United States
Department of
Agriculture

Forest
Service

**Southwestern
Region**

MB-R3-03-23

July 2012

Environmental Assessment for the Isleta Collaborative Landscape Analysis Project

Bureau of Indian Affairs, Cibola National Forest, and Chilili Land Grant

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TTY). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TTY). USDA is an equal opportunity provider and employer.

Printed on recycled paper – July 2012

Environmental Assessment
for the
Isleta Collaborative Landscape Analysis Project

Prepared for:

Bureau of Indian Affairs
Cibola National Forest
Chilili Land Grant

On behalf of:

Pueblo of Isleta
P.O. Box 1270
Isleta, NM 87022
Telephone: (505) 724-9240
Fax: (505) 869-2284

Prepared by:

SWCA Environmental Consultants
5647 Jefferson St. NE
Albuquerque, NM 87109
(505) 254-1115

SWCA Project No. 16134

Contents

Chapter 1. Purpose and Need **1**
Document Structure 1
Background 1
The Project Area 3
Purpose and Need for Action 5
Purpose and Need for All Partners 5
Existing Conditions 5
Existing Conditions Specific to the Pueblo 5
Existing Conditions Specific to Chilili 6
Existing Conditions Specific to Sandia and Mountainair RDs 6
Proposed Action 7
Decision Framework 10
Public Involvement 10
Issues 11

Chapter 2. Alternatives, Including the Proposed Action **13**
Alternative A – No Action 13
Alternative B – The Proposed Action 13
Alternative C 14
Proposed Action Specific to Isleta Pueblo 14
Piñon-Juniper Treatments 16
Ponderosa Pine Treatments 16
Exterior Units 16
Interior Units 17
Prescribed Burning 17
Meadow Areas 17
Material Hauling 17
Herbicide Application 19
Proposed Action Specific to Chilili 20
Proposed Action Specific to Cibola NF&Gs 22
Piñon-Juniper Treatments 22
Ponderosa Pine Treatments 22
Oak Woodland Treatments 23
Mixed Conifer Treatments 23
Areas Over 40 Percent Slope 23
Slash Disposal 23
Maintenance 23
Connected Actions 25
Migratory Bird Recommendations 25
Wood Hauling 25
Heritage/Cultural Resources 32
Northern Goshawk 32
Alternative C 33
Piñon-Juniper Treatments 33
Ponderosa Pine Treatments 33
Mitigation Measures Common to Action Alternatives 34
Soils/Watershed 34
Scenic Resources 34
Air Quality 35
Prescribed Burning 35
Wildlife 36
Vegetation 37
Recreation (Cibola NF&Gs) 38

New Mexico Forest Restoration Principles 38
Comparison of Alternatives 44

Chapter 3. Affected Environment and Environmental Consequences 51
Fuels and Fire Behavior 51
Historic Conditions of Forest Types and Fire 51
Pueblo and Chilili Affected Environment 56
Cibola NF&Gs Affected Environment 58
Pueblo and Chilili Environmental Consequences 62
Cibola NF&Gs Environmental Consequences 64
Cumulative Effects on All Jurisdictions 68
Soils 68
Climate 68
Pueblo and Chilili Affected Environment 69
Cibola NF&Gs Affected Environment 71
Pueblo and Chilili Environmental Consequences 80
Cibola NF&Gs Environmental Consequences 81
Water Resources 84
Pueblo and Chilili Affected Environment 84
Cibola NF&Gs Affected Environment 85
Pueblo and Chilili Environmental Consequences 86
Cibola NF&Gs Environmental Consequences 88
Cumulative Effects 97
Vegetation 97
Pueblo and Chilili Affected Environment 97
Cibola NF&Gs Affected Environment 100
Pueblo and Chilili Environmental Consequences 105
Cibola NF&Gs Environmental Consequences 107
Cumulative Effects 110
Wildlife 112
Pueblo and Chilili Affected Environment 113
Cibola NF&Gs Affected Environment 117
Pueblo and Chilili Environmental Consequences 122
Cibola NF&Gs Environmental Consequences 125
Cumulative Effects Across Jurisdictions 137
Air Resources 138
Affected Environment Across Jurisdictions 138
Environmental Consequences Across Jurisdictions 140
Climate Change 140
Affected Environment Across Jurisdictions 140
Impact of Climate Change on Fire Frequency and Severity 141
Environmental Consequences Across Jurisdictions 142
Scenic Resources 142
Pueblo and Chilili Affected Environment 142
Cibola NF&Gs Affected Environment 142
Pueblo and Chilili Environmental Consequences 144
Cibola NF&Gs Environmental Consequences 144
Cumulative Effects Across Jurisdictions 147
Transportation 148
Cibola NF&Gs Affected Environment 148
Transportation Environmental Consequences 152
Socioeconomic Resources 153
Pueblo and Chilili Affected Environment 153
Cibola NF&Gs Affected Environment 154

Methodology....158
Environmental Consequences....159
Cultural Resources....160
Pueblo and Chilili Affected Environment....160
Cibola NF&Gs Affected Environment....161
Environmental Consequences....161
Recreation Resources....162
Pueblo and Chilili Affected Environment....162
Cibola NF&Gs Affected Environment....162
Pueblo and Chilili Environmental Consequences....163
Cibola NF&Gs Environmental Consequences....163
Cibola NF&Gs Cumulative Effects....165
Indian Trust Assets....165
Affected Environment....165
Environmental Consequences....165

Chapter 4. Consultation and Coordination....167
Federal, State, and Local Agencies....167
USFS Interdisciplinary Team Members....167
Tribes and Pueblos....167
Others....168
List of Preparers....168

Literature Cited....169

Appendix
A. Fire Risk Map for the Project Area....181
B. Pueblo and Chilili Biological Evaluation....183

List of Figures

Figure 1. Project location (Source: Cibola National Forest 2011).... 4
Figure 2. Illustration of desired spatial arrangement of leave groups.... 9
Figure 3. Pueblo treatment units.... 15
Figure 4. Pueblo and Chilili meadow restoration areas.... 18
Figure 5. Chilili treatment units.... 21
Figure 6. Cibola NF&Gs proposed action treatment types.... 26
Figure 7. Cibola NF&Gs implementation phases.... 27
Figure 8. Cibola NF&Gs proposed action haul zones.... 29
Figure 9. Cibola NF&Gs proposed action road designations post-treatment.... 31
Figure 10. Annual fire occurrences within the proposed project area and 5 miles from the project boundary from 1970 to 2009.... 55
Figure 11. Piñon-juniper woodland, note high tree density and continuous vegetative cover.... 59
Figure 12. Even-aged ponderosa pine stand; note dense tree stocking and lack of herbaceous understory.... 60
Figure 13. Mixed conifer stand; note abundant regeneration creating ladder fuels.... 61
Figure 14. TEUs in the Mountainair RD of the Isleta CFR Project.... 73
Figure 15. TEUs within the Sandia RD of the Isleta CFR Project.... 74
Figure 16. Soil condition of the primary TEUs in the project area.... 77
Figure 17. Soil condition in the Sandia RD.... 78
Figure 18. Soil condition in the Mountainair RD.... 79
Figure 19. Sixth code watersheds, project watersheds, streams, and springs.... 87
Figure 20. USFS project watersheds.... 93

