with live beetle eggs, larva, pupae or adults in order to prevent the beetles from spreading to healthy high-value trees located nearby. Trees that do not contain live beetles and do not present a risk to property or human safety should not be removed. Beetle killed trees provide many benefits to wildlife.
17. A non-hazardous beetle-killed tree no longer containing live eggs, larva, pupae or adults may be removed to improve the aesthetics of the location as determined by the park's management team.
18. When notified by an adjacent landowner or inholder of beetle infested trees on park-owned land, the site shall be assessed and the conditions for removal as specified in this plan shall be met before removal occurs.
19. Use the "Minimum Requirement Decision Guide" for bark beetle work in recommended or designated wilderness (Backcountry/Wilderness Management Plan, Rocky Mountain National Park, 2001).
20. Ensure that work crews removing trees are able to identify exotic plants and at least one crew member must be able to identify rare native species.
21. Avoid treatment in sensitive wildlife habitat during lambing, calving, or denning periods, usually occurring between May 1 to mid-June in low elevations, and from May 1 to August 31 for high elevation areas. Do not enter closed areas that protect sensitive wildlife.
22. Perform thinning operations in infested areas from August to December and burn slash from January to July, particularly where *Ips* beetles occur. Wood that is infested with live beetle eggs, larva, pupae or adults must be burned by the end of June to prevent further infestations. ***Note***: WUI hazard fuel reduction projects are typically not designed to manage pine beetles and slash pile burning may not be accomplished by the end of June. WUI projects are not required to implement this mitigation measure.

Mitigation Measures Specific to Alternative 2

1. The threshold warranting the use of an insecticide to protect high-value trees is when one or more beetle-infested trees occurs within ¼ mile of a site to be protected and high-value trees are at risk of a bark beetle attack.
2. Healthy high-value trees shall not be sprayed with an insecticide if the nearest beetle-infested tree is more than ¼ mile away unless some other factors place the trees at risk of a bark beetle attack.
3. Follow the Communication Plan (p. 27) for insecticide application.
4. Coordinate insecticide spraying activities with the RMNP Fire Management Office. Spraying shall not occur in areas where prescribed burns are planned within the next 12 months.
5. Use only water as a carrier for Carbaryl.
6. Use the Relative Aquifer Vulnerability Evaluation (RAVE) scoring system to evaluate Carbaryl for on-site groundwater contamination potential (Invasive Exotic Plant Management Plan, RMNP, 2003).
7. Insecticide application may not occur between Memorial Day and Labor Day to reduce impacts during peak visitation.
8. Do not spray chemical repellants within 100 feet from the top of a stream bank, lake shore, or aquatic, wetland or riparian habitat. This also applies to roadsides, trails, and utility corridors within 100 feet of stream crossings.
9. Use a spot treatment strategy to spray individual trees. Aerial spraying is not permitted.
10. Reopen sprayed, high use areas no sooner than 12-hours after treatment. In some cases, the actual length of closure could be longer based on the re-entry time interval stated on the product label and MSDS sheets. For example, Loop A in the Moraine Campground would be closed at noon (check-out time) the day of spraying. High-value trees would be treated either that evening or early in the morning the next day. If treated the next morning, the loop would not be reopened until the following

morning, requiring campsite closure for two nights. If treated the evening of the first day the campsite could be reopen at noon the next day.

11. Treated trees shall be flagged for a minimum of 60 days.
12. Notices shall be posted at treatment areas for a minimum of 60 days after chemical application. Posted notices shall include a warning that flagged trees should be avoided.
13. Move and/or cover picnic tables and cover tent pads beneath trees during spraying.
14. When an area is targeted for spraying, determine buffer zones where spraying would be prohibited. Identify buffer zones with pin flags before spraying begins. Areas to avoid include open water and wetlands. The Intermountain Region's IPM Specialist shall be consulted regarding appropriate width of buffer as needed.
15. Select application methods, equipment, and rates that minimize drift and off-target impacts. Use drift reduction techniques.
16. Spraying shall only occur during early morning and/or evening hours to minimize impact to non-target species such as honeybees and reduce the possibility of spray drift.
17. Notify occupants when spraying near homes, offices, or vehicles. Occupants will be advised to keep doors and windows closed and pets indoors during application. Wash areas after spraying if drift leaves residues.
18. All contractors shall be state-licensed commercial applicators. A qualified supervisor must oversee chemical applications, whether conducted by a contractor or NPS personnel.
19. The NPS Pesticide Use Proposal shall be used for all insecticides. Fill out annual Pesticide Use Logs in the NPS approval system.
20. Follow all label instructions, precautions on the Material Safety Data Sheets (MSDS), and additional advice provided by the regional and park IPM Specialists during the NPS Pesticide Approval System review.
21. Monitor weather conditions before and during chemical application. Do not apply when rain appears imminent.
22. Do not apply when wind speeds exceed 5 mph and when wind direction is toward an occupied home, office building, structure, campsite, or picnic tables within 200-feet of treated trees.
23. Do not apply when wind speeds exceed 5 mph and when wind direction is toward aquatic, wetland or riparian habitat within 100 feet of trees to be treated.
24. Use the application rates specified by the manufacturer unless directed otherwise by a certified applicator or IPM Coordinator.
25. Monitor treated areas to determine effectiveness of Carbaryl to repel bark beetles.
26. Do not apply Carbaryl in or within 200 yards of known boreal toad or fish habitat.
27. For NPS personnel applying Carbaryl:
    a) Transport only the quantity needed for that day's work;
    b) Transport concentrate to treatment site in original containers in a manner that will prevent tipping or spilling, and in a compartment that is isolated from food, clothing, and safety equipment.
28. Ensure that park employees and contractors follow manufacturer's instructions for mixing, loading, and disposing chemicals.
29. Ensure that all chemical applicators, (employees and contractors), inspect equipment for leaks or other problems before each application and at intervals during the application day. Test all nozzles, caps or other fittings for seating at intervals throughout the workday. Set aside faulty equipment immediately for repair or replacement.

30. Store Carbaryl only in facilities designed and constructed in accordance with provisions of Title 35, Article 10 of the Colorado Pesticide Applicator Act; Part 11 of "Rules and Regulations Pertaining to Administration and Enforcement of the Pesticide Applicator Act." Construct all pesticide storage facilities with adequate sump capacity to contain spillage of the entire quantity of pesticide stored.
31. Dispose all Carbaryl containers in accordance with State and Federal requirements. Empty containers thoroughly, rinse them three times, and puncture them to prevent reuse. Recycle containers as per instructions on the product label and MSDS sheets.
32. Ensure all applicators wear protective clothing. NPS will provide PPE for employees. Contractors are responsible for providing PPE to their workers. Applicators must use chemical resistant gloves such as barrier laminate, nitrile, neoprene, or Viton®. Applicators must wear shoes and socks, chemical-resistant headgear for overhead exposure, and any other safety clothing and equipment recommended or required by the insecticide label and MSDS sheets. During mixing and loading, eye protection and additional protective clothing (e.g. polypropylene-coated overalls or aprons) may be needed.
33. Carry additional safety equipment, including soap, water clearly labeled as non-drinking water, eyewash kits, first aid equipment, and extra clothing.
34. Provide safety briefings each day prior to Carbaryl application.
35. Ensure that MSDS are available at storage facilities, in vehicles, and are readily available to workers.
36. Ensure all chemical applicators are aware of threatened, endangered or rare plants in the area. Rare plant locations shall be flagged using pin flags. Do not apply Carbaryl in rare plants locations unless warranted under special circumstances and in a way that will not harm them.
37. By April 30 of each year identify locations in the park where Carbaryl application is warranted. Identify all campgrounds and picnic areas that will remain chemical free for that year. Inform the public via the RMNP website and other print media.
38. By April 30 of each year identify trail segments, trailheads, picnic areas, parking lots and campsites within or adjacent to treatment areas. Inform the public via the RMNP website and other print media.

Alternative summaries

Table 3 summarizes the major components of Alternatives 1 and 2 and compares their ability to meet the Bark Beetle Management Plan goals. As shown in the following table, Alternative 2 meets each of the objectives identified for this project, while the No Action Alternative does not address all the goals.

Table 3 - Alternative Summary and Extent to which Each Alternative Meets Plan Goals

Alternative 1 – No Action	Alternative 2 – Preferred Alternative
Bark beetle management practices would continue, featuring mechanical removal (hazard tree removal, sanitation and thinning), watering, mistletoe removal, and prescribed fire techniques. The park would work with adjacent landowners and inholders to reduce the threat of beetle infestations on their land. Control work would be limited to localized areas within the park.	Bark beetle management practices would continue, featuring mechanical removal (hazard tree removal, sanitation and thinning), watering, and mistletoe removal. In addition, an insecticide (Sevin® brand XLR plus Carbaryl is currently proposed) would be applied to up to 1,000 high-value trees each year. Control work would be limited to localized areas within the park. Pheromone use will be included in bark beetle management if proven effective in controlling infestations during the life of this plan.
Meets Plan Goals?	**Meets Plan Goals?**
No. Current practices are not totally effective at protecting high-value trees. High-value trees continue to be at risk of significant loss in developed, high use areas of the park, such as campgrounds, picnic areas, housing areas, and identified cultural landscapes where high-value trees are an integral component of the landscape. The number of hazardous trees due to beetle infestations would increase, placing property, park visitors and employees at greater risk.	Yes. This proactive approach would increase the effectiveness of current control measures. With the additional technique of insecticide application, the park would control the loss of high-value trees in Developed and Historic zones. Beetle-infested or hazard trees would be removed to prevent further outbreaks and to protect property and human safety.

Table 4 summarizes the anticipated environmental impacts for Alternatives I and 2. Only those impact topics that have been carried forward for further analysis are included: The *Environmental Consequences* chapter provides a detailed explanation of these impacts.

Table 4 - Comparative Summary of Environmental Impacts on Alternatives 1 and 2

Topic	Alternative 1 – No Action	Alternative 2 – Preferred Alternative
Soils and Vegetation	High-value trees may continue to be lost in significant numbers, resulting in a **moderate long-term adverse impact** to vegetation in high-use developed areas of the park. There would be **negligible to minor impacts** to soil and native vegetation in other areas of the park. The fire risk due to bark beetles in WUI areas are addressed in the 2002 WUI Fuels Management Plan. There would be a **short-term localized minor impact** in recommended/designated wilderness along the park boundary. The risk to high-value trees on private land adjacent to the park would be reduced.	Provides greatest **long-term beneficial effects** to high-value trees. This alternative offers the greatest protection to high-value trees in developed areas. Impacts to areas within WUI fuel management areas would be the same as Alternative 1. There would be a **short-term localized minor impact** during insecticide application. There would be a **short-term localized minor impact** in recommended/ designated wilderness along the park boundary. The risk to high-value trees on private land adjacent to the park would be reduced.

Topic	Alternative 1 – No Action	Alternative 2 – Preferred Alternative
Natural Soundscape	There would be a **minor to moderate short-term impact** on the natural soundscape from chainsaw use and crews conducting hazard tree removal, sanitation, thinning, and prescribed fire operations during treatments. There would be **short-term localized moderate impacts** in recommended/ designated wilderness along the park boundary, while work occurs.	Impacts would be the same as Alternative 1 in WUI and developed areas of the park. There would be **short-term localized moderate impacts** in recommended/designated wilderness along the park boundary, while work occurs.
Aquatic, Wetland and Riparian Communities	Bark beetle management activities will not occur in aquatic, wetland and riparian communities, so **no adverse impacts** are anticipated.	Insecticide use could cause **short-term negligible to minor adverse impacts** if insecticides enter open water through runoff and spills. Mitigating measures and the RAVE scorecard will minimize adverse impacts.
Endangered, Threatened and Rare Species	There could be **short-term negligible impacts** to the Northern goshawk and Canada lynx and a **minor adverse impact** on rare plants and insects if encountered in project areas. Prescribed fire would result in a **short-term minor impact**, but a **long-term minor benefit** to T&E or rare species.	Impacts would be the same as Alternative 1.
Wildlife	Wildlife may be temporarily displaced from habitat, resulting in **localized short-term**, **negligible to minor impacts.** Beetle-infested/killed trees provide food and shelter for some birds and small mammals, resulting in **minor beneficial impacts** to some wildlife species.	Impacts would be the same as Alternative 1, except that Carbaryl use could result in a **long-term localized minor adverse impact** on wildlife that use chemically treated trees.

Topic	Alternative 1 – No Action	Alternative 2 – Preferred Alternative
Wilderness	There would be **localized short-term minor to moderate adverse** impacts if infested trees are removed from recommended/designated wilderness adjacent to private land. Mitigation measures will reduce consequences to a **short-term localized minor impact**. Temporary displacement of wildlife and noise due to control work nearby can adversely affect wilderness values.	Impacts would be the same as Alternative 1.
Air Quality	There would be a **localized negligible adverse impact** on air quality in areas where chainsaws or prescribed fires are used.	Impacts would be the same as Alternative 1. Using an insecticide could have **short-term minor impacts** on air quality, principally from drift. Mitigating measures will reduce adverse effects.
Cultural Resources: Archeological resources, cultural landscapes and historic structures	There would be a **long-term minor to moderate impact** to cultural landscapes due to the continued risk of losing high-value trees. There are no known archeological resources in project areas, however, sites will be surveyed and mitigation measures implemented to ensure their protection.	There would be a **minor long-term beneficial impact** to cultural landscapes due to greater protection of high-value trees though the use of Carbaryl. There are no known archeological resources in project areas, however, sites will be surveyed and mitigation measures implemented to ensure their protection.
Visitor Experience	There would be a **localized short-term minor to moderate impact** due to the presence of work crews and noise during tree removal and control activities. Continued loss of high-value trees that provide shade and screening in campgrounds and picnic areas may occur. No roads, trails or campgrounds would be closed. Some picnic areas and campsites may be closed briefly during tree removal.	The impacts would be the same as Alternative 1, except that additional **short term minor to moderate adverse impacts** would occur from temporary closures of chemically-treated campgrounds and picnic areas. While this may cause short-term minor inconveniences, there would be a **long-term minor beneficial** impact resulting from protecting high-value trees in high-use recreation areas.