List of Tables

Table 1. Summary of Pueblo Treatment Units ... 14
Table 2. BMPs for herbicide use ... 19
Table 3. Proposed treatments to meet the desired condition for each forest type based on soil conditions, location, and slope ... 24
Table 4. NFS roads ... 30
Table 5. Comparison of alternatives ... 45
Table 6. Fire regimes and condition classes ... 62
Table 7. Ponderosa pine, fuel model TU5 ... 64
Table 8. Piñon-juniper, fuel model 6 ... 65
Table 9. Mixed conifer, fuel model 10 ... 65
Table 10. Ponderosa pine, fuel models TL8 (60 percent) and GR2 (40 percent) ... 66
Table 11. Piñon-juniper, fuel models 8 (60 percent) and GR1 (40 percent) ... 66
Table 12. Mixed conifer, fuel model TL5 ... 66
Table 13. Ponderosa pine, fuel models TL8 (90 percent) and GR2 (10 percent) ... 67
Table 14. Piñon-juniper, fuel models 8 (90 percent) and GR1 (10 percent) ... 67
Table 15. Mixed conifer, fuel model TL 5 ... 67
Table 16. Soils in the project area ... 69
Table 17. Available woody material information for the project area ... 77
Table 18. Comparison of alternatives for soil condition ... 84
Table 19. 12-digit Hydrologic Unit Code (sixth code) watersheds ... 86
Table 20. Average percent basal area reduction from each project watershed ... 95
Table 21. Summary of water resource measures ... 97
Table 22. Old growth allocation within the Manzanita/Manzano Ecosystem Management Area ... 102
Table 23. Old growth allocation within the combined Manzanita/Manzano Ecosystem Management Area and Manzano Mountain Wilderness ... 102
Table 24. Old growth allocation within the Isleta CFRP ... 103
Table 25. Distribution by VSS class and forest type (percentage) for forested areas within the Manzanita/Manzano Ecosystem Management Area ... 103
Table 26. Distribution by VSS class and forest type (percentage) for forested areas within the Isleta CFRP Project area ... 104
Table 27. Distribution by VSS diameter groups (by site) at the site level ... 104
Table 28. Average tree densities (trees per acre) by forest type at the different scales ... 105
Table 29. Average number of snags (standing dead trees) per acre at the different scales ... 105
Table 30. Average number of downed logs larger than 12 inches in midpoint diameter per acre at the different scales ... 105
Table 31. Potential threatened and endangered species for Bernalillo and Torrance Counties (species highlighted in gray will be considered in more detail) ... 117
Table 32. Sensitive species considered but not evaluated ... 118
Table 33. Potential sensitive species ... 119
Table 34. Habitat types, MIS, and existing forestwide habitat and population trends ... 120
Table 35. Migratory bird species evaluated in the analysis area ... 122
Table 36. Summary of effects determinations on Mexican spotted owl ... 126
Table 37. Summary of effects determinations to sensitive species by alternative ... 129
Table 38. Summary of alternative A effects on MIS ... 130
Table 39. Summary of alternative B effects on MIS ... 132
Table 40. Summary of alternative C effects on MIS ... 133
Table 41. Summary of effects on migratory birds ... 135
Table 42. David Canyon haul route summary (miles) ... 149
Table 43. North Manzano Division haul route summary (miles) ... 150
Table 44. Maintenance summary (miles) ... 150

Table 45. Transportation cost summary....151
Table 46. Ethnicity by county, state and nation, 2010....155
Table 47. Poverty status by county, state, and nation, 2000 and 2009....155
Table 48. Components of population change for the aggregated reporting area, 2000–2009....156
Table 49. Population change, Bernalillo and Torrance Counties and the State, 2000–2010....156
Table 50. Population trends for land grant communities....156
Table 51. Components of personal income change, 2000–2009 for the aggregated counties (Bernalillo and Torrance)....157
Table 52. Employment by industry 2001–2009 for the aggregated counties (Bernalillo and Torrance)....157
Table 53. TREAT summary table, average annual impacts....159

List of Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
BMP(s)	best management practice(s)
BIA	Bureau of Indian Affairs
c.b.d	crown bulk density
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Chilili	Chilili Land Grant
Cibola NF&Gs	Cibola National Forest and Grasslands
CWPP	community wildfire protection plan
d.b.h.	diameter at breast height
d.r.c.	diameter at root collar
DOD	Department of Defense
DOE	Department of Energy
EA	environmental assessment
EMS	emergency medical services
EPA	Environmental Protection Agency
FRI	Fire return interval
FEMA	Federal Emergency Management Agency
FM	fuel model
forest plan	“Cibola National Forest Land and Resources Management Plan” 1985
FRCC	Fire Regime Condition Class
FONSI	finding of no significant impact
Kirtland	Kirtland Air Force Base
MIS	management indicator species
MSO	Mexican spotted owl
NAAQS	National Ambient Air Quality Standards
NAD	North American Datum
NEPA	National Environmental Policy Act
NF&G	national forest and grasslands
NMCRIS	New Mexico Cultural Resource Information System
NMED	New Mexico Environment Department

NMEMNRD	New Mexico Energy, Minerals and Natural Resources Department
OSHA	Occupational Safety and Health Administration
PFA	post-fledging area
Pueblo	Pueblo of Isleta
RD	ranger district
SHPO	State Historic Preservation Officer
SMZ	streamside management zones
SPA	Southern Pueblo Agency
SWCA	SWCA Environmental Consultants
SWCD	Soil and Water Conservation District
SWPPP	stormwater pollution prevention plan
TPA	trees per acre
USDA-NRCS	U.S. Department of Agriculture, National Resources Conservation Service
USFS	U.S. Forest Service
USGS	United States Geological Service
UTM	Universal Transverse Mercator
VSS	vegetative structural stage
WUI	wildland-urban interface

Chapter 1. Purpose and Need

Document Structure

The Pueblo of Isleta (Pueblo), Chilili Land Grant (Chilili), and Sandia and Mountainair Ranger Districts (RDs) of the Cibola National Forest and Grasslands (Cibola NF&Gs) have prepared this environmental assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and state laws and regulations. This EA discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into several parts:

1. **Introduction**: This section includes information on the history of the project proposal, the purpose and need for the project, and the project partner's proposal for achieving that purpose and need. This section also details how the public was informed of the proposal and how the public responded.
2. **Alternatives, Including the Proposed Actio**n: This section provides a more detailed description of the project partner's proposed action as well as the no action alternative and alternative methods for achieving the stated purpose. These alternatives were developed based on issues raised during scoping. This section also includes proposed mitigation measures and a summary of possible environmental consequences associated with each alternative.
3. **Affected Environment and Environmental Consequences**: This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the no action alternative that provides a baseline for evaluation and comparison of the proposed action that follows and other alternatives.
4. **Consultation and Coordination**: This section provides a list of agencies and persons consulted and/or contacted during development of the EA, as well as those persons who assisted in preparation of this document.
5. **Literature Cited**
6. **Appendix:** Additional information and documentation is provided in the appendix.