Topic	Alternative 1 – No Action	Alternative 2 – Preferred Alternative
Human Health and Safety	There could be **direct short – term adverse effects** on human health and safety resulting from accidents, insect stings, smoke, and flying debris from implementing the various mechanical, cultural, and prescribed fire techniques to treat beetle-infested trees.	The impacts would be the same as Alternative 1, except that additional **short term direct and indirect minor to moderate adverse impacts** would occur from insecticide application. Strictly-implemented mitigation measures would minimize human risk from dermal, respiratory, or dietary exposure to insecticides.
Park Operations	Alternative 1 affords less protection to high-value trees and the number of beetle infested and hazardous trees is expected to increase under this alternative. The amount of time, money and personnel devoted to bark beetle management is expected to be greater under Alternative 1 than for Alternative 2, resulting in a **minor to moderate long-term adverse** effect on park operations.	Using an insecticide will provide increased protection of high-value trees and reduce safety risks associated with hazardous trees. Consequently less time, money, and personnel would be devoted to bark beetle control, resulting in a **minor to moderate long-term beneficial** effect on park operations.

Environmentally Preferred Alternative

Alternative 2 is the environmentally preferred alternative. The environmentally preferred alternative is determined by applying criteria suggested in the National Environmental Policy Act of 1969 (NEPA), with additional guidance provided by the Council on Environmental Quality (CEQ). The environmentally preferred alternative is the one "that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural and natural resources." As expressed in section 101 of NEPA, "it is the continuing responsibility of the Federal Government to:

- Fulfill the responsibility of each generation as trustee of the environment for succeeding generations;
- Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- Enhance the quality of renewable natural resources and approach the maximum attainable recycling of depletable resources."

Alternative 2 is the environmentally preferred alternative because using the full range of IPM techniques, including insecticide application, is the most effective way to reduce the number of beetle-infested/killed trees in developed areas of the park. It also offers the greatest long-term protection for high-value trees in developed areas where screening for privacy and shade in campgrounds, picnic areas, and housing areas is desirable and in national register historic districts where large mature trees are an integral part of the cultural landscape. Consequently, fewer hazardous trees would require removal, which meets all of

the environmental policy goals. Bark beetle management would be focused on areas where bark beetles are found. Insecticide use would be allowed in developed and historic zones to ensure high-value tree protection.

Alternative 1, the No Action Alternative, which restricts control techniques to mechanical removal (hazard tree removal, sanitation and thinning), watering, mistletoe removal, and prescribed fire is not as effective at preventing loss of high-value trees as Alternative 2. It is also likely that there would also be higher numbers of hazardous trees to be removed.

SUMMARY

In compliance with NPS and RMNP policies, the Preferred Alternative would protect high-value trees in developed areas and in cultural landscapes. Beetle-infested or killed trees would be removed to prevent further outbreaks and to protect the safety of park visitors and employees. High-value trees in developed areas and in cultural landscapes that are at risk from a beetle attack would be treated with an insecticide (Sevin® brand XLR Plus Carbaryl is the insecticide of choice) in order to repel beetles. Each year, up to 1,000 trees could be treated with Carbaryl.

Additionally, the park would work with adjacent landowners and park inholders to protect high-value trees on private property. Trees may be removed in localized areas along the park boundary in recommended or designated wilderness upon request by adjacent landowners. Only trees containing live larva or beetles within 150 feet of the park boundary would be considered for removal. Insecticides would not be used in wilderness or in WUI areas outside developed areas.

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

Methodology

The proposed Integrated Pest Management (IPM) techniques of both alternatives are evaluated on their effectiveness in managing bark beetles while minimizing risks to natural resources, cultural resources, and the human environment. The alternatives have been evaluated for their effects on the resources and values determined during the scoping process. For each topic, impacts are identified in terms of context (effects are site-specific, local, or regional), intensity (negligible, minor, moderate, or major), and duration (short- or long-term). Definitions for intensity levels vary by topic, but for all impact topics the following definitions apply:

Impacts may be beneficial, adverse, direct, indirect, or cumulative:

Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

Adverse: A change that moves the resource away from a desired condition or detracts from its desired condition.

Direct: An impact caused by an action, occurring at the same time and place as the action.

Indirect: An effect caused by the action that occurs later in time or farther removed from the place.

Cumulative: An "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts can result from individually minor, but collectively significant actions taking place over time. The Council on Environmental Quality (CEQ) regulations, that implements the National Environmental Policy Act, requires assessment of cumulative impacts in the decision making process for federal projects.

Most bark beetle management activities are proposed to occur in developed areas already altered by human presence predating park establishment through today. Forests within the park have been altered by anthropic disturbances that were intended to facilitate land uses such as livestock grazing and haying, water diversions and irrigation, cultivation of grassland meadows, mining, settlements, lodges, camps and cabins, a downhill ski area, nine-hole golf course and park facilities. In most of these cases, trees were removed or prevented from growing in order to accommodate non-forested land uses. The anthropic disturbances varied considerably as to type, intensity, and duration before and after the park was established. The development of homes, driveways, roads and trails near the park boundary has also altered the forest landscape and has had an indirect impact on the forested landscape within the park.

Fire suppression within the park has allowed forests to grow and mature without the recurrence of natural fire cycles. In some locations, forests have become denser than would occur naturally, which makes them more susceptible to forest pests and diseases, such as the mountain pine beetle. The Wildland-Urban Interface (WUI) Hazard Fuel Reduction projects that are approved and scheduled to occur along the eastern boundary of the park and in the vicinity of Grand Lake are intended to thin the forest and reduce the build-up of forest fuels. Over time, the remaining trees will become healthier and will likely be less susceptible to forest pests and disease.

Some pine beetle activities are proposed to occur in, or overlap with, areas currently being managed for WUI fuel reduction and invasive exotic plant management control. Fuels and hazardous tree management activities are presently removing trees, including high-value trees killed by bark beetles in proposed bark beetle treatment areas. These practices are expected to continue. Cumulative impacts from fuel treatment and exotic plant management are addressed in recent management plans/EA's (NPS, 2002, 2003).

Impairment of Park Resources and Values
In addition to determining the environmental consequences of the No Action and Preferred alternatives, NPS policy requires analysis of potential effects to determine whether actions would impair park resources (Management Policies 2001).

The fundamental purpose of the national park system, established by the Organic Act, is preservation, and park managers must seek ways to avoid or minimize adverse impacts on park resources and values. However, the laws provide for management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values or a particular law directly and specifically provides otherwise. Impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value may constitute impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the enabling legislation or proclamation that established the park;
- Key to the natural or cultural integrity of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

SOILS AND VEGETATION

Intensity Level Definitions

Determination of the intensity of impacts to soils and native vegetation was derived from available soils and vegetation information (Natural Resources Conservation Service and park files) and park staff observation of the effects on soils and vegetation from bark beetle management activities. The thresholds of change for the intensity of impacts to soils and vegetation are defined as follows:

Negligible: The impact is at the lowest level of detection and causes very little or no physical disturbance/removal, compaction, and unnatural erosion, when compared with current conditions.

Minor: The impact is slight, but detectable in some areas, with few perceptible effects of physical disturbance/removal, compaction or unnatural erosion.

Moderate: The impact is readily apparent in some areas and has measurable effects of physical disturbance/removal, compaction or unnatural erosion.

Major: The impact is readily apparent in several areas and has severe effects of physical disturbance/removal, compaction, or unnatural erosion.

Effects of Alternative 1 - No Action

Removing beetle-infested/killed trees would have minor impacts to soil in developed areas of the park, where soil is already compacted. Minor soil compaction and erosion and native plant loss is expected where trees are cut and removed, but effects would be short-term with full recovery expected.

Accessing work sites and hazard tree removal, thinning and sanitation and the resulting dragging of trees and/or piling of slash would have negligible to minor short-term localized, direct adverse effects on soils and vegetation. These effects would be short-term with full recovery expected. Sanitation would have a minor, beneficial short-term localized impact in helping to reduce local beetle populations and prevent further mortality of uninfested high-value trees in the area.
Watering and mistletoe removal is expected to have a minor beneficial impact on soils and high-value trees around visitor centers and housing areas. Watering can increase the ability of trees to withstand bark beetle attacks, and would benefit herbaceous plants that grow around their bases.

Low-intensity, prescribed fire would have minor local beneficial impacts on soil fertility. This would occur directly as minerals and nutrients are released during combustion, and indirectly by increasing decomposition rates. Prescribed fire would establish healthier forests, better able to withstand bark beetle outbreaks. Vegetation would experience minor short-term adverse impacts from prescribed fire but would create a minor to moderate long-term beneficial effect as prescribed fire can mimic an ecological process in a fire-adapted community.

Bark beetle management activities would benefit high-value trees on adjacent private lands if infestations can be kept from spreading beyond park boundaries. Loss of numerous high-value trees would be expected to continue, as IPM techniques available in the No Action Alternative would slow, but not stop mortality.

Cumulative Effects: Cumulatively, Alternative 1 would result in a minor adverse impact on soils and native vegetation where mechanical removal (hazard tree removal, sanitation and thinning) techniques are expected to continue in controlling infestations and where fuel reduction and invasive plant management are ongoing.

Conclusion: Alternative 1 would have a minor to moderate cumulative impact on soils and native vegetation in specific areas of the park due to mechanical removal (hazard tree removal, sanitation and thinning) and prescribed fire control techniques. These cumulative effects would be ameliorated over time as the bark beetle outbreaks subside and control is eventually discontinued. Alternative 1 may not be effective at protecting high-value trees. If bark beetles continue to infest high-value trees in developed areas of the park, there could be a moderate cumulative long-term adverse impact due to eventual mortality of ponderosa and lodgepole pine trees and a minor adverse impact to soil erosion.

Because there would be no major, adverse impacts to soils or native vegetation whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 1 is selected.

Effects of Alternative 2 - Preferred Alternative

The environmental consequences of using mechanical removal (hazard tree removal, sanitation and thinning), watering, mistletoe removal and prescribed fire techniques would be the same as Alternative 1.

Insecticides would not be used in recommended or designated wilderness, which includes about 95 percent of the park. Chemical use would have a minor localized short-term adverse impact to soils. The half-life of carbaryl in dry soil is 4 – 10 days and in wet soil 19 - 29 days (Spectrum, 2005). When applied to the trunks of trees, as proposed in this plan, Carbaryl will be absorbed within the bark and is expected to remain effective at repelling beetles for just over one year. Protecting live trees in this manner would result in a moderate benefit as treated trees would not be infested or killed by bark beetles. Carbaryl that inadvertently ends up on native vegetation as overspray or drift is expected to have a residual life (life expectancy) of less than 14 days (Spectrum, 2005). Mitigating measures would reduce potential impacts to non-target plants.

Spraying from the back of a truck or ATV may necessitate driving off-road into frontcountry areas, causing short-term localized minor impact on soils and native plants.

Cumulative Effects: WUI hazard fuels reduction projects and bark beetle management activities are presently removing trees, including high-value trees killed by bark beetles, in proposed bark beetle treatment areas. These practices are expected to continue. Cumulative impacts from hazard fuels treatment and exotic plant management are addressed in management plans/EA's (NPS, 2002, 2003).

The proposed use of Carbaryl may overlap with areas receiving herbicide treatments as described in the Invasive Exotic Plant Management Plan (NPS, 2003). Using herbicides and an insecticide in the same

area may have a short-term minor impact on soil microbes and on vegetation at the base of trees and nearby.

Conclusion: Use of an insecticide, in combination with other IPM techniques, will better protect high-value trees by increasing their ability to withstand bark beetle attacks. Minor adverse cumulative impacts would eventually be ameliorated. Protecting large high-value trees and native plant biodiversity would result in a moderate long-term beneficial effect.

Because there would be no major, adverse impacts to soils or native vegetation whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 2 is selected.

NATURAL SOUNDSCAPE

Intensity Level Definitions

Analyses of the potential intensity of impacts were derived from park staff's observations of the effects on the natural soundscape from ongoing bark beetle control activities. The thresholds of change for the intensity of impacts to the natural soundscape are defined as follows:

Negligible: The impact is at the lowest level of detection and causes very little or no disturbance when compared with current conditions.

Minor: The impact is slight, but detectable in some areas, with few perceptible effects of disturbance.

Moderate: The impact is readily apparent in some areas and has measurable effects of disturbance.

Major: The impact is readily apparent over a larger area and has severe effects of disturbance.

Effects of Alternative 1 - No Action

There would be moderate short-term localized noise impacts from chainsaw use and use of a gasoline or diesel powered chipper in developed areas of the park. There would be short-term moderate adverse impacts in recommended/designated wilderness if beetle-infested trees are removed to protect adjacent private land. Mechanical treatment (hazard tree removal, sanitation and thinning), piling slash, chipping and removing mistletoe branches would have moderate short-term localized, direct adverse effects to the natural soundscape due to the presence of work crews, equipment use, and activities associated with mechanical cutting, trimming and removal of trees.

Cumulative Effects: Most of the proposed bark beetle management activities would occur in developed areas (campgrounds, visitor centers, along roadsides) already altered by human presence, park visitation, and human-caused noise. Some beetle control activities would occur in the park utility area where human noise and vehicle/machinery use are an ongoing part of daily park operations. Other bark beetle activities occur in, or overlap with, areas currently being managed for WUI hazard fuel reduction. Prescribed fire activities could occur in WUI fuels management areas and would have a short-term, minor, local, adverse impact on natural sounds within the park. Hazard fuels and hazardous tree management activities are presently removing trees, including high-value trees killed by bark beetles, in proposed bark management areas. These practices are expected to continue. Cumulatively, there will be a short-term direct moderate localized adverse impact on the natural soundscape.

Conclusion: Alternative 1 would have a direct short-term localized minor to moderate impact on the natural soundscape in specific areas from mechanical removal (hazard tree removal, sanitation and

thinning), chipping, removal of mistletoe and prescribed fire. The effects on the natural soundscape would last only during the proposed work and would be ameliorated over time as outbreaks subside, alleviating the need for control measures altogether.

Because there would be no major, adverse impacts to the natural soundscape whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 1 is selected.

Effects of Alternative 2 - Preferred Alternative

The environmental consequences of using mechanical removal, chipping, cultural, and prescribed fire management techniques are the same as Alternative 1.

Negligible to minor short-term localized impacts would occur as using an ATV or truck to apply insecticides creates noise. There would be no aerial application of Carbaryl, so noise impacts from a helicopter or fixed winged aircraft would not occur.

Cumulative Effects: Most of the proposed bark beetle management activities would occur in developed areas of the park (campgrounds, visitor centers, parking lots and other park facilities) where human generated noise is already occurring. Some bark beetle management activities would overlap with areas currently being managed for WUI fuel reduction. These practices are expected to continue. ATV or truck use associated with spraying an insecticide on high-value trees would result in minor direct short-term adverse impacts. Cumulatively, impacts will have a minor to moderate, localized direct adverse effect on the natural soundscape while work is ongoing.

Conclusion: Alternative 2 would have a minor to moderate short-term impact during control activities only. Impacts would be ameliorated over time as the outbreak subsides and controls are no longer necessary.

Because there would be no major, adverse impacts to the natural soundscape whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the pPark; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 2 is selected.

AQUATIC, WETLAND, AND RIPARIAN COMMUNITIES

Intensity Level Definitions

Analyses of the potential intensity of impacts were derived from research conducted in the park, park files, scientific literature, and park staff's observations of the effects on aquatic, wetland and riparian communities from bark beetle management activities. The thresholds of change for the intensity of impacts to aquatic, wetland and riparian communities are defined as follows:

Negligible: The impact is at the lowest level of detection and causes very little or no physical disturbance when compared with current conditions.

Minor: The impact is slight, but could be detectable in some areas, with few perceptible effects.

Moderate: The impact is readily apparent in some areas and has measurable effects.

Major: The impact is readily apparent in several areas and has severe effects.

Effects of Alternative 1 - No Action

Bark beetle management activities will not occur within aquatic, wetland and riparian communities unless a hazardous tree is located within such an area. In that case, every effort will be made to remove the hazardous tree during the winter months when the ground is frozen to minimize impacts. If a large tree was removed from an upland area adjacent to a wetland or riparian area, soil erosion could increase and have a negligible short-term impact on riparian communities and water quality. Native wetland and riparian vegetation would be expected to fully recover.

Watering high-value trees and mistletoe removal would have no impact on aquatic, wetland or riparian communities, as efforts would be directed in upland habitat, removed from sensitive aquatic resources.

Prescribed fire is currently suspended on willow and aspen found throughout RMNP's riparian areas, so no impacts are expected to occur from this activity.

Cumulative Effects: Visitor use and atmospheric deposition has altered water quality. Previous impacts in wetland and riparian communities have resulted from early settlement and development of park infrastructure. Cumulatively, there would be negligible impacts to wetlands and riparian communities as bark beetle management activities will avoid these sensitive areas.

Conclusion: Alternative 1 could result in negligible impacts to wetland and riparian vegetation from mechanical removal occurring in adjacent upland habitat. No motorized vehicles would be allowed in wetland and riparian communities. Negligible impacts could occur if a hazardous tree had to be removed from an aquatic, wetland or riparian area during the winter months when the ground is frozen. It is anticipated that Alternative 1 would not be highly effective at protecting high-value trees near aquatic, wetland or riparian habitat. As more high-value trees are lost, additional mechanical controls would be needed, creating the potential for increased cumulative impacts to wetland and riparian vegetation.

Because there would be no major, adverse impacts to aquatic, wetland or riparian communities whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 1 is selected.

Effects of Alternative 2 - Preferred Alternative

The environmental consequences of using mechanical removal (hazard tree removal, sanitation and thinning), watering, mistletoe removal, and prescribed fire techniques would be the same as Alternative 1.

Carbaryl would not be applied within aquatic, wetland or riparian habitat, which would reduce potential impacts to these sensitive resources and groundwater**.** The use of Carbaryl near water, however, could result in negligible to minor short-term adverse impacts to aquatic, wetland and riparian communities as the insecticide has the potential to enter open water through runoff and spills. When mixed with water and applied to high-value trees, Carbaryl is unlikely to contaminate surface water except when heavy rainfall occurs soon after application.

Leaching, root uptake, and movement in soil and groundwater govern the effects of Carbaryl. The potential for leaching is low. In water Carbaryl is broken down by hydrolosis and microorganisms. At neutral pH, Carbaryl has a half-life in water of about 10 days. Carbaryl does not persist in aquatic environments and has a low leachability in soils (USDA 1992, Infoventures 2004, Hastings et al. 2001), resulting in a negligible short-term impact.

Carbaryl is moderately toxic to fish and moderately toxic to highly toxic to aquatic invertebrate animals. It builds up in fish at low rates, but is unlikely to affect them since no control activities are proposed in aquatic habitat. The park will use an aquifer vulnerability scoring system – Relative Aquifer Vulnerability Evaluation (RAVE) – to identify areas near wetlands unsuitable for insecticide application (NPS, 2003). Those areas would not be sprayed.

Insecticide use in RMNP will be based on published research and current scientific data. It will follow the NPS-Pesticide Use Proposal System, which requires review and approval by the Intermountain Region IPM Specialist before work begins.

Cumulative Effects: Insecticide use would result in minor cumulative impacts to wetland and riparian vegetation in specific areas of the park where herbicide use is, or will be, occurring, in accordance with the approved 2003 Invasive Exotic Plant Management Plan. It is anticipated that with insecticide use high-value trees would be better protected, ultimately reducing cumulative impacts.

Conclusion: Alternative 2 would result in minor cumulative impacts to wetland and riparian vegetation in specific areas of the park due to insecticide use and the implementation of the 2003 Invasive Exotic Plant Management Plan that approved the use of herbicides. It is anticipated that high-value trees would be better protected, ultimately reducing cumulative impacts.

Because there would be no major, adverse impacts to aquatic, wetland or riparian communities whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 2 is selected.

ENDANGERED, THREATENED, AND RARE SPECIES

Intensity Level Definitions

Analyses of the potential intensity of impacts were derived from available information on endangered, threatened and rare species. Map locations of sensitive resources were compared with ongoing and proposed bark beetle management activities. Predictions about short-term and long-term site impacts were based on existing inventory and monitoring data from RMNP. The thresholds of change for the intensity of impacts to endangered, threatened and rare species are defined as follows:

Negligible: The impact could result in a change to a population or individuals of a species or resource but the change would be so small that it would not be of any measurable or perceptible consequence.

Minor: An action that could result in a change to a population or individuals of a species or a resource. The change would be small and localized and of little consequence.

Moderate: An action that would result in some change to a population or individuals of a species or resource. The change would be measurable and of consequence to the species or resource but more localized.

Major: An action that would have a noticeable change to a population or individuals of a species or resource. The change would be measurable and result in a severely adverse or major beneficial impact, with possible permanent consequences for the species or resource.

Effects of Alternative 1 - No Action Alternative

No threatened or endangered plant and insect species are known to occur in areas proposed for bark beetle control work, so no impacts from mechanical removal (hazard tree removal, sanitation and thinning), chipping and piling slash are expected. Treatment areas will be examined to determine the presence and proximity of threatened, endangered, and candidate species before treatment begins, and work would be adjusted away from sensitive species which would mitigate potential adverse impacts.

Presently, no lynx are known to reside in the park. Occasional removal of beetle-infested trees at spot locations along the park boundary is not expected to alter lynx habitat.

The occasional removal of an infested tree or small cluster of trees along the park boundary adjacent to private land would have negligible to minor impacts due to temporary displacement of endangered, threatened, or rare wildlife such as the state-listed Northern goshawk. Treatments will not occur in boreal

toad, native trout, or bald eagle habitats. Areas recommended for treatment in recommended or designated wilderness would be surveyed for endangered, threatened or rare species before work begins.

Watering high-value trees in developed high-use areas of the park or removing mistletoe would have no impact on endangered, threatened or rare species.

Minor soil erosion and native plant loss may occur around beetle-killed trees when removed. Removing large numbers of trees could have a minor affect on rare plants, but flagging would be used to identify their locations and control work would be adjusted to protect them from adverse impacts. Native vegetation is expected to fully recover after control work subsides.

No work is proposed near known breeding locations of endangered, threatened or rare wildlife species. There are no eagle nests near proposed treatment areas.

Removing beetle-infested or killed trees could have a minor short-term direct adverse impact on the Northern goshawk, which is state listed as vulnerable during its breeding season. Goshawks forage and hunt in forested areas and near developed areas where control treatments are proposed. Temporary displacement could occur; however, there are no known nests in proposed treatment areas.

There is no relic population of the federal and state-listed lynx, but four radio-collared lynx have been sighted in and near RMNP since their release in southwestern Colorado in 1999. Under the No Action Alternative, beetle control activities would occur in developed areas, removed from potential lynx habitat in the park. No adverse impacts to the Canada lynx are anticipated.

Cumulative Effects: Ongoing fuel reduction and hazardous tree removal, coupled with bark beetle management activities could result in temporary displacement of wildlife, causing negligible direct short-term impact to threatened or endangered or rare species. Animals are expected to return when work subsides, alleviating cumulative impacts.

Prescribed fire is used for hazard fuel reduction (in WUI areas. All prescribed fire areas in the park are inventoried for threatened, endangered and candidate species before burning occurs. Therefore, this activity would result in no impacts to endangered, threatened and rare species in the park.

Conclusion: Alternative 1 could have negligible to minor impacts to endangered, threatened and rare species, such as the Northern goshawk and Canada lynx. Areas would be surveyed for these species before control techniques are implemented and work would be limited to developed areas and spot locations along the park boundary where infested trees are removed to protect adjoining private property. Alternative 1, however, will not been as effective at protecting high-value trees as Alternative 2. To control beetles, additional mechanical removal would be required, with the potential to create impacts to endangered, threatened or rare species.

Because there would be no major, adverse impacts to endangered, threatened or rare species whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 1 is selected.

Effects of Alternative 2 – Preferred Alternative

Using Carbaryl is potentially hazardous to endangered, threatened, candidate and rare species. Most endangered, threatened and rare species occur in recommended or designated Wilderness areas of the park where Carbaryl would not be used, so adverse impacts are not anticipated.

Carbaryl will not be sprayed in or near boreal toad, greenback cutthroat trout or Colorado River cutthroat trout habitat. It would not be used in or near known bald eagle nesting sites or potential lynx habitat, resulting in no impact to these endangered, threatened or candidate species.

Though Carbaryl has the potential to enter systems and bioaccumulate in wildlife (Cox 1993), the amount proposed for use is considered low-risk with no bioaccumulation threat (Hasting et al. 2001). Mitigation

measures would further reduce the risk. Carbaryl is moderately toxic to fish and moderately to highly toxic in aquatic invertebrate animals. It can build up in fish at low rates and impact wildlife, such as bald eagles and ospreys that feed on them. Mitigation measures will be followed so Carbaryl does not enter aquatic environments.

Long-term persistence of Carbaryl in the food chain, and subsequent toxic effects are not expected to occur in RMNP due to the quantities proposed for application. Carbaryl does not contain organo-chlorines that can cause egg-shell thinning and other harmful effects to wildlife (Infoventures 2004).

Though no known rare plants occur near proposed treatment sites (DBG 2000), every area would be surveyed for endangered, threatened or rare species before treatment occurs. If rare plants are found, further review would be required prior to chemical use. If federally listed or candidate species are involved, RMNP would consult with the U.S. Fish and Wildlife Service (FWS).

Contamination of rare plant species due to runoff or drift is unlikely except when heavy rainfall occurs soon after application. Consequently, Carbaryl would not be applied when rainfall is imminent or winds exceed 5 mph. Carbaryl would have no impact to federally listed species occurring downstream of RMNP.

Sevin® brand XLR Plus Carbaryl is less hazardous to insects than other brands when direct application to insects is avoided and the spray residues have dried. To reduce impacts to rare insects and butterflies, Carbaryl would be applied in the late evening or early morning when insects are less likely to forage. Spraying would avoid concentrations of flowering plants.

Implementing mitigation measures would reduce the risk of affecting T&E species and rare plants and insects with chemical control to a minor short-term adverse impact.

Cumulative Effects: Fuel reduction and herbicide use are ongoing activities that occur in areas proposed for bark beetle management. Together, these controls pose a negligible, minor short-term impact to T&E and rare flora and fauna in RMNP. The long-term impact is beneficial as forest health is maintained and the need for control activities subsides.

Conclusion: The environmental consequences of using mechanical, cultural, and prescribed fire techniques are the same as Alternative 1. Being proactive in protecting high-value trees by using an insecticide would reduce the amount of chemical repellant and other techniques needed to protect trees in the long run. Carbaryl would only be used at the peak of an outbreak when high-value trees are at greatest risk. Once the risk subsides, insecticide use would be discontinued, reducing risks to T & E and rare plants and animals.

Because there would be no major, adverse impacts to endangered, threatened or rare species whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of thepPark's resources or values if Alternative 2 is selected.

WILDLIFE

Intensity Level Definitions

Analyses of the potential intensity of impacts were derived from all available information on wildlife. Map locations of sensitive resources were compared with proposed bark beetles management activities. Predictions about short- and long-term site impacts were based on existing inventory and monitoring data from RMNP. The thresholds of change for the intensity of impacts to wildlife are defined as follows:

Negligible: The impact could result in a change to a population or individuals of a species or resource but the change would be so small that it would not be of any measurable or perceptible consequence.

Minor: The action could result in a change to a population or individuals of a species or a resource. The change would be small and localized and of little consequence.

Moderate: The action would result in some change to a population or individuals of a species or resource. The change would be measurable and of consequence to the species or resource but more localized.