Background

Because of the proximity of large-scale fires to reservation boundaries during the 2008 fire season and in response to requests from the Pueblo of Isleta Tribal Council, the Bureau of Indian Affairs (BIA) assisted the Pueblo in making initial contact with concerned land management agencies and owners adjacent to the Pueblo to explore the possibility of conducting mutually beneficial, cross-jurisdictional fuels treatments in the Manzano and Manzanita Mountains. The purpose of these treatments would be to reduce the potential of uncharacteristic wildfires and protect community, cultural, and natural resources at a landscape scale.

Approximate proposed treatment acres by jurisdiction are as follows: 2,000 acres on the Pueblo, 620 acres on Chilili, 5,700 acres on the Mountainair RD, and 2,100 acres on the Sandia RD of the Cibola NF&G. For locations of proposed treatment areas, refer to Figure 1.

In addition to the land managed by the three project partners, numerous small communities adjacent to the project area are rated as high risk in the 2007 "New Mexico Communities at Risk

Assessment Plan" (New Mexico Energy, Minerals and Natural Resources Department (EMNRD) 2007) and would benefit from the fuels reduction treatments being proposed.

According to historic records, there were approximately 250 lightning caused and 100 human-caused fires in the project area between 1970 and 2011. Fire occurrence, an increase in human activity, and high stand densities have created a higher potential for uncharacteristic fire activity potentially affecting the vegetation and residents in nearby communities. The Manzano and Manzanita Mountains have been identified as high wildfire risk within their respective community wildfire protection plans (CWPPs).

Fire no longer plays its natural role in maintaining ecosystem structure and function within the project area. The increase in tree density has reduced the structural diversity of the forest and increased potential for uncharacteristic fire. These kinds of fires, such as those that occurred on the Mountainair RD in 2007 and 2008, as well as on the Sandia RD military withdrawal lands in 2009, can result in the destruction of large areas of forest vegetation. Increased diversity can help reduce the potential for loss of vegetation due to destructive wildfires.

The existing forest conditions throughout the entire project area include closed and continuous canopies, high stocking of trees per acre, high densities of small diameter timber generating ladder fuels, low understory productivity and diversity, and heavy fuel loading on the ground. In addition, the topography in the project area is made up of high elevation, steep, inaccessible terrain that facilitates rapid and intense fire spread creating unsafe conditions for firefighting personnel.

Two CWPPs have been completed in the last 5 years, the "East Mountain Area CWPP" (SWCA Environmental Consultants (SWCA) 2006) and the "Torrance County CWPP" (SWCA 2008). Fire modeling efforts from both CWPPs indicate that the boundary area across Pueblo, Chilili, and Cibola NF&Gs lands are at high to extreme potential for future uncharacteristic wildfires (appendix A). The "East Mountain Area CWPP" (SWCA 2006) shows the area directly east and north of the project area as being classified with high wildfire hazard, with patches of extreme hazard. The "Torrance County CWPP" (SWCA 2008) shows the project area to be classified with extreme and high potential for uncharacteristic fire interspersed with some patches of low and moderate potential for uncharacteristic fire that would represent rock outcropping and bare ground. The most extreme hazard is found along the Pueblo's eastern boundaries with Chilili and the Cibola NF&Gs. The "Torrance County CWPP" (SWCA 2008) recommends enacting the NEPA process to develop a firebreak along the boundary between the Pueblo, Kirtland Air Force Base (Kirtland), and Cibola NF&Gs, extending eastward to include Chilili. This project is given a high priority rating in the "Torrance County CWPP."

As a result of the 2007 and 2008 wildfires (Ojo Peak, Trigo, and Big Springs) and the continued threat to the area, as identified in the CWPPs, the Pueblo initiated a collaborative planning effort with its neighbors to address the remaining high wildfire risk in the region. The parties held a series of meetings to begin scoping discussions, identify potential treatment areas, and develop multiparty support for cross-jurisdictional activities. This collaborative planning effort incorporated a number of additional partners including: the BIA Southern Pueblo Agency (SPA); three Soil and Water Conservation Districts (SWCDs): Claunch-Pinto, Edgewood, and Ciudad; Kirtland; the New Mexico State Forestry Division; the U.S. Geological Survey (USGS); and the New Mexico Wild Turkey Federation (NMWTF). This multijurisdictional planning effort, funded by the Collaborative Forest Restoration Program (CFRP), requires coordination and cooperation

among Federal, tribal, and private landowners. This multijurisdictional planning process is further supported by the Tribal Forest Protection Act of 2004.

In addition to ongoing planning efforts, all parties have been engaged in on-the-ground treatments in and adjacent to the project area. The Pueblo completed 420 acres of firebreak along the Pueblo and U.S. Forest Service (USFS) eastern boundary in June through October 2008. The firebreak work followed BIA NEPA guidelines and the "Isleta Pueblo Fire Management Plan" (Ecosystem Management, Inc. (EMI) 2005). The firebreak project was funded by the Pueblo.

Chilili received CFRP funding in 2008 to complete the appropriate environmental compliance for 269 acres of piñon-juniper and ponderosa pine (*Pinus ponderosa*) forest that borders the "land-locked" USFS portion of the project area. Chilili were successful in securing 2010 CFRP funding to carry out implementation of treatment actions for this project throughout the summer and fall of 2010.

Much of the active forest management on the Cibola NF&Gs portion of the project area has occurred in the last 10 years under the Thunderbird Ecosystem Management Project, approved in 2004 and ongoing. This management includes approximately 1,400 acres of wildlife habitat improvement comprising meadow restoration, rehabilitation of openings and other structural/nonstructural habitat improvement, approximately 8,400 acres of thinning and selection harvests, implementation of northern goshawk (*Accipiter gentilis*) management guidelines, and fuels management (prescribed burning, burning of piles, rearrangement of fuels, etc.) on an estimated 10,000 acres. Wildfire activity during the last 10 years has also affected approximately 16,700 acres within the Ecosystem Management Area. The remaining Thunderbird Ecosystem Management Project area was implemented in 2012. These activities primarily involve thinning and group selection treatments favoring habitat improvement for the northern goshawk.

Since May 2008, 11 project partners have committed their time and resources to this multi-jurisdictional project engaging in project scoping and resource analysis. The three jurisdictions managing land in the project area have conducted stand exams, cultural resources surveys, and biological indicator measurements within their portions of the project area. The USFS is the lead agency in accordance §1508.16 of the Council on Environmental Quality (CEQ) NEPA regulations. The Pueblo, Chilili, and BIA are cooperating agencies in accordance with §1508.5 CEQ NEPA regulations.

The Project Area

The Pueblo is a federally recognized tribe located in New Mexico's Middle Rio Grande valley, south of Albuquerque. The Pueblo encompasses approximately 211,890 acres, including a portion of the East Mountain area, and is located adjacent to lands under jurisdiction of multiple land management agencies. The Pueblo portion of the project area encompasses 2,000 acres. The legal description of the Pueblo portion of the project area is Section 1, Township 7 North, Range 5 East; Sections 1, 2, 11–13, and 35, Township 8 North, Range 5 East; and Sections 4–9, 16, 18, 20, 21, and 28–32, Township 8 North, Range 6 East. The project area is presented in Figure 1.