Major: An action that would have a noticeable change to a population or individuals of a species or resource. The change would be measurable and result in a severely adverse or major beneficial impact, with possible permanent consequences for the species or resource.

Effects of Alternative 1 - No Action Alternative

Removing bark beetle-infested trees or dead hazardous trees would have negligible to minor localized adverse impacts to wildlife due to temporary displacement of animals during mechanical treatments. Wildlife is expected to return when these activities cease. Beetle-infested trees may be removed in recommended or designated wilderness adjacent to private land, resulting in a negligible to minor impact to wildlife. Mitigation measures and the small number of trees that may be removed along the park boundary would result in minor localized adverse impacts on wildlife. Areas recommended for treatment in recommended or designated wilderness would be surveyed for nests and snags with cavities to ensure wildlife habitat is protected.

Tree removal, however, can eliminate important habitat for cavity nesting birds and mammals, such as woodpeckers, sparrows, cottontails, and snowshoe hares. An important food source (beetles and larva) would be lost for some birds, resulting in minor long-term adverse effects. Tree removal would normally only occur in developed areas of the park. Developed areas generally contain less wildlife habitat than other areas of the park, so beetle management activity is expected to have little impact on wildlife habitat.

Some soil erosion and native plant loss may occur around a beetle-killed tree when removed, resulting in a negligible impact to wildlife habitat. Watering high-value trees and removing mistletoe would have no adverse impact on wildlife. It would have a long-term benefit to wildlife habitat if trees are better able to withstand a bark beetle outbreak.

Hazard tree removal, sanitation, thinning and the resultant piling of slash, chipping or burning would have negligible to minor adverse impacts. Accessing work sites and dragging slash and downed timber could result in temporary displacement, but removing beetle infested trees and slowing the spread of pine beetles is expected to benefit wildlife in the long run.

Cumulative Effects: Fuel reduction, hazardous tree removal, and prescribed fire may overlap with bark beetle management activities to achieve mutual resource benefits. Burn units are inventoried and important wildlife habitat, such as a snag with cavities, is protected. Known nest sites for raptors and other wildlife habitat, such as a fox den, will be identified for workers to avoid. A prescribed fire would have a short-term minor adverse impact on plant and animal communities, but could result in a long-term minor to moderate benefit when communities are restored to natural conditions. Impacts to wildlife in WUI fuel management areas are addressed in the park's fire management plan (NPS 2002).

Conclusion: Alternative 1 would have a short-term negligible to minor adverse impact to wildlife due to temporary displacement while control activities are conducted. The No Action Alternative, however, would not be effective in protecting high-value trees in developed areas of the park or in adjacent private lands. If infestations continue to spread, additional mechanical, cultural, and prescribed fire control may be required in developed high-use areas and in WUI fuel management zones, which would cause short-term moderate cumulative adverse impacts to wildlife.

The No Action Alternative could provide minor beneficial impacts to some wildlife species as bark beetle outbreaks provide food for wildlife and beetle-killed trees provide shelter for cavity-nesting birds and small mammals.

Because there would be no major adverse impacts to wildlife whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative is selected.

Effects of Alternative 2 - Preferred Alternative

The environmental consequences of using mechanical, cultural, and prescribed fire techniques are the same as Alternative 1.

Carbaryl will not be used in recommended or designated wilderness and will have no adverse effect on wildlife in undeveloped areas. Used in developed areas, Carbaryl has the potential to enter systems and bioaccumulate in fish. The amount of insecticide proposed, the number of trees proposed for treatment, and avoidance of aquatic habitats would result in no adverse impact to fish species within RMNP. Carbaryl could result in a short-term minor impact to terrestrial wildlife, similar to effects on T&E and rare wildlife species. Carbaryl would not be used within 100-feet of aquatic, wetland and riparian areas, which would protect all fish species. Mitigation measures are intended to minimize drift.

Carbaryl is extremely toxic to aquatic invertebrates, but treatments are not proposed in or near water where they thrive. It is also toxic to bees through direct treatment or residues found on blooming plants. Sevin® brand XLR PLUS Carbaryl is less hazardous to honey bees than other Carbaryl products when direct application to bees is avoided and spray residues have dried. Carbaryl has a minor to moderate impact to moths and butterflies. To minimize impacts, Carbaryl would be applied in the evening or early morning when insects are less likely to forage. Drift would be minimized to reduce residues on wildflowers. Once residue dries, impacts to insects are reduced.

Cumulative Effects: Hazard fuel reduction and herbicide use are ongoing activities that occur in areas proposed for bark beetle management. Together, these controls pose a minor short-term impact to wildlife due to temporary displacement while work is conducted. The long-term impact to wildlife is beneficial as forest health is maintained and the need for control activities subsides.

Conclusion: Alternative 2 would have a minor impact if Carbaryl was allowed to bioaccumulate in wildlife or residue impacts terrestrial and aquatic insects. It is anticipated that high-value trees in developed areas of the park and on private land adjacent to the park would be protected at a higher level than the No Action Alternative. Bark beetle impacts to high-value trees would decrease as the full range of IPM techniques are implemented, resulting in a long-term moderate benefit to wildlife. As infestations subside, cumulative impacts to wildlife would be ameliorated.

The Preferred Alternative would provide the greatest benefit to high-value trees. Negative impacts from insecticide use are expected to decrease as the outbreak subsides. Once high-value trees are no longer at risk, Carbaryl would be discontinued. Spraying healthy high-value trees is not warranted when the nearest infested trees are more than ¼ mile away. Some wildlife would be temporally displaced during control operations, resulting in a short-term negligible to moderate impact. Great care would be used during insecticide applications to protect non-target insects. Wetlands would be avoided to minimize adverse impacts to riparian-dependent species.

Because there would be no major, adverse impacts to wildlife whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of thepPark; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 2 is selected.

WILDERNESS

Intensity Level Definitions

Analyses of the potential intensity of impacts on wilderness were derived from park files, the 2001 Backcountry/Wilderness Management Plan, the 1999 Wilderness and Preservation Management manual, minimum tool analysis and park staff's observations of the effects of control techniques. Predictions on

short- and long-term site impacts were based on existing inventory and monitoring data of bark beetle locations requiring treatments. The thresholds of change for the intensity of impacts to wilderness are defined as follows:

Negligible: The impact would be so small that it would not be of any measurable or perceptible consequence.

Minor: The impact is slight but would be small and localized and of little consequence.

Moderate: The impact is readily apparent, would be measurable and consequential, but more localized.

Major: The impact is severely adverse or exceptionally beneficial. The change would be measurable and the consequences could be permanent.

Effects of Alternative 1 - No Action Alternative

The No Action Alternative allows the removal of hazard trees and beetle-infested trees in recommended or designated wilderness adjacent to private lands and within 150 feet of the park boundary. This would result in minor to moderate short-term adverse impacts, but would not diminish suitability for wilderness designation. By implementing mitigation measures, including a Minimum Tool Requirement analysis, the adverse effects of using hazard tree removal and sanitation techniques in recommended or designated wilderness would be minor.

Beetle control activities proposed adjacent to recommended/designated wilderness at McGraw Ranch, Holzwarth Homestead, Aspenglen Campground, and some areas of Moraine Park could have a short-term minor indirect adverse effect on wilderness values. Noise from beetle treatment activities could filter into wilderness, resulting in an indirect short-term negligible to minor impact on wilderness values.

Cumulative Effects: Prescribed fire could occasionally occur in recommended or designated wilderness as per the management strategies addressed in the 1992 Fire Management Plan (as amended) and adjacent to recommended or designated wilderness as per the 2002 WUI Fuels Management Plan. These prescribed fire activities may not necessarily be specific to bark beetle management. Prescribed fire would help maintain healthy forests that are better able to withstand bark beetle outbreaks while also reducing fire risk in WUI areas. Prescribed fire activities would have a short-term minor impact related to burning, but would have long-term benefits in sustaining forest health. Cumulative effects are addressed in RMNP's 1992 Fire Management Plan (as amended) and 2002 WUI Fuels Management Plan.

Conclusion: Short-term negligible to minor impacts may occur through work performed at spot locations along the park boundary in recommended/designated wilderness. Indirect short-term negligible to minor impacts to recommended/designated wilderness may occur because of beetle management activities on adjacent park lands. If bark beetles continue to spread within the park, additional mechanical, cultural and prescribed fire controls may be required in recommended/designated wilderness along the park boundary and in developed and WUI fuel management zones adjacent to wilderness, prolonging impacts to wilderness resources.

Mitigation measures will increase protection of wilderness resources and values. The overall effects of the No Action Alternative on Wilderness would be negligible to minor.

Because there would be no major, adverse impacts to wilderness whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 1 is selected.

Effects of Alternative 2 - Preferred Alternative

Insecticide use is prohibited in recommended or designated wilderness in RMNP, resulting in no impacts from chemicals. The impacts of mechanical removal would be the same as Alternative 1.

Cumulative Effects: Prescribed fire would occasionally occur in and adjacent to recommended or designated wilderness, according to strategies identified in the 1992 Fire Management Plan (as amended) and 2002 WUI Fuels Management Plan, but these activities typically are not directly tied to bark beetle management. Prescribed fire would have a minor long-term indirect beneficial impact to wilderness resources by sustaining healthy forests that are better able to withstand bark beetle outbreaks while reducing fire risk in WUI areas. Prescribed fires would have a short-term minor adverse impact related to burning.

Conclusion: The Preferred Alternative would have a short-term minor to moderate impact to wilderness values but would not diminish suitability for wilderness designation. Mitigation measures, including the use of Minimum Tool Requirement analysis, would reduce the overall impact to a minor level. Hazard trees and beetle-infested trees located along the park boundary may occasionally be removed, but because bark beetle outbreaks are considered a natural process, no other beetle management activities are proposed in recommended or designated wilderness. No insecticide will be used in recommended/designated wilderness. Parkwide, bark beetle management activities would decrease over time as the full range of IPM techniques are implemented. There will be a long-term moderate benefit to wilderness as beetle outbreaks subside. Control work would cease and cumulative impacts to wilderness would be ameliorated.

Because there would be no major, adverse impacts to wilderness whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if the Preferred Alternative is selected.

AIR QUALITY

Intensity Level Definitions

Analyses of the potential intensity of impacts from the effects of bark beetle management techniques on air quality were derived from park files and literature cited in this plan. The thresholds of change for the intensity of impacts to air quality are defined as follows:

Negligible: The impact would be so small that it would not be of any measurable or perceptible consequence.

Minor: The impact is slight but would be small and localized and of little consequence.

Moderate: The impact is readily apparent, would be measurable and consequential, but more localized.

Major: The impact is severely adverse or exceptionally beneficial. The change would be measurable with possible permanent consequences.

Effects of Alternative 1 - No Action Alternative

The No Action Alternative would have a negligible impact on air quality. Using gasoline fueled chainsaws to remove hazard trees or beetle-infested trees, and using gasoline or diesel fueled chippers would generate pollutants, which could create a direct short-term localized negligible adverse impact.

Mechanical treatment alone may not effectively protect high-value trees. Consequently, periodic re-treatment may be necessary during the height of an outbreak, which would prolong beetle management activities and the use of powered equipment.

Hazard tree removal, sanitation and thinning would result in a negligible impact to air quality. Watering and mistletoe removal would have no impact on air quality.

Cumulative Effects: Fire is a natural component of the ecosystem, but has been suppressed throughout RMNP over many years. Prescribed fires for resource benefit are being used to maintain healthy native plant communities in some habitat types. State smoke permits are required and prescriptions are designed to minimize smoke impacts on air quality (addressed in the 1992 Fire Management Plan as amended and the 2002 Wildland-Urban Interface Fuels Management Plan). Prescribed fire would result in a short-term localized minor adverse impact on air quality, but would create a long-term minor benefit when ecological balance is restored.

Conclusion: The No Action Alternative has a short-term impact on air quality resulting from the use of gasoline fueled chainsaws and the use of gasoline or diesel fueled chippers. Prescribed fire related to fire management activities causes smoke, resulting in a short-term localized minor adverse effect on air quality and a long-term beneficial effect in maintaining healthy forests that are better able withstand beetle infestations.

Because there would be no major, adverse impacts to air quality whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 1 is selected.

Effects of Alternative 2 - Preferred Alternative

The environmental consequences of using mechanical treatment and cultural techniques are the same as Alternative 1.

Insecticide use could pose a short-term minor adverse impact to air quality, principally from drift. The half-life of carbaryl in the vapor phase is estimated to be 12.6 hours (Spectrum, 2005). Impacts to air quality can be reduced by limiting spraying to early morning or evening hours with little or no wind. Using drift reduction techniques and spot treatment strategies would further minimize air quality impacts to a negligible level.

Cumulative Effects: Impacts to air quality in proposed treatment areas are primarily due to pollutants originating outside the park. When combined with pollutants inside the park, such as vehicles, the use of chainsaws, chippers, herbicides, insecticides, and prescribed fire, the impacts to air quality increase under the Preferred Alternative. Mitigation measures associated with insecticide use will minimize impacts to a negligible level.

Conducting prescribed fires on land previously treated with Carbaryl should not occur until sufficient time has passed to ensure that there is no residual. Chemicals released through burning could be carried in air currents beyond the treatment area, resulting in minor short-term adverse effects on air quality and the people and wildlife exposed to it. To minimize adverse effects, insecticide application would be coordinated with fire management staff and prescribed fire activities. Carbaryl would be applied at least one year ahead of a prescribed burn or more than two months after to maintain safe air quality for park employees, visitors, neighbors, and wildlife. If a wildfire occurs following a Carbaryl application, chemicals could be released into the air, resulting in minor short-term adverse affects.

Conclusion: Numerous mitigation measures and coordination of bark beetle controls with herbicide and fire management activities will ensure that the combination of fire, invasive exotic plant control, and bark beetle management activities will cumulatively have a negligible to minor impact to air quality.
With a successful bark beetle management program, the use of Carbaryl would be significantly reduced over time. Once an outbreak begins its downward cycle, Carbaryl use would cease, eliminating adverse impacts to air quality.

Because there would be no major, adverse impacts to air quality whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if either Alternative 1 or 2 is selected.

CULTURAL RESOURCES

Intensity Level Definitions

Analyses of the potential intensity of impacts on cultural resources were derived from park files, the park archeologist and park staff observation of the effects of management techniques. Predictions on short- and long-term site impacts were based on existing inventory and monitoring data from RMNP. The thresholds of change for the intensity of impacts to cultural resources are defined as follows:

No impact: For purposes of Section 106, the determination of effect would be *no adverse effect*.

Negligible: Impact is at the lowest levels of detection, barely measurable consequences, either adverse or beneficial, to prehistoric or historic resources. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Minor: Adverse: Site disturbance results in little, if any, loss of cultural significance or integrity and the National Register eligibility of the site is unaffected. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial: Bark beetle management activities result in maintenance and preservation of a site. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Moderate: Adverse: Site disturbance does not diminish the cultural significance or integrity of the site to the extent that its National Register eligibility is jeopardized. For purposes of Section 106, the determination of effect would be *adverse effect*.
Beneficial: Bark beetle management activities result in protection of high-value trees in a site. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Major: Adverse: Site disturbance diminishes the cultural significance and integrity of the site to the extent that it is no longer eligible to be listed in the National Register of Historic Places. For purposes of Section 106, the determination of effect would be *adverse effect*.
Beneficial: Bark beetle management activities result in maintenance and preservation of a site. For purposes of Section 106, the determination of effect would be *no adverse effect*.

ARCHEOLOGICAL RESOURCES

Effects of Alternative 1 - No Action Alternative

There are no known archeological resources in proposed bark beetle management areas. However, the potential for encountering them during beetle management work exists. Mitigating measures call for the survey of all proposed management areas for archeological resources. Should archeological resources be encountered, activities will cease until a qualified archeologist documents the resources and clears the project area.

Alternative 1 could result in a minor adverse impact on archeological resources, if found, through hazard tree removal, thinning, sanitation, and prescribed fire. Watering high-value trees would have no adverse affect on archeological resources.

Thinning could have a minor impact on archeological resources, but would only occur in WUI fuel management areas, as addressed in the WUI Fuels Management Plan (NPS 2002).

All prescribed fires would be reviewed and approved by the park archeologist prior to implementation to ensure archeological resources are not affected. High-value trees would be protected during a prescribed fire.

Cumulative Effects: Tree removal, hauling, piling slash, pile burning, and prescribed fire are ongoing management techniques for hazardous fuel reduction and WUI management activities as well as for bark beetle management. These activities will be coordinated with fire management staff and the park archeologist to ensure that there are no adverse effects on archeological resources.

Alternative 1 has not proven effective for protecting high-value trees from beetle infestations in RMNP. If outbreaks continue, additional mechanical removal (hazard tree removal, sanitation and thinning) would be required, which could result in minor adverse impacts to potential archeological resources. Cumulative impacts from thinning and prescribed fire on archeological resources are addressed in the 2001 WUI Plan and 1992 Fire Management Plan, as amended.

Conclusion**:** While there are no known archeological resources in proposed treatment areas, potential for encountering them exists. Mitigating measures call for the survey of all proposed beetle management areas for archeological resources. Should they be encountered, activities will cease until a qualified archeologist documents the resources and clears the project area.

Because there would be no major, adverse impacts to archeological resources whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if Alternative 1 is selected.

Effects of Alternative 2 - Preferred Alternative

The effects of Alternative 2 are the same as the No Action Alternative, except that the use of Carbaryl may require driving a truck, tractor or ATV off-road to apply Carbaryl in frontcountry areas. This could only proceed with clearance from the park archeologist. Carbaryl would not be used in recommended or designated wilderness, so there would be no impact to archeological resources from vehicle use in recommended or designated wilderness, which represent about 95 percent of the land area in the park.

Cumulative Effects: Cumulative effects are the same as in the No Action Alternative. It is anticipated that Carbaryl use would decrease as the full range of IPM techniques are implemented. Mechanical removal would also decrease which would eventually ameliorate cumulative impacts to archeological resources.

Conclusion: Disturbance of potential archeological resources will be mitigated by archeological surveys, documentation, and clearance by the park archeologist, resulting in negligible adverse impacts. The use of a motorized vehicle to apply Carbaryl in front country areas may impact some resources, but guidance by the park archeologist would ensure that no adverse impacts occur.

Because there would be no major, adverse impacts to archeological resources whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if the Preferred Alternative is selected.

CULTURAL LANDSCAPES

Effects of Alternative 1 – No Action Alternative

Under the No Action Alternative, continued loss of high-value trees could have a minor adverse effect on the aesthetics and integrity of cultural landscapes such as McGraw Ranch, Holzwarth Homestead, and other historic districts. Furthermore, dead trees can pose fire hazards to historic resources.

Mechanical removal (hazard tree removal, sanitation and thinning) would result in a minor short-term adverse impact to cultural landscapes, but a minor long-term beneficial impact by removing hazardous and infested trees. Removing infested trees will reduce the risk of other high-value trees succumbing to bark beetles.

Watering high-value trees and removing mistletoe-infested branches in cultural landscapes during drought would help reduce stress to high-value trees. This would improve their ability to resist beetle attacks, resulting in a minor short-term benefit to the integrity and aesthetics of cultural landscapes.

Cumulative: If bark beetles continue to infest high-value trees under the No Action Alternative, additional mechanical removal would be required, creating cumulative impacts to the integrity and aesthetics of cultural landscapes. Cumulative impacts from thinning and prescribed fire are addressed in the 2001 WUI plan and 1992 Fire Management Plan, as amended.

Conclusion: The IPM techniques currently being used are not 100 percent effective at protecting high-value trees in cultural landscapes. Dead trees could result in a direct minor adverse effect on the visual quality of a cultural landscape. They can also pose a fire hazard to historic resources. When trees must be removed, new trees can be planted in their place, resulting in a minor long-term beneficial effect.

Because there would be no major, adverse impacts to cultural landscapes whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if the Preferred Alternative is selected.

Effects of Alternative 2 - Preferred Alternative

The consequences of the Preferred Alternative are the same as Alternative 1, except that high-value trees in cultural landscapes would receive greater protection from the use of Carbaryl, resulting in a minor long-term beneficial impact. Spraying Carbaryl would have no adverse impact on a cultural landscape as the aesthetics and integrity would not be altered.

Because dead and dying trees could negatively affect the viewshed in a cultural landscape, their removal is desirable. Furthermore, because they can pose a fire hazard to historic resources they should be removed. New trees can be planted in their place, resulting in long-term minor benefits to the aesthetics of cultural landscapes.

Cumulative Effects: Exotic plants are being managed by mechanical and chemical techniques in the McGraw Ranch, Never Summer Ranch, and Beaver Meadows areas where bark beetle management will occur. This could result in a moderate short-term adverse cumulative impact, with a minor long-term beneficial impact to aesthetics and integrity of cultural landscapes (Exotic Plant management plan, EA, 2002). Management activities will be coordinated to minimize adverse effects.

Conclusion: While short-term minor to moderate adverse effects can occur to cultural landscapes under the Preferred Alternative, minor long-term benefits would result from the increased protection afforded to high-value trees with the use of Carbaryl, which will ultimately protect the aesthetics and integrity of the landscape. Replanting trees that are lost due to pine beetle infestation will also help to protect the integrity of cultural landscapes.

Because there would be no major, adverse impacts to cultural landscapes whose conservation is: 1) necessary to fulfill specific purposes identified in the enabling legislation of RMNP; 2) key to the natural or cultural integrity of the park; or 3) identified as a goal in the Master Plan (1976) or other relevant NPS planning documents, there would be no impairment of the park's resources or values if the Preferred Alternative is selected.

VISITOR EXPERIENCE

Intensity Level of Definitions

RMNP was established to provide for the freest use of the park for recreation and for the preservation of natural conditions, scenic beauty, and wildlife. The methodology used for assessing impacts to visitor

experience is based on how proposed bark beetle management would affect visitors' enjoyment of the park's resources. The thresholds for this impact are as follows:

Negligible: Visitors would not be affected or changes in visitor use and/or experiences would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Changes in visitor use and/or experience would be detectable, although the changes would likely be short-term. The visitor would be aware of the effects associated with the alternative, but effects would be slight.

Moderate: Changes in visitor use and/or experience would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would likely be able to express an opinion about the changes.

Major: Changes in visitor use and/or experience would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.

Effects of Alternative 1 – No Action Alternative

Mechanical removal (hazard tree removal, sanitation and thinning) entail the use of hand saws or chainsaws, dragging logs, piling slash, chipping and pile burning would cause noise and disturbance in treatment areas such as campgrounds and picnic areas. These activities would result in minor to moderate adverse impacts on visitor experience. Management activities would occur primarily during the fall, winter and early spring when park visitation is lower. Activities would occur in localized developed areas of the park and would cause short-term direct adverse impacts from the noise of powered equipment and visual impacts from work crews removing trees.

The removal of hazard trees and beetle infested trees within 150 feet of the park boundary in recommended/designated wilderness will have a short-term direct minor to moderate adverse impact to visitors who value wilderness resources and are recreating nearby.

Watering high-value trees or cutting mistletoe-infested branches would have a minor long-term aesthetic beneficial impact on the visitor experience because this technique offers greater protection of high-value trees that provide screening and shade, which are important to the visitor experience.

Prescribed fire, used to restore ecological balance in forests, reduce fuel loads, or burn beetle-infested slash piles, could cause a short-term minor adverse impact on the aesthetic quality of park views, possibly affecting sightseeing experiences. Burns result in blackened ground and vegetation loss, which is perceived by some visitors as an adverse visual impact. Usually native grasses and forbs return within one year. Smoke may reduce the quality of a scenic vista for a short time, causing visitor concern, but prescribed burns are not conducted if conditions are not favorable for smoke dispersion.

Thinning in WUI areas would have a short-term localized minor adverse impact on visitor experience, as addressed in the WUI Fire Management plan, 2002. There would be short-term noise and visual impacts during work. Following thinning operations, visitors can see slash piles, and ultimately burnt ground and ashes in the natural landscape. Thinning, however, has a long-term beneficial impact, resulting in healthy trees, better able to withstand a bark beetle outbreak.

Sanitation proposed in campgrounds, picnic areas, around visitor centers, parking lots and cultural landscape areas could cause minor short-term direct impacts on visitors' experience. Usually beetle-infested trees are removed, piled out of view and burned when conditions are favorable, to reduce visual impacts. Removal of a significant number of high-value trees would result in a moderate long-term adverse impact due to the loss of shade, screening and aesthetics in campgrounds, picnic areas and parking lots. Remaining high-value trees, however, would be better protected which would result in a minor beneficial impact on the visitor experience. Mature trees will eventually return, but may take up to 100 years.

Cumulative Effects: Hazard tree removal, thinning, sanitation, piling slash, chipping, pile burning, and prescribed fire are ongoing activities to achieve resource benefits in RMNP (1992 Fire Management Plan, as amended, and 2002 WUI Fuels Management). These activities, along with bark beetle control efforts, could cumulatively result in a short-term direct minor adverse impact to visitors. These effects would be temporary, however, and visitors would receive long-term minor benefits resulting from the aesthetics of a healthier forest and protection of high-value trees necessary for screening and shading in campgrounds, picnic areas and parking lots. Visitors to historic districts, such as Holzwarth Homestead, will also benefit as trees in cultural landscapes in the park are protected.

Conclusion: Noise and aesthetics are the primary short-term minor direct impacts to the visitor experience. Beetle control activities will be implemented during low visitation periods and kept out of sight from visitors to the extent possible. No activities will occur in recommended or designated wilderness.

Effects of Alternative 2 - Preferred Alternative

The environmental consequences of mechanical removal, cultural techniques and prescribed fire are the same as Alternative 1.

Using an insecticide would have a short-term direct localized minor adverse impact on the visitor experience due to the intrusion and noise of a sprayer. Furthermore, spraying in Moraine Park and Timber Creek campgrounds would require a 12 to 24-hour closure in campsite loops, causing inconvenience and resulting in a short-term direct minor to moderate adverse impact to some visitors. Park attractions, like the Holzworth Ranch, may also experience closures, also resulting in short-term direct minor adverse impacts on a small percentage of visitors. There would be long-term minor benefits from better-protected high-value trees that provide screening, shade, and aesthetics that contribute to the visitor experience.

By April 30th each year park staff would identify park locations where insecticide application is warranted and treatment would be limited to these areas. If the Preferred Alternative is implemented in 2005, spraying would occur in late summer/early fall in Moraine Park and Timber Creek campgrounds, the Holzworth and McGraw ranches, and around the Beaver Meadows Visitor Center, park utility areas, and Grand Lake Cemetery.

Each year, RMNP would identify trail segments, trailheads, picnic areas, parking lots and campsites within or adjacent to treatment areas. RMNP will also identify campgrounds and picnic areas that would remain chemical free for that year. This information will be made available to the public via the RMNP website, printed media, press releases, signage, information kiosks, and other focal points to inform visitors. Treatment location, approximate dates and duration of closures will be included.

Insecticide applications would not occur between Memorial Day and Labor Day to reduce impacts during peak visitation. Treatment areas, including parking lots, trails, picnic areas and campsites will be posted with signs. Signs will remain in place up to 60 days following application. Closures will be reopened no sooner than12 hours after application, as directed on the chemical manufacture's label, and no later than 24 hours to minimize adverse impacts to visitors.

Cumulative Effects: Cumulative impacts on the visitor experience from mechanical removal, cultural techniques and prescribed fire are the same as the No Action Alternative. In addition to the proposed use of an insecticide to protect high-value trees, herbicides are used in the park to control invasive exotic plants. Short-term closures are also put in place when herbicides are used and the same protocols are used to communicate this information to the public as proposed in this plan. The cumulative effect on visitor experience resulting from closures for herbicide and insecticide use would be short term minor to moderate adverse impacts.