Chilili is located on the Pueblo's eastern border, with a portion of USFS lands "locked" between the Pueblo and Chilili. The project area encompasses 613 acres of Chilili land. The legal description of the Chilili portion of the project area is Chilili Land Grant.

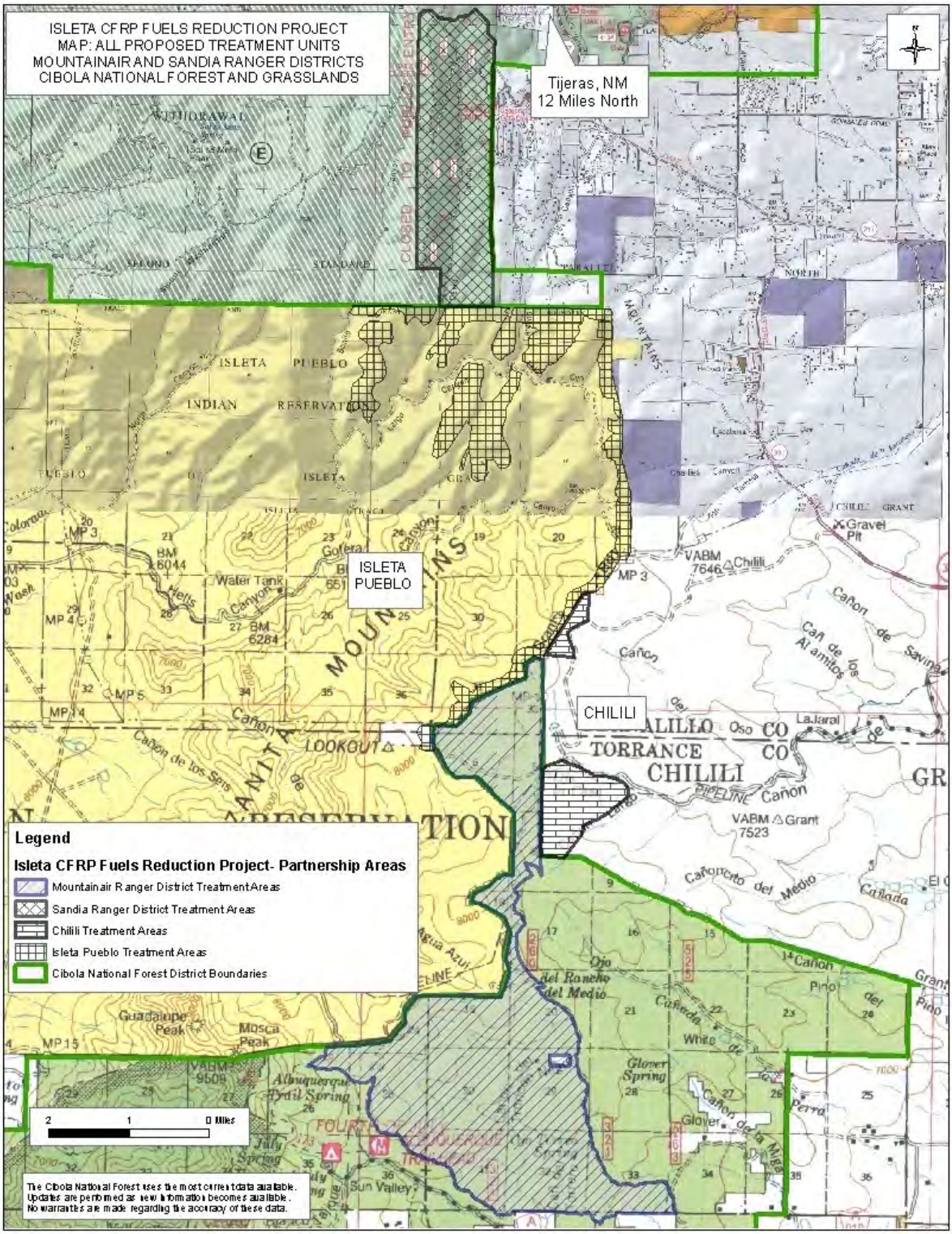

Figure 1. Project location (Source: Cibola National Forest 2011)

The Cibola NF&Gs portion of the project area is split between the Mountainair and Sandia RDs. The Mountainair RD portion of the project area is located in the northern portion of the Manzano Mountains and begins directly south of the Pueblo and west of Chilili. The legal description of the Mountainair RD portion of the project area is Sections 24 and 25, Township 7 North, Range 5 East; Sections 5, 6, 8, 18–20, 29, and 31–33, Township 7 North, Range 6 East; and Section 32, Township 8 North, Range 6 East. This area is located outside the Manzano Mountain Wilderness. This portion of the proposed project lies within Management Areas 11 and 15 as defined by the 1985 "Cibola National Forest Land and Resources Management Plan" (forest plan, pages 140–173).

The Sandia RD portion of the project area is located in David Canyon and begins directly west of the Tranquillo Pines subdivision located west of New Mexico Highway 337 and extends west to the U.S. Department of Defense Withdrawal Area and south to the Pueblo. The legal description for the project is Sections 6, 24, 25, and 36, Township 9 North, Range 6 East. This area is located outside the Sandia Mountain Wilderness and T'uf Shur Bien Preservation Trust area. This portion of the proposed project lies within Management Area 2 as defined by the forest plan (page 85).

Purpose and Need for Action

Purpose and Need for All Partners

The purpose of the project for all partners is to reduce fuel loadings and structure on lands managed by the Pueblo, Chilili, and the Cibola NF&Gs Sandia and Mountainair RDs. These treatments are needed to reduce the potential of uncharacteristic wildfires that would threaten local communities (as identified in the East Mountain and Torrance County CWPPs), wildlife habitat and other natural and cultural resources in the area, and improve public and firefighter safety.

Existing forest conditions, in all forest types, are described by:

- High tree densities ranging from 4 to 1,288 trees per acre;
- Continuous tree canopies and lack of openings;
- Reduced understory productivity and diversity;
- Fire Regime Condition Class (FRCC) (a classification of the amount of departure from the natural fire regime) of 3, which is characterized as "a significant departure from the natural range of variability and predisposed to a high risk of loss of key ecosystem components" (Hann and Bunnell 2001);
- Low crowning index (the wind speed in miles per hour necessary for a fire that reaches the forest canopy to continue as a crown fire) values meaning a crown fire would remain active even at relatively low wind speeds.