Conclusion: Noise and visual disturbance from mechanical treatments and the use of a powered sprayer to apply insecticide will result in a short-term minor impact to the visitor experience in developed areas and historic districts in the park. Insecticide application requires localized closures. When combined with the effect of closures for herbicide application, there would be a short-term direct minor to moderate

adverse impact to the visitor experience. Mitigation measures, including the implementation of a communication plan, will help to minimize visitor inconvenience.

HUMAN HEALTH AND SAFETY

Analyses of the potential intensity of impacts from bark beetle management activities were derived from park files and literature cited in this plan. The methodology for assessing insecticide impacts to human health and safety were derived from the following sources:

- Technology Transfer Network Air Toxics Website (EPA, 2004) http://www.epa.gov/ttn/atw/hlthef/Carbaryl.html
- Attia et al. (1991)
- Risk Assessment for Pesticide Use (USDA-USFS, 1992)
- Cox (1993)
- Occupational Safety & Health Administration (OSHA) http://www.osha.gov/dts/chemicalsampling/data/CH_225100.html
- Sevin® Brand Carbaryl Material Safety Data Sheets.
- Hastings et al. (2001)
- Sevin® Brand Carbaryl Specimen Labels
- Carbaryl Pesticide Fact Sheet http://infoventures.com/e-hlth/pestcide/Carbaryl.html
- The problem with Sevin® (Carbaryl) http://www.monitor.net/~cap/Sevin.html
- http://design.ntnu.no/ansatte/hertwich/HTP_ETC.html

Intensity Level Definitions

Negligible: Human health and safety would not be affected or would be at or below the lowest detection level. There would be "no observed effect" on park visitors, employees, residents, or contractors.

Minor: The effect could be detectable, but of a magnitude that would not have an appreciable adverse or beneficial impact to human health and safety. If mitigation was needed to offset adverse effects, it would be relatively simple to implement and would be highly successful.

Moderate: The effects would be readily apparent and result in noticeable adverse health and safety consequences to park visitors, employees, residents, and contractors. Exposure could exceed acceptable daily limits. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major: Effects would be readily apparent and would pose substantial health and safety risks to park visitors, employees, residents, and contractors. Mitigation measures to offset adverse effects would be needed, could be expensive, and their success could not be guaranteed.

Effects of Alternative 1 - No Action Alternative

Using a chainsaw, dragging heavy logs and piling slash could have a direct adverse impact on human health and safety if accidents occur. Potential hazards include falls, scrapes, scratches, puncture wounds, and eye irritation from flying debris. Workers may also be at risk from biting or stinging insects. Park employees and volunteers conducting strenuous mechanical control activities in summer may face risks including dehydration, fatigue, heat exhaustion, and heat stroke.

Watering high-value trees or cutting mistletoe-infested branches would have a negligible to minor impact on human health and safety. Park employees and volunteers could be injured performing these activities.

Prescribed fire activities could have a short-term minor impact on public health and safety. Smoke produced from prescribed fires can irritate eyes and lungs and can cause respiratory problems. Prescribed fires would

only occur in small, localized areas and only on days favorable for smoke dispersal. Visitors would be alerted and would be able to avoid these areas. Fire fighters are encouraged to stay upwind to avoid smoke inhalation. Limited use of prescribed fire as discussed in the park's Fire Management Plan (as amended) and WUI Fuels Management Plan is possible near the park boundary, so minor impacts to nearby residents related to smoke may occur.

Cumulative Effects: Mechanical and cultural techniques and prescribed fire are ongoing activities to achieve resource benefits in RMNP. Cumulatively, they result in short-term minor adverse impacts to human health and safety. These effects have also been addressed in the 1992 Fire Management Plan, as amended, and the 2002 WUI Fuels Management Plan.

Conclusion: The No Action Alternative could result in direct short-term minor adverse impacts to human health and safety. These impacts could result from accidents, insect stings, smoke inhalation and flying debris. Mitigation measures, such as required use of PPE, will be followed to minimize risks to human health and safety.

Effects of Alternative 2 - Preferred Alternative

The environmental consequences of using mechanical, cultural, and prescribed fire IPM control techniques are the same as the No Action Alternative.

Carbaryl is one of the three most commonly used insecticides in the United States with an estimated use of between 10 and 15 million pounds per year. It is used to control insects that affect animals, ornamental plants, indoor areas and over 100 agricultural crops. The Preferred Alternative proposes the use of Sevin® brand XLR Plus Carbaryl to protect high-value trees from bark beetle infestations.

Carbaryl impacts range from negligible to moderate adverse effects to human health and safety, depending on many factors, such as dosage, environmental conditions during application, type of exposure and an individual's sensitivity to chemicals. Potential human health effects, based on toxicity tests in laboratory animals and studies conducted on human health, are illustrated in Table 5.

Table 5 - Impact of Carbaryl on Human Health

Insecticide/Active Ingredient Sevin® Carbaryl (1-naphthyl N-methylcarbamate)	**Impacts of Carbaryl on Human Health**
Acute Toxicity:	In tests in male and female rats, the acute oral LD50 was 255 mg/kg. Acute dermal (skin) LD50 was greater than 2 grams/kilogram in rabbits. In laboratory tests in rabbits, Carbaryl was a mild eye irritant. Death in humans has resulted from Carbaryl intentionally taken in a suicide attempt. Lower doses of Carbaryl over a longer period of time may cause a variety of adverse effects. EPA has set a Lifetime Health Advisory level for Carbaryl in drinking water at 700 micrograms per liter. This level includes a margin of safety to protect human health and should be considered as a guideline. EPA believes that water containing Carbaryl at or below this level is acceptable for drinking every day over the course of one's lifetime, and does not pose any health concerns.
Chronic Toxicity:	Repeated overexposure may cause severe cholinesterase inhibition The exposure levels a person could receive from contacting or consuming treated vegetation, water or animals as a result of routine operations, are below levels shown to cause harmful effects in laboratory studies.
Toxicology:	Carbaryl inhibits the enzyme acetylcholinesterase in a manner similar to organophosphates, but the enzyme-inhibitor complex breaks down approximately five-fold faster. Carbaryl is safer toward warm-blooded animals than most organophosphate insecticides. Carbaryl's potent anticholinesterase activity could kill mammals only by forced oral administration.

Insecticide/Active Ingredient Sevin® Carbaryl (1-naphthyl N-methylcarbamate)	**Impacts of Carbaryl on Human Health**
Neurotoxicity:	Dietary exposure presented no risk of neurotoxicity, and the risk to humans "is vanishly small." Epidemiological studies have shown no symptoms of delayed neurotoxicity, dysmorphic sperm or viral enhancement in humans exposed to Carbaryl.
Carcinogenicity:	It is not known to be carcinogenic to animals. Laboratory tests in rats and mice fed up to 200 ppm (rats) or 400 ppm (mice) for 2 or 1.5 years respectively did not show any evidence of carcinogenicity. However, epidemiology studies have associated exposure to agricultural and household use of Carbaryl with an increased risk of cancer in humans. At least 15 laboratory studies have been done and three of the fifteen showed that Carbaryl exposure caused an increase in cancer incidence.
Developmental:	Studies with Carbaryl in pregnant laboratory animals indicated that Carbaryl is not a potential human teratogen (cause of birth defects).
Reproduction:	A three-generation reproduction study in rats did not show any adverse effects on fertility or reproduction at doses up to 200 mg/kg per day. Two studies at a Carbaryl manufacturing facility showed that Carbaryl exposure affected the quantity and quality of sperm produced by the workers. Other studies showed problems that included reduced fertility, increased fetal mortality, low birth weights, reduced growth and survival and birth defects in eight different types of animals.
Mutagenicity:	Carbaryl was found to show weak mutagenicity (the ability to cause genetic damage), and there is no *in vivo* information which would support the likeliness of heritable problems occurring in future generations.

The Human Toxicity Potential (HTP) is used to indicate the danger of a chemical's release to air or surface water. HTP contains two elements:

1. The toxicity of the chemical. This is represented by the unit risk factor (for carcinogens) or the safe dose (RFD) for non-carcinogenic effects.
2. The potential dose. This is represented by the intake of the pollutant by an individual living in a certain model environment (Hertwich et al. 2001, Hertwick et al. 2000).

General Public: People may be exposed to Carbaryl via dermal, respiratory, and dietary routes (e.g. contact with vegetation at a recently treated site, breathing herbicide vapors in or near recently treated areas, and touching or eating berries with residues). With strictly-enforced implementation of mitigation measures, it is unlikely that the general public would receive doses above "no observed effect" levels, which equates to a negligible short-term direct impact to human health and safety.

Human cancer risks from exposure would be negligible from the small amount of insecticide proposed for use in RMNP. Risks to the general public from spaying Carbaryl for bark beetle control are believed to be low. However, scientific research in this area is not conclusive.

Given the small amount of insecticide proposed for use and the number of trees proposed for spraying (up to 1000 trees each year while the beetle population is high), the potential for bioaccumulation is low, resulting in negligible effects. Park animals at the top of the food chain (eagles, coyotes, mountain lions, peregrine falcons, fox, bobcat) and humans are not expected to receive concentrated doses of the chemical by feeding on contaminated plants or animals. Carbaryl does not persist in aquatic environments, but can bioaccumulate in fish in small amounts if fish eat affected invertebrates (USDA-USFS 1996). Mitigation measures should reduce the risk to "no adverse effect" for fish or those animals that feed on them.

Workers: Employees and contractors applying Carbaryl may be exposed via dermal, respiratory, and dietary routes. Dermal exposure could occur by touching recently sprayed surfaces or through skin contact with the concentrate, mixture, or drifting spray droplets. Respiratory exposure could occur by breathing spray particles or vapors during spraying operations. Dietary exposure could occur if spray lands on food or drinks.

Routine-typical exposures are based on average conditions in application rate, number of trees treated, and doses identified in field-based exposure guides (USDA 1992). There can be an indirect effect on human health from Carbaryl use through improper application, mixing, or contamination of a water source.

Workers applying Carbaryl are required to use Personal Protective Equipment (PPE) as specified on the label or Material Safety Data Sheet (MSDS). PPE includes wrap-around goggles. With the required use of PPE as specified on the product label, it is unlikely workers would receive doses above the "no observed effect" level, resulting in a short-term direct negligible effect. Research shows that PPE such as long-sleeved shirts, coveralls, rubber gloves, and hats substantially reduce dermal exposure. Chemical Inhalation is reduced by using protective breathing devices. With the implementation of mitigation measures, proper use of PPE, and barring accidents, workers are unlikely to receive doses above the "no observed effect" level.

Multiple Chemical Sensitive (MCS) Population: There are individuals who are extremely sensitive to pesticides and other chemicals. Individual susceptibility to the toxic effects of Carbaryl can be variable and unpredictable. Following label instruction is considered by toxicologists to be sufficient to ensure a margin of safety where most people would experience no toxic effects from the use Carbaryl. However, chemically-sensitive individuals may experience effects from extremely small amounts of Carbaryl. For this reason, RMNP will notify all persons listed in the Colorado Registry of Pesticide Sensitive Persons of planned Carbaryl applications.

> **Notification:** By April 30th each year, park staff will identify park locations where Carbaryl use is warranted and treatment will be limited to those areas. Treated areas will be closed to the public during chemical application and for up to 24 hours after, or based on the re-entry time interval stated on the product label and MSDS sheets. Park visitors, neighbors, inholders and chemically sensitive people near proposed treatment areas would be notified about the location and time of application and duration of closure. Mitigating measures would reduce effects to a negligible to minor short-term impact on human health and safety.

Cumulative Effects: Proposed insecticide use may overlap with areas being sprayed with herbicide to manage invasive exotic plants. Used together, effects are expected to be negligible to minor when mitigation measures are followed. Prescribed burns would not be permitted for at least 1 year in areas where Carbaryl has been applied to reduce the potential for chemical exposure.

Conclusion: Using insecticides can pose risks to human health and safety from dermal, respiratory or dietary exposure. Strictly enforced mitigation measures will ensure that effects on human health and safety will be minimized. The public will be notified and treated areas will be clearly posted to minimize exposure. Effects are expected to be short-term direct negligible to minor effects.

Given the small amount of Carbaryl proposed for use in RMNP, the potential for bioaccumulation, cancer, and genetic damage appears to be negligible. The number of trees proposed for treatment (a maximum of 1,000 each year) is low, which will minimize the risk of exposure. Once the bark beetle outbreak is on a downward trend, the use of Carbaryl would no longer be necessary and the potential for human impacts would be ameliorated.

PARK OPERATIONS

Intensity Level Definitions

Implementation of a project can affect the operations of a park such as the number of employees needed; the type of duties that need to be conducted; when/who would conduct these duties; how activities should be conducted; and administrative procedures. The thresholds of change for the intensity of impacts to park operations are defined as follows:

Negligible: Park operations would not be affected or the effect would be at or below the lowest levels of detection, and would not have an appreciable effect on park operations.

Minor: The effect would be detectable, but would be of a magnitude that it would not have an appreciable adverse or beneficial effect on park operations. If mitigations were needed to offset adverse effects, it would be relatively simple and successful.

Moderate: The effects would be readily apparent and would result in a substantial adverse beneficial change in park operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major: The effects would be readily apparent and would result in a substantial adverse or beneficial change in park operations in a manner noticeable to staff and the public, and be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, could be expensive, and their success could not be guaranteed.

Effects of Alternative 1 - No Action Alternative

The No Action Alternative could alter current park operations related to bark beetle management in RMNP. If infestations continue to spread at the current rate, existing control activities may not be effective at protecting high-value trees, at preventing new infestations, or reducing the risk of personal injury and property damage due to hazardous trees. Consequently, increased staff time and park resources would be needed to control outbreaks in the Colorado River District on the west side of the park and in high use developed areas on the east side of the park read. This would result in a moderate adverse impact to park operations in the short-term (0-5 years). Under the No Action Alternative, two seasonal employees would be needed to evaluate the increasing number of infested trees. Technical assistance would be needed from the park's fire crews to assist with removal and burning of hazardous trees.

Cumulative Effects: Mechanical removal and cultural techniques would continue in high priority areas (Moraine Park and Timber Creek campgrounds, Beaver Meadows Visitor Center, Utility areas, Moraine Park Museum, Holzwarth Homestead, and McGraw Ranch), but would probably increase as infestations continue to spread. This would cumulatively result in a short-term minor to moderate adverse effect on park operations in terms of increased staff time and budget devoted to these activities.

RMNP has committed funding, staff and resources to inventory, monitor and maintain resources that contribute to the overall health of forest ecosystems. These programs include exotic plant management, fuel reduction and bark beetle management. These activities will continue, in concert, to achieve park resource benefits. Coordinating activities where possible will reduce cumulative impacts to park operations.

Conclusion: The current staff time and budget devoted to bark beetle management will not be sufficient if infestations continue to spread at the current rate. Using current control techniques, more staff time and funding would be needed to address an expanding beetle infestation, which would have a short-term

moderate adverse impact to park operations. Areas requiring treatment would likely be expanded to all developed areas and all historic districts in the park to prevent infestations and high-value tree mortality.

Effects of Alternative 2 - Preferred Action

Using an insecticide to control infestations would increase protection of high-value trees. A minor increase in funding would be necessary to contract with a state-certified applicator to spray selected areas. Chemical treatment of 1,000 trees per year could be accomplished in three weeks, which would result in a negligible short-term impact on park operations.

A seasonal or term employee would be needed to identify target trees, oversee contract operations, keep the public safe, and sanitize any infested trees that spraying may have missed. Ultimately, however, Carbaryl use would decrease the staff time and funds needed to manage bark beetles. This would result in a long-term minor to moderate benefit on park operations. Being proactive in preventing infestations will reduce resource damage, safety risks and property damage thereby freeing staff time and funds for other resource and visitor related projects.

Cumulative Effects: Insecticide use would reinforce the other IPM techniques currently in use, increase long-term resource benefits and reduce safety and wildfire risks to humans. This would result in a beneficial long-term impact on park operations through reduced staff time and funding needed for bark beetle management. Coordination with fire management activities could also streamline park operations, achieving mutually beneficial resource results.

Conclusion: Using the full range of IPM techniques to prevent infestations and protect high-value trees will ultimately result in a minor to moderate long-term benefit on park operations from reduced staff time and funding needed to manage bark beetles.

CONSULTATION AND COORDINATION

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Department of Agriculture, United States Forest Service, Regional Office, Denver
Colorado Coalition for Alternatives to Pesticides
Colorado State Forest Service
State Historic Preservation Office (EA to be forwarded for review and comment as part of the Section 106 process)
U.S. Fish and Wildlife Service (EA to be forwarded for review and comment as part of the Endangered Species Act consultation process)

Individuals Consulted

The following people assisted in identifying issues, developing alternatives, and/or analyzing impacts related to this plan. They do not necessarily agree with the proposed action or all of the material presented.

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City of Longmont
Colo. Dept. of Agriculture
Colo. Dept. of Natural Resources
Colo. Natural Areas Program
Colo. Division of Wildlife
Colo. Historical Society
Colo. State Forest Service
Estes Valley Rec. & Park District
Grand Cty. Dept. of Natural Res.
Northern Colo. Water Conservancy Dist.
Northern Arapaho Tribe
NPS Regional IPM Coordinator
U.S. Natural Resources Conservation Service
St. Vrain Lefthand Water Conservancy Dist.
Town of Grand Lake
U.S. Bureau of Land Management
U.S. Environmental Protection Agency
U. S. Fish & Wildlife Service
U.S. Army Corps of Eningeers
U.S. Bureau of Reclamation
U.S. Dept. of Argiculture - Aphis
USDA Forest Service
USFS Canyon Lakes Ranger District
USFS Sulphur Ranger Dist.

Businesses
Cascade Cottages
Ferrellgas
McMarr Properties
MJC Properties
YMCA of the Rockies

Elected Officials
Boulder County Commissioners
Colorado House Dist. 13
Colorado House Dist. 49
Colorado House Dist. 57
Colorado Senate Dist. 8
Colorado Senate Dist. 15
Colorado Senate Dist. 16
Grand County Commissioners
Jackson County Commissioners
Larimer County Commissioners
Representative Marilyn Musgrave
Representative Mark Udall
Senator Ken Salazar
Senator Wayne Allard

Organizations
Alliance of Backcountry Parachutists
American Alpine Club
American Lands Alliance
Audubon Society
Biodiversity Associates
Biodiversity Legal Foundation
Center for Native Ecosystems
Colo. Natural Heritage Program
Coalition for Pesticide Restraint
Colo. Environmental Coalition
Colo. Wildlife Heritage Fund.
Colo. Mountain Club
Colo. Mule Deer Ass'n.
Colo. Native Plant Society
Colo. Open Lands
Colo. Pesticide Network
Colo. Riparian Assn.
Continental Divide Trail Alliance
Continental Divide Trail Soc.
Earthlaw
Environmental Defense
Estes Park Convention & Visitors Bureau
Estes Valley Land Trust
Estes Valley Improvement Association
Grand Cty Land Conservancy
Great Old Broads for Wilderness
J T Stone Cliffs Association
Land and Water Fund
League of Women Voters
Mtn. Prairie Girl Scout Council
National Parks & Conservation Assoc.
Rocky Mtn. Elk Foundation
Rocky Mtn. Rec. Initiative
Shining Mountains Group, CMC
Sierra Club
Southern Rockies Forest Network
Tahosa Valley Landowners
The Conservation Fund
The Nature Conservancy

The Trust for Public Land
Wilderness Society
Wilderness Watch
Wildlands CPR

Media
Boulder Daily Camera
Denver Post
Estes Park Trail-Gazette
Fort Collins Coloradoan
Longmont Times-Call
Loveland Reporter-Herald
Rocky Mountain News
Sky Hi News

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Boulder Public Library
Estes Park Public Library
Fort Collins Public Library
Juniper Library
Longmont Public Library
Loveland Public Library

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APPENDIX A - Dendroctonus and Ips beetles known in Colorado to attack pine and spruce trees

Species	Hosts	Comments
Dendroctonus adjunctus (roundheaded bark beetle)	*Pinus ponderosa, P. flexilis, P. contorta*	Attacks the basal portion of the bole of overstocked and pole sized trees. Flies during the fall.
D. approximatus larger Mexican bark beetle	*P. Ponderosa*	Attacks the basal portion of the bole.
D. brevicomis Western bark beetle	*P. ponderosa, P. contorta*	Attacks mid bole of over mature or trees weakened by drought >6 in. diameter. Introduces blue stain fungi. Can kill vigorous trees during outbreaks.
D. frontalis southern bark beetle	*P. ponderosa,*	Rarely a pest in the Western states.
D. ponderosae mountain bark beetle	*P ponderosa, P. contorta, P. flexilus,*	The bark beetle in RMNP currently killing thousands of trees. Attacks the entire bole of trees >4 in. diameter. Can kill numerous trees during outbreaks.
D. valens red turpentine beetle	*P. ponderosa, P. contorta*	Attacks lower bole and root crown of weakened or injured trees.
Ips hunteri	*Picea pungens*	This is a common species affecting Colorado blue spruce in landscape settings. Upper bole are typically infested first.
Ips pilifrons	*Picea pungens*	A forest species often called the “spruce ips”; tends to infest the upper part of fallen trunks.
Ips pini	*P. ponderosa, P. contorta*	The most common species associated with other pines in Colorado
Ips knausi	*P. ponderosa*	Common at base of trunk and in fresh stumps.
Ips calligraphus six spined ips	*P. ponderosa*	Largest *Ips* species in Colorado; often in main trunk. Attacks the lower bole of large trees.
Ips integer	*P. ponderosa, P. contorta,*	Attacks the entire bole of weakened and felled trees.
Ips woodi	*P. flexilis*	
Ips borealis	*Picea engelmannii*	
Ips mexicanus Monterey pine ips	*P. Flexilis, P. contorta*	Attacks the bole of lining, injured or dying trees
Ips latidens	*P. ponderosa*	Attacks three and five needle pines

Pinus ponderosa – ponderosa pine; *P. contorta* – lodgepole pine; *P. flexilis* – limber pine; *Picea pungens* – Colorado Blue spruce; *P. engelmannii* – Engelmann spruce

APPENDIX B - Threatened and Endangered Unit Species List
Endangered Species Act (ESA)
Rocky Mountain National Park

December 2004

The following table contains a list of species that are specific to Rocky Mountain National Park and are federally listed as endangered, threatened or candidates for listing, by the U.S. Fish and Wildlife Service under the provisions of the Endangered Species Act. The U.S. Fish and Wildlife Service has reviewed the list and provided a letter of concurrence dated April 12, 2005 (Appendix C).

The species that are included in the table must meet one of the following criteria:

1. The species is known to occur within the park.
2. The species does not occur within the park, but suitable habitat is available, the habitat is within the known elevation range for the species, and the species is known to exist in counties that the park occupies.
3. The species does not occur within the park, but actions within the park have the potential to affect the species.

In compliance with the Endangered Species Act, all management actions within the park are evaluated to determine if they will have any effect on endangered, threatened or candidate species on this list.

Federally Listed and Candidate Species & Their Status in Colorado	Known to Occur in RMNP	Known to Occur in Boulder County	Known to Occur in Larimer County	Known to Occur in Grand County
Amphibians				
Boreal toad, *Bufo boreas boreas*, Candidate for Listing	Yes	Yes	Yes	Yes
Birds				
Bald Eagle, *Haliaeetus leucocephalus,* Threatened	Yes	Yes	Yes	Yes
Least tern, *Sterna antillarum*, Endangered	No	▲	▲	No
Mexican spotted owl, *Strix occidentalis lucida*, Listed Threatened	No	Yes Historically	Yes Historically	No
Piping plover, *Charadrius melodus*, Threatened	No	▲	▲	No
Whooping crane, *Grus americana*, Endangered	No	▲	▲	No
Yellow-billed cuckoo, *Coccyzus americanus*, Candidate for Listing	Yes Historically	No	Yes	Yes
Fish				
Bonytail, *Gila elegans*, (presumed-historical) Endangered	No	No	No	*
Colorado pikeminnow, *Ptychocheilus lucius*, Endangered	No	No	No	*
Greenback cutthroat trout, *Oncorhynchus clarki stomias*, Threatened	Yes	Yes	Yes	No

Federally Listed and Candidate Species & Their Status in Colorado	Known to Occur in RMNP	Known to Occur in Boulder County	Known to Occur in Larimer County	Known to Occur in Grand County
Humpback chub, *Gila cypha*, Endangered	No	No	No	*
Pallid sturgeon, *Scaphirhunchus albus*, Threatened	No	▲	▲	No
Razorback sucker, *Xyrauchen texanus*, Endangered	No	No	No	*
Mammals				
Canada lynx, *Lynx canadensis*, Threatened	Yes	Yes	Yes	Yes
Preble's meadow jumping mouse, *Zapus hudsonius preblei*, Threatened	No	Yes	Yes	No
Plants				
Colorado butterfly plant, *Gaura neomexicana* spp. *Coloradensis*, Threatened	No	Yes	Yes	No
Utes ladies'-tresses, *Spiranthes diluvialis*, Threatened	No	Yes	Yes	No

Table Terminology

*	Water depletions in the Upper Colorado River basin may affect these species
▲	Water depletions in the South Platte River basin may affect these species
Candidate	Means there is sufficient information indicating that formal listing under the ESA maybe appropriate
Endangered	Means the species could become extinct
Threatened	Means the species could become endangered

APPENDIX C – Concurrence Letter from the U.S. Fish & Wildlife Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Colorado Field Office
755 Parfet Street, Suite 361
Lakewood, Colorado 80215

IN REPLY REFER TO:
ES/CO: NLAA/RMNP
Mail Stop 65412

APR 12 2005

Mr. Larry Gamble
Chief, Branch of Planning & Compliance
Rocky Mountain National Park
Estes Park, Colorado 80517

Dear Mr. Gamble:

The U.S. Fish and Wildlife Service has received your January 1, 2005, emailed correspondence requesting concurrence for your revised Threatened and Endangered Unit Species List (revised December 2004). The purpose of the "unit species list" is to streamline the section 7 consultation required of Federal agencies under the Endangered Species Act. This list would eliminate the Rocky Mountain National Park (RMNP) agencies from having to request a threatened and endangered species list each time they require consultation with the Service.

The Service concurs with your updating the status listed for the Canada lynx, *Lynx canadensis*, from being currently extirpated to being known to occur within RMNP. The Service also concurs that the following listed species may be affected by activities of the Rocky Mountain National Park and consultations will be needed. Although candidate species presently receive no protection under the Act, it is within the spirit of the Act to consider project impacts to potentially sensitive species. Please be aware that threatened and endangered species lists should be updated every 90 days by telephone or in writing. If the update requires a change in the list below, the change will be documented in writing. The following species are of potential concern for your projects.

Unit Species List for the Rocky Mountain National Park

Bald eagle	*Haliaeetus leucocephalus*
Bonytail	*Gila elegans*
Boreal toad	*Bufo boreas boreas*
Canada lynx	*Lynx canadensis*
Colorado butterfly plant	*Gaura neomexicana spp. Coloradensis*
Colorado pikeminnow	*Ptychocheilus lucius*
Greenback cutthroat trout	*Oncorhynchus clarki stomias*
Humpback chub	*Gila cypha*
Least Tern	*Sterna antillarum*
Mexican spotted owl	*Strix occidentalis lucida*

Pallid sturgeon	*Scaphirhunchus albus*
Piping plover	*Charadrius melodus*
Preble's meadow jumping mouse	*Zapus hudsonius preblei*
Razorback sucker	*Xyrauchen texanus*
Ute ladies'-tresses	*Spiranthes diluvialis*
Whooping crane	*Grus americana*
Yellow-billed cuckoo	*Coccyzus americanus*

If the Service can be of further assistance, contact Andrea Jackson of my staff at (303)275-2349.