Existing Conditions

Existing Conditions Specific to the Pueblo

The Pueblo project area is approximately 2,000 acres. The following is the breakdown by dominant forest types:

- **Piñon-Juniper Woodland –** Approximately 608.7 acres. Total tree densities (trees greater than 5 inches diameter at root collar (d.r.c.) range from 23.7 to 305.1 trees per acre. Stands have 18.7 to 473.9 trees per acre from 2 to 5 inches d.r.c.. The average basal area (BA) is 114.8 square feet per acre. These areas are primarily even aged, lacking structural diversity, and many units have a thick understory of Gambel oak (*Quercus gambelii*) primarily with stems less than 5 inches d.r.c..
- **Ponderosa Pine –** Approximately 1,236 acres. Total tree densities (trees greater than 5 inches diameter at breast height (d.b.h.)) range from 4.07 to 95.5 trees per acre. Stands have 0.0 to 74.8 trees per acre from 2 to 5 inches d.b.h.. The average BA is 100.5 square feet per acre. These areas are primarily even aged, lacking structural diversity.
- **Mixed Conifer –** There were only two white fir (*Abies concolor*) and one Douglas-fir (*Pseudotsuga menziesii*) trees measured on all plots across the project area that were greater than 5 inches d.b.h.. There is very little regeneration of mixed conifer species. The understory is dominated by Gambel oak.

Existing Conditions Specific to Chilili

The Chilili project area is approximately 620 acres. The following is the breakdown by dominant forest types:

- **Piñon-Juniper Woodland –** Approximately 36.72 acres. Total tree densities (trees greater than 5 inches d.r.c.) range from 27.8 to 102.06 trees per acre. Stands have 51.8 to 64.1 trees per acre from 2 to 5 inches d.r.c.. The average BA is 114.8 square feet per acre. These areas are primarily even aged, lacking structural diversity, and many units have a thick understory of Gambel oak with stems less than 5 inches d.r.c..
- **Ponderosa Pine –** Approximately 572.9 acres. Total tree densities (trees greater than 5 inches d.b.h.) range from 52.6 to 127.1 trees per acre. Stands have 0.0 to 69.0 trees per acre from 2 to 5 inches d.b.h.. The average BA is 100.5 square feet per acre. These areas are primarily even aged, lacking structural diversity.

Existing Conditions Specific to Sandia and Mountainair RDs

Mountainair RD

The Mountainair RD project area is approximately 5,700 acres. Following is the breakdown by dominant forest types based on stand exam data:

- **Piñon-Juniper Woodland –** Approximately 1,000 acres. Total tree densities (trees greater than 5 inches d.r.c.) range from 25 to 888 trees per acre. In addition, stands have an average of 1,890 trees per acre less than 5 inches d.b.h.. Overall, canopy closure is 60 percent. These areas are primarily even aged, lacking structural diversity.
- **Ponderosa Pine –** Approximately 3,500 acres. Total tree densities (trees greater than 5 inches d.b.h.) range from 34 to 1,288 trees per acre. In addition, stands have an average of 1,758 trees per acre less than 5 inches d.b.h.. Overall, canopy closure is 60 percent. These areas are primarily even aged, lacking structural diversity.
- **Oak Woodland –** Approximately 1,100 acres. Total tree densities (trees greater than 5 inches d.r.c.) range from 0 to 656 trees per acre. In addition, stands have an average of

2,503 trees per acre less than 5 inches d.r.c.. Overall, canopy closure is less than 40 percent. These areas are primarily even aged, lacking structural diversity.

- **Mixed Conifer –** Approximately 130 acres. Total tree densities (trees greater than 5 inches d.b.h.) range from 61 to 502 trees per acre. In addition, stands have an average of 2,076 trees per acre less than 5 inches d.b.h.. Overall, canopy closure is 60 percent. These areas are primarily even aged lacking structural diversity.

Sandia RD

The Sandia RD project area is approximately 2,100 acres. Following is the breakdown by dominant forest types based on stand exam data:

- **Piñon-Juniper Woodland –** Approximately 1,600 acres. Total tree densities (trees greater than 5 inches d.r.c.) range from 62 to 537 trees per acre. In addition, stands have an average of 2,294 trees per acre less than 5 inches d.b.h.. Overall, canopy closure is 60 percent. These areas are primarily even aged, lacking structural diversity.
- **Ponderosa Pine –** Approximately 400 acres. Total tree densities (trees greater than 5 inches d.b.h.) range from 109 to 451 trees per acre. In addition, stands have an average of 3,082 trees per acre less than 5 inches d.b.h.. Overall, canopy closure is 60 percent. These areas are primarily even aged, lacking structural diversity.
- **Oak Woodland –** Approximately 60 acres. Total tree densities (trees greater than 5 inches d.r.c.) range from 44 to 47 trees per acre. In addition, stands have an average of 4,146 trees per acre less than 5 inches d.r.c.. Overall, canopy closure is less than 40 percent. These areas are primarily even aged, lacking structural diversity.

The existing condition for all of the dominant forest types on both ranger districts is deficient of trees greater than 16 inches d.b.h. and d.r.c. (based on stand exam data). This project does not propose to cut any trees over this diameter in order to move the area toward the desired condition.

This project complies with Federal, state, and local laws or requirements for the protection of the environment

Proposed Action

The proposed action has been changed since USFS public scoping. Treatments on Kirtland have been removed from the proposed action.

The proposed action for which Federal decisions will be made and for which NEPA is required are:

- Forest Service – application of a series of fuels reduction treatments within delineated units as shown in Figure 1 and described below.
- BIA – dependent upon funding availability, proposes (1) to implement treatments within the projects areas identified on Pueblo lands and/or (2) distribute funds through Public Law 93-638 contracts to the Pueblo for implementation of treatments. The treatments would include prescribed burning, mechanical treatments, biomass utilization, and

chemical and biological applications as defined in the BIA 2006 “Fuels Program Business Management Handbook.”

Many of the proposed activities would be common to all units, regardless of land jurisdiction in order to maintain the landscape-scale approach described in chapter 2. However, some applied treatments would change based on the location of the unit. The proposed action is presented, first, by describing the activities that would be common to all units and then by describing the activities that would occur based on land management agency.

Desired vegetation conditions for the entire project area are those that reduce the potential for active crown fires and provide for public and emergency personnel safety in the event of a wildfire. Within the ponderosa pine and piñon-juniper forest types, the desired condition would be to provide northern goshawk habitat that is consistent with the northern goshawk guidelines (forest plan 1985, pages 71-5 through 71-8.) Overall the desired conditions include:

- Managing for uneven-aged stand conditions for live trees to include tree groups and openings;
- Retaining live reserve trees, snags (2 per acre), large downed logs (3 per acre), and woody debris levels (5–7 tons per acre) throughout ponderosa pine woodland and 10 to 15 tons per acre of woody debris in mixed conifer and spruce-fir forest cover types;
- Managing for old age trees such that as much old forest structure as possible is sustained over time across the landscape;
- Sustaining a mosaic of vegetation densities, age classes, canopy gaps, and species composition across the landscape;
- Maintaining a range of vegetation structural stages (VSS, or growth stages of living trees); treatments would strive to achieve, over time, a VSS distribution of 10 percent VSS 1 (grasses, forbs, and shrubs), 10 percent VSS 2 (seedlings and saplings), 20 percent VSS 3 (young forest), 20 percent VSS 4 (mid-aged forest), 20 percent VSS 5 (mature forest), and 20 percent VSS 6 (old forest) across the landscape;
- Keeping residual trees per acre and canopy cover slightly higher within northern goshawk post-fledgling family areas (PFAs) and dispersal PFAs due to habitat needs compared to foraging areas (lands outside PFAs);
- Maintaining a minimum of 30 to 40 trees per acre in nest areas and a size class distribution of VSS 5 and/or 6;
- Developing and maintaining old growth conditions for USFS lands on 20 percent of the 3,900 ponderosa pine acres (approximately 780 acres) and 20 percent of 2,600 piñon-juniper acres (approximately 520 acres) the desired condition as defined in the forest plan (1985) “Forest Wide Standards and Guidelines” page 66, table “The Minimum Criteria for the Structural Attribute Used to Determine Old Growth.” These areas would be designated during the environmental analysis process;
- Reducing tree spacing for trees that are in groups with interlocking crowns, typically 0.25 to 0.75 acre in size but ranging from a few trees to 2 acres. Scattered individual trees exist between groups. Residual spacing between groups would be irregular and would range from 40 to 80 feet with few, if any, trees in this “rooting zone;” and

- Maintaining temporary openings, for regeneration purposes, up to 4 acres with a maximum width of 200 feet existing on approximately 10 percent of the area. Three to five reserve trees per acre are maintained in these openings. Two large snags and three large logs per acre would exist and five to seven tons of woody debris would be retained.

Figure 2 displays the arrangement of leave groups and rooting zones that would remain after treatment. Not shown are the temporary openings created for regeneration purposes.

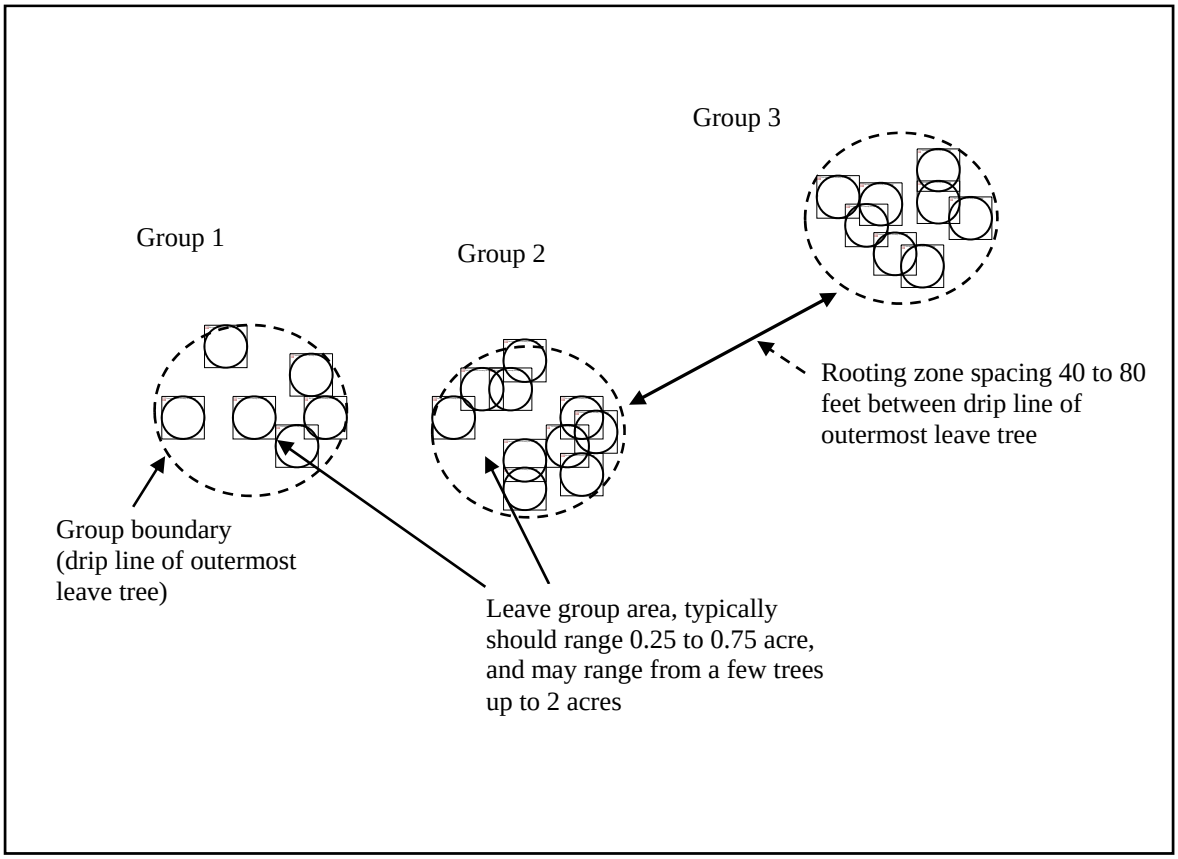

Figure 2. Illustration of desired spatial arrangement of leave groups

Mixed Conifer – Within the mixed conifer forest type, the desired condition would be to maintain the existing condition to meet threshold conditions for Mexican spotted owl (*Strix occidentalis lucida*) (MSO) restricted habitat as stated in the forest plan (pages 71-2 to 71-3).

Oak Woodland – Within the oak woodland forest type, the desired condition would be to develop and maintain a variety of wildlife habitat by having the area in the following seral stage: (1) 35 percent of the acreage in an early seral stage that would provide browse and forage; (2) 35 percent in a mid-seral stage that would provide browse, forage, and cover; and (3) 30 percent in a late seral stage that would provide mast, forage, and cavities for cavity nesting birds.

The existing condition for both ponderosa pine and piñon-juniper woodland is deficient of trees greater than 16 inches d.b.h. and d.r.c.. This project proposes to not cut any trees over this diameter to assist in moving the area to desired condition.

In addition to the northern goshawk desired conditions, all land jurisdictions would also treat selected trees with chain saws, mastication, or treatment using other mechanical methods; Pueblo, Chilili, and contract crews would implement treatments. Woody material, not removed for firewood may be removed by permit or other authorization. Hand piles would average 10 feet in diameter and have an average height of 5 feet. Piles would be placed away from remaining trees to minimize scorch damage and outside drainages to mitigate against soil erosion and water quality effects. Piles would be burned 1 to 2 years after the initial treatment. Along drainage edges, scattered slash would be used to promote grass production, provide soil stability, and minimize erosion. Three slash piles per acre would be retained within the firebreak to provide wildlife cover.

Decision Framework

Given the purpose and need, the deciding official reviews the environmental consequences of the proposed action and the other alternatives in order to make the following decisions:

- To implement the proposed action;
- To implement an alternative action; or
- To take no action.

Public Involvement

On September 9, 2011, a scoping letter and project location map was mailed to approximately 1,500 different agencies, businesses, individuals, tribes, and organizations interested in or determined to be potentially impacted by the proposed project. Comments were accepted through October 10, 2011. In addition, the proposal was first listed in the “Schedule of Proposed Actions” on October 1, 2010. See the project record for a list of comments received.

Comments received during scoping were used to develop a list of issues and these issues helped guide the development of alternative C.