Sincerely,

Susan Linner
Colorado Field Supervisor

Reference: SpeciesList/ RMNP 3-2005

APPENDIX D - State Endangered, Threatened, and Rare Species of Rocky Mountain National Park

December 2004

Rocky Mountain National Park uses the following table to identify state endangered, threatened and rare species that must be protected if found within a proposed project site. Federally threatened, endangered and candidate species are maintained separately from state listed species.

Agencies have a variety of ways of tracking and measuring the biological imperilment of species. The Colorado Wildlife Commission determines if a given specie needs protection under state laws. Four primary categories are applicable to Rocky Mountain National Park:

State Status Codes

E **State Endangered** – Listed as endangered by the Colorado Division of Wildlife. Those species or subspecies of native wildlife whose prospects for survival or recruitment within Colorado are in jeopardy, as determined by the Commission. State endangered species have legal protection under Colorado Revised Statues 33-2-105 Article 2.

T **State Threatened** – Listed as threatened by the Colorado Division of Wildlife. Those species or subspecies of native wildlife which, as determined by the Commission, are not in immediate jeopardy of extinction but are vulnerable because they exist in such small numbers, are so extremely restricted in their range, or are experiencing such low recruitment or survival that they may become extinct. State threatened species have legal protection under Colorado Revised Statues 33-2-105 Article 2.

SC **State Special Concern** – Those species or subspecies of native wildlife that have been removed from the state threatened or endangered list within the last five years; are proposed for federal listing (or a federal listing "candidate species") and are not already state listed; have experienced, based on the best available data, a downward trend in numbers or distribution lasting at least five years that may lead to an endangered or threatened status; or are otherwise determined to be vulnerable in Colorado.

The Colorado Natural Heritage Program (CNHP), based in Fort Collins manages a large database and ranking system for Colorado species. The database can be accessed through the Internet at www.cnhp.colostate.edu. The CNHP ranking system has two primary components – a ranking for the global status of the specie (G), and a ranking for that part of the range found within the state (S). Numeric extensions are added to these on a scale of 1 (critically imperiled) to 5 (demonstrably secure). A reference that CNHP uses to identify global status of a species is an online encyclopedia of life maintained by NatureServe at http://www.natureserve.org/

Natural Heritage ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. National Park Service policies and guidelines require the preservation and protection of all native species.

Partners in Flight (PIF) developed a North American Landbird Conservation Plan in 2004. This plan provides a continental synthesis of priorities, objectives and rankings that will guide landbird conservation actions at national and international scales. PIF rankings are identified in the column with CNHP global rank codes. Only those species that have a state rank by CNHP are identified. A list of all PIF landbird species of continental importance, watch listed species, and stewardship species that occur in the Park are maintained separately from federal and state listed species.

Global Rank Codes

G1 Critically imperiled globally because of rarity (5 or fewer occurrences in the world; or 1,000 or fewer individuals), or because of some factor of its biology makes it especially vulnerable to extinction.

G2 Imperiled globally because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
G3 Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
G4 Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery, usually more than 100 occurrences and 10,000 individuals.
G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.
G#T# Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
GQ Indicates uncertainty about taxonomic status.
G#? Indicates uncertainty about an assigned global rank.

North American Landbird Conservation Plan (RMNP is within the Intermountain West Avifaunal Biome, Bird Conservation Region 16)
GW Partners in Flight Watch List Species, with at least 10% of their global population in the Intermountain West Avifaunal Biome. A watch listed species are those birds warranting attention due to concerns related to declining populations, and distinct threats to habitat.
GS Partners in Flight Stewardship Species with ≥ 75% of their global population in the Intermountain West Avifaunal Biome. A stewardship species are those birds that have small or restricted ranges.

State Rank Codes
S1 Critically imperiled state because of rarity (5 or fewer occurrences in the world; or 1,000 or fewer individuals), or because of some factor of its biology makes it especially vulnerable to extinction.
S2 Imperiled state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
S3 Vulnerable through its range within a state or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
S4 Apparently secure within the state, though it might be quite rare in parts of its range, especially at the periphery, usually more than 100 occurrences and 10,000 individuals.
S5 Demonstrably secure within the state, although it may be quite rare in parts of its range, especially at the periphery.
S#B Refers to the breeding season imperilment of species that are not permanent residents.
S#N Refers to the non-breeding season imperilment of species that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SH Historically known, but usually not verified for an extended period of time and could be extirpated from the park or the state.
SNR Not yet ranked in the state due to lack of information.
SX Presumed extirpated from within the state.
S#? Indicates uncertainty about an assigned state rank.

The Rocky Mountain National Park list of state Endangered, Threatened, and Rare Species does not include State Ranks Codes S4 and S5 because these rankings indicate that the specie is apparently or demonstrably secure within the state. The RMNP list is updated annually. If a specie is listed as unconfirmed, it means it occurred historically and is presently not confirmed; or has never been confirmed in the park, but the park has the appropriate habitat is within the species elevation range, and it has been confirmed in the counties the park occupies.

Scientific Name	Common Name	Time of Occurrence in RMNP	State Status	CNHP, PIF Rank	
				Global	State
Amphibians					
Bufo boreas pop1	Boreal toad (Southern Rocky Mountain Population)	All year	E	G4T1Q	S1
Rana sylvatica	Wood Frog	All year		G5	S3
Birds					
Accipiter gentilis	Northern goshawk	All year		G5	S3B
Aegolius funereus	Boreal owl	All year		G5	S2
Amphispiza belli?	Sage sparrow	Summer or migrant		G5,GS	S3B
Bucephala islandica	Barrow's goldeneye	Winter or migrant	SC	G5	S2B
Buteo regalis	Ferruginous hawk	Migrant	SC	G4	S3B, S4N
Calcarius mccownii	Mccown's longspur	Migrant		G5, GW	S2B
Catharus fuscescens	Veery	Summer or migrant		G5	S3B
Catoptrophorus semipalnatus	Willet	Migrant		G5	S1B
Coccyzus americanus occidentalis (unconfirmed)	Western Yellow-billed cuckoo	Accidental, two recorded occurrences, 1947 & 1980		G5T3	SNA
Cypseloides niger	Black swift	Summer		G4, GW	S3B
Dendroica graciae	Grace's warbler	Accidental, one recorded occurrence, 1990		G5	S3B
Dolichonyx oryzivorus	Bobolink	Accidental, summer or migrant		G5	S3B
Egretta thula	Snowy Egret	Migrant or rare summer		G5	S2B
Falco peregrinus anatum	American peregrine falcon	Summer or migrant	SC	G4T3	S2B
Glaucidium gnoma	Northern pygmy owl	All year		G5	S3B
Grus canadensis tabida	Greater sandhill crane	Summer or migrant	SC	G5T4	S2B, S4N
Haliaeetus leucocephalus	Bald eagle	All year	T	G4	S1B, S3N
Leucosticte australis	Brown-capped rosy-finch	All year		G4, GW	S3B, S4N
Loxia leucoptera	White-winged crossbill	All year, Irreg-ular visitor		G5	S1B
Numenius americanus	Long-billed curlew	Migrant	SC	G5	S2B
Pelecanus erythrorhynchos	American white pelican	Migrant	SC	G3	S1B

Scientific Name	Common Name	Time of Occurrence in RMNP	State Status	CNHP, PIF Rank	
				Global	State
Plegadis chihi	White-faced ibis	Migrant		G5	S2B
Seiurus aurocapillus	Ovenbird	Rare summer or rare migrant		G5	S2B
Sterna forsteri	Forster's tern	Migrant		G5	S2B
Strix occidentalis lucida (Unconfirmed)	Mexican spotted owl	All Year	T	G3T3, GW	S1B, SUN
Fish					
Oncorhynchus clarki pleuriticus	Colorado River cutthroat Trout	All year	SC	G4T3	S3
Oncorhynchus clarki stomias	Greenback cutthroat trout	All year	T	G4T2T3	S2
Mammals					
Canis lupis (unconfirmed)	Gray wolf			G4	SX
Lynx canadensis	Lynx	All year	E	G5	S1
Gulo gulo (unconfirmed)	Wolverine	All year	E	G4	S1
Plecotus townsendii pallescens	Townsend's big-eared bat	All Year		G4T4	S2
Sorex hoyi montanus	Pygmy shrew	All year		G5T2 T3	S2
Sorex nanus	Dwarf shrew	All year		G4	S2
Ursus arctos (unconfirmed)	Grizzly or Brown bear			G4	SX
Invertebrates (Insects)					
Hyles galli	Galium sphinx moth	Summer		G5	S3?
Paratrytone snowi	Snow's skipper	Summer		G5	S3
Pyrgus ruralis	Two-banded skipper	Summer		G4	S3
Mollusk					
Acroloxus coloradensis	Rocky mountain capshell	All year	SC	G1G2	S1
Lichens					
Brachythecium ferruginascens				G4	S1S3
Bryum alpinum				G4G5	S1S3
Mosses					
Andreaea heinemannii				G3G5	S1S3
Andreaea rupestris				G5	S1S3
Aulacomnium palustre var. imbricatum				G5TNR	S1S3
Campylopus schimperi				G3G4	S1S3
Grimmia teretinervis				G3G5	S1S3
Hylocmiastrum pyrenaicum				G4G5	S1S3
Hylocomium alaskanum				G5	S1S3
Leptopterigynandrum austro-alpinum				G5	S1S3
Mnium blyttii				G5	S1S3
Oreas martiana				G5?	S1S3
Plagiothecium cavifolium				G5	S1S3
Pleurozium schreberi	Feathermoss			G5	S1S3

Scientific Name	Common Name	Time of Occurrence in RMNP	State Status	CNHP, PIF Rank	
				Global	State
Pohila tundrae				G2G3	S1S3
Rhytidium rugosum	Golden Glade-moss			G5	S1S3
Roellia roellii				G5	S1S3
Sphagnum contortum	Sphagnum			G5	S1S3
Liverworts					
Gymnomitrion corallioides				G4G5	S1S3
Plants					
Aletes humilis (unconfirmed)	Larimer aletes			G2G3	S2S3
Aquilegia saximontana	Rocky Mountain columbine			G3	S3
Artemisia pattersonii	Patterson's wormwood			G3G4	S3
Asplenium septentrionale	Grass-fern			G4G5	S3S4
Botrychium echo	Reflected moonwort			G3	S3
Botrychium hesperium	Western moonwort			G3	S2
Botrychium lanceolatum var lanceolatum	Lance-leaved moonwort			G5T4	S3
Botrychium lunaria	Common Moonwort			G5	S3
Botrychium minganense	Mingan's moonwort			G4	S1
Carex diandra	Lesser panicled sedge			G5	S1
Carex leptalea	Bristle-stalk sedge			G5	S1
Carex limosa	Mud sedge			G5	S2
Carex oreocharis	A sedge			G3	S1
Carex stenoptila	River bank sedge			G2	S2?
Castilleja puberula	Downy Indian-paintbrush			G2G3	SNR
Chionophila jamesii	Rocky mountain snowlover			G4?	S3S4
Cyripedium fasciculatum	Purple's lady's-slipper			G4	S3
Cystopteris montana	Mountain bladder fern			G5	S1
Draba crassa	Thick-leaf whitlow-grass			G3	S3
Draba fladnizensis	Arctic Draba			G4	S2S3
Draba grayana	Gray's peak whitlow-grass			G2	S2
Draba porsildii	Porsild's Whitlow-grass			G3G4	S1
Draba streptobrachia	Colorado Divide			G3	S3

Scientific Name	Common Name	Time of Occurrence in RMNP	State Status	CNHP, PIF Rank	
				Global	State
	whitlow-grass				
Drymaria effusa var. depressa	Spreading drymaria			G4T4	SNR
Dryopteris expansa	Spreading wood fern			G5	S1
Erocallis triphylla	Dwarf Spring Beauty			G4?	S2
Hippochaete variegata	Variegated scouringrush			G5	S1
Isoetes tenella	Spiny-spored quillwort			G5?T5?	S2
Juncus tweedyi	Tweedy rush			G3Q	S1
Juncus vaseyi	Vasey bulrush			G5?	S1
Lewisia rediviva	Bitteroot			G5	S2
Liatris ligulistylis	Gay-feather			G5?	S1S2
Lilium philadelphicum	Wood lily			G5	S3S4
Listera borealis	Northern twayblade			G4	S2
Listera convallarioides	Broad-Leaved twayblade			G5	S2
Luzula subcapitata	Colorado wood-rush			G3?	S3?
Mimulus gemmiparus	Weber monkey flower			G1	S1
Minuartica stricta	Rock sandwort			G5	S1
Lysimachia thrysiflora	Tufted Loosetrife			G5	SH
Mentzelia sinuata	Wavy-leaf stickleaf			G3	S2
Nuttallia speciosa	Jeweled blazingstar			G3?	S3?
Papaver radicatum spp. Kluanense	Alpine poppy			G5T3 T4	S3S4
Parnassia kotzebuei	Kotzebue grass-of-parnassus			G4	S2
Penstemon harbourii	Harbour beardtongue			G3	S3S4
Polypodium hesperium	Western polypody			G5	S1S2
Potentilla rupincola	Rocky mountain cinquefoil			G5?T2	S2
Pyrola picta (unconfirmed)	Pictureleaf wintergreen			G4G5	S3S4
Salix serissima	Autumn willow			G4	S1
Silene kingii	King's campion			G2G4Q	S1
Sisyrinchium pallidum	Pale blue-eyed grass			G2G3	S2
Telesonix jamesii	James' telesonix			G2G3	S2?
Tonestus lyallii	Lyall haplopappus			G5	S1

Scientific Name	Common Name	Time of Occurrence in RMNP	State Status	CNHP, PIF Rank	
				Global	State
Viola Selkirkii	Selkirk violet			G5?	S1

APPENDIX E - List of sources used by Rocky Mountain National Park to identify Endangered, Threatened and Rare Species

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