The Cibola NF&Gs currently consults with 13 Native American tribes and one Navajo Chapter that may have used or may continue to use Sandia and/or Mountainair RD lands for traditional cultural or religious activities, and that might attach religious or cultural significance to properties within the Sandia, Manzanita, and Manzano Mountains. These include the Pueblos of Acoma, Zuni, Isleta, Sandia, Santo Domingo, Santa Ana, San Felipe, San Ildefonso, Cochiti, Zia, and Jemez, as well as the Mescalero Apache tribe, the Navajo Nation, and the To’hajiilee Navajo Chapter. At the time the tribes were first introduced to the project in August 2008, the Cibola NF&Gs was still consulting with the Jicarilla Apache Nation concerning projects on Sandia RD land.

Tribal consultation pursuant to Section 106 of the National Historic Preservation Act was initiated in August 2008. The project was included in the Cibola NF&Gs’ annual consultation letter highlighting projects proposed for planning or implementation. Followup consultation meetings to discuss the projects were held in the fall of 2008 with the Pueblos of Sandia, Isleta, Acoma, Zuni, and Jemez, and the Navajo Nation. During these meetings, the Pueblo of Isleta indicated its support for the project, as did the Pueblo of Sandia, provided that the archaeological resources are protected during project implementation. None of the other tribes expressed any interest or

concern about the project. Consultation pursuant to NEPA was initiated in September 2011 when the Cibola NF&Gs mailed the 13 tribes a scoping letter. The Cibola NF&Gs did not receive any tribal responses. To date, no traditional cultural properties have been identified within the proposed project areas. The project would have no effect on sites of traditional cultural or religious significance

Issues

Through scoping, the interdisciplinary team identified the following issue:

- The establishment of rooting zones as described in the proposed action might reduce the quality of northern goshawk habitat and be inconsistent with Cibola forest plan direction for goshawk stand structure.

Chapter 2. Alternatives, Including the Proposed Action

This section describes the alternatives that have been considered in the development of this EA. The no action alternative must always be considered in the EA process. An EA often addresses two or more “action” alternatives; in this case one action alternative would result in the restoration of the project area.

Alternative A – No Action

Under the no action alternative, the current level of management would continue to guide management of the project area. No treatments would be implemented to address existing vegetation or fuel concerns. Suppression of wildfire would continue.

The no action alternative would fail to address the existing conditions that favor uncharacteristic wildfires.

Alternative B – The Proposed Action

The proposed action has been changed since USFS public scoping. Following are the changes:

1. Treatments on Kirtland have been removed from the proposed action.
2. The term “risk” has been changed to “potential” in the purpose and need as originally scoped in referring to “reducing the potential of uncharacteristic wildfire.”
3. The first sentence in the scoped purpose and need has changed to “the purpose of the project for all partners is to reduce fuel loadings and structure on lands managed by the Pueblo, Chilili, and the Cibola NF&Gs Sandia and Mountainair RDs” from “The purpose of the project for all partners is to complete a series of fuel reduction treatments on lands managed by the Pueblo, Chilili, and the Cibola NF&Gs Sandia and Mountainair RDs.”
4. The desired fuel loading for mixed conifer areas has been changed from 5 to 7 tons per acre to 10 to 15 tons per acre to be consistent with forest plan direction.
5. Under the “Transportation and Wood Hauling” section, the following were added: the Map 3 Haul Zone map was revised to display more existing roads, a “Roads Conditions Pre and Post Implementation” section was added with a high level of detail of the existing authorized and unauthorized roads, and map 4: NFS Road Designations Post Treatment was added that displays how the road would be post treatment.
6. A site-specific forest plan amendment for this project to the “Cibola National Forest Land and Resource Management Plan” was added that explicitly provides for the establishment and retention of rooting zones on Cibola National Forest treatment areas.

The Pueblo, Chilili, and Cibola NF&Gs would apply a series of fuels reduction treatments within delineated units as shown in Figure 3. Many of the proposed activities would be common to all units, regardless of land jurisdiction in order to maintain the landscape-scale approach described below. However, some applied treatments would change based on the location of the unit. The proposed action is presented first, by describing the activities that would be common to all units, and then by describing the activities that would occur based on land management agency.

In order to achieve fuel reduction objectives while complimenting the northern goshawk desired conditions, each land management jurisdiction would also implement their own treatments, as described below.

Alternative C

This alternative provides for treatments on the Cibola National Forest and Grasslands ranger districts of the proposed action but is modified to not include rooting zones. Alternative C was developed due to scoping comments received during the public scoping comment period initiated on October 10, 2011. This alternative is described in more detail in this chapter after the description of the "Proposed Action Specific to the Cibola NF&Gs" section below.

Proposed Action Specific to Isleta Pueblo

There are 11 treatment units located on Pueblo lands. The exterior units, located along common boundaries with Chilili and the Cibola NF&Gs are known as the Bonito to David West, Bonito to David East, David to Carolino, Carolino Northeast, Northeast Corner to Tribal Road (TR) 207, and TR 207 to Fire Tower Road units. The interior units consist of the Carolino, David Canyon East, David Canyon West, Area 207/208, and Bonito units. Table 1 provides a summary of the size and location of the Pueblo treatment units. Refer to figure 3 for the map of these treatment units.

Table 1. Summary of Pueblo treatment units

Unit Name	Size (Acres)	Location
Bonito to David West	29.4	Exterior unit sharing a boundary with Kirtland
Bonito to David East	51.4	Exterior unit sharing a boundary with Kirtland
David to Carolino	96.8	Exterior unit sharing a boundary with Cibola NF&Gs (Sandia RD)
Carolino Northeast	138.7	Exterior unit sharing a boundary with private land
Northeast Corner to TR 207	208.9	Exterior unit sharing a boundary with private land
TR 207 to Fire Tower Road	399.1	Exterior unit sharing a boundary with Chilili and Cibola NF&Gs (Mountainair RD)
Carolino	181.2	Interior unit directly south of Carolino NE unit
David Canyon East	64.6	Interior unit directly south of the boundary between the David to Carolino and Carolino Northeast exterior units
David Canyon West	67.5	Interior unit directly south of the David to Carolino exterior unit
Area 207/208	507.7	Interior unit located south of TR 60, in the middle to the Pueblo treatment area
Bonito	218.7	Interior unit located on the west side of Pueblo treatment area, just south of the Bonito to David West exterior unit
Total	**1,964.0**	

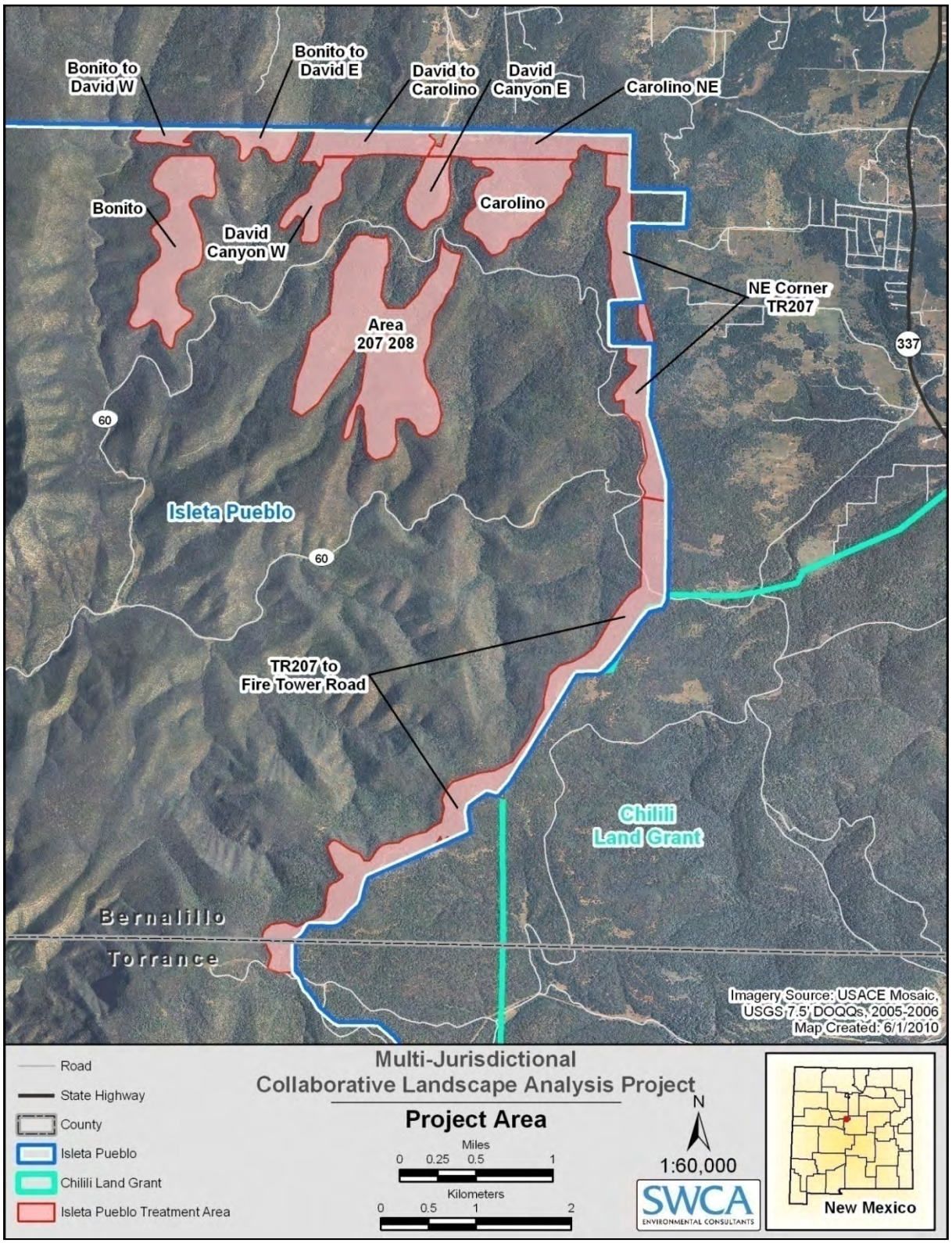

Figure 3. Pueblo treatment units

The existing condition for both ponderosa pine and piñon-juniper woodland is deficient of trees greater than 16 inches d.b.h. and d.r.c.. This project proposes to not cut any trees over this diameter to assist in moving the area to desired condition.

Treatment goals for all Pueblo units include increasing the canopy height by 35–40 percent and decreasing the fuel loading by 80–85 percent. Since thinning alone would only remove trees that act as ladder fuels, prescribed fire would be used in combination with thinning in some units in order to alter the surface fuels that have been found to heavily influence the incidence of high severity wildfire (Omi and Martinson 2007). Herbicides, including Roundup, Garlon 3A, and Garlon 4, would also be used by the Pueblo throughout the project area in order to control resprouts from treated Gambel oak, minimizing the need for repeated thinning treatment. No restricted herbicides would be used on the project.

Piñon-Juniper Treatments

Treatments in the piñon-juniper community type would follow an uneven-aged (where trees are found in three or more distinct age classes, either mixed or in small groups) group selection silviculture system (where trees are removed and new age classes are established in small groups; also, where regeneration, growth, and yield are regulated in an aggregation of groups). Within groups, designated trees would be thinned from below in order to increase the canopy base height by 30–40 percent. Spacing of groups would be irregular, and openings between groups would vary in size. Alligator juniper (Juniperus deppeana) would be retained throughout. Approximately 10 percent of this forest type would be converted to temporary openings to encourage natural regeneration. Ponderosa pine, white fir, and Douglas-fir occurring in piñon-juniper woodlands would be maintained as groups or stringers. Piñon and juniper species 16 inches d.r.c. and larger would be retained.

Ponderosa Pine Treatments

Treatments in the ponderosa pine community type would follow an uneven-aged group selection system. Within groups, designated trees would be thinned from below in order to increase the canopy base height by 30–40 percent. Spacing of groups would be irregular and openings between groups would vary in size. Alligator juniper would be retained throughout. Approximately 10 percent of this forest type would be converted to temporary openings to encourage natural regeneration. On average at least two snags per acre would be retained for wildlife habitat. Ponderosa pine, Douglas-fir, and white fir that are 16 inches d.b.h. and larger would be retained.

Exterior Units

The Pueblo would prioritize treatment in the exterior units because these units would serve as firebreaks to protect from fire movement across boundaries. Thinning and pile burning would be used to treat the exterior units where reduction of hazardous fuels is a primary objective and where the threat of fire spread across landownership boundaries would prevent the use of a broadcast burn. The Pueblo proposes an average target basal area of 50 square feet per acre for the exterior treatment units.

Interior Units

The interior units would be treated by tribal chain saw crews, and the treated timber would be removed by tribal members for firewood either through the established permitting process at staging areas established at the site or at a Pueblo wood yard for tribal member use only. Oak islands would be created within the interior treatment units in order to provide wildlife habitat for deer (*Cervidae*), turkey (*Meleagris* sp.), and elk (*Cervus canadensis*). As with the exterior treatment units, the treatment goals for the interior units include increasing the canopy height by 35–40 percent and decreasing the fuel loading by 80–85 percent. Areas with a moderate to high incidence of dwarf mistletoe would be treated with stand-specific prescriptions to reduce long-term effects of the pathogen. The Pueblo proposes an average target basal area of 60 square feet per acre for the interior units.

Prescribed Burning

Following thinning treatments on interior units, a broadcast burn would be used to raise crown base height (c.b.h.) of residual trees and clear out undergrowth and remaining slash. Prescribed burning would proceed only after exterior fuel break units are cleared and provide secure firebreaks with adequate spacing to act as suppression areas to prevent fire spread across jurisdictional boundaries. All prescribed burning would be conducted only with an approved burn plan and concurrence of an approved tribal resolution as outlined in the “Pueblo Fire Management Plan” (2005). Prescribed fire implementation would be conducted in accordance with guidance issued in the local “Geographic and National Mobilization Guides” for the various preparedness levels. At National Level IV, concurrence by the regional fire management officer (FMO) must be obtained before implementing a prescribed fire. At National Preparedness Level V, a representative from the BIA, Branch of Fire Management must concur with the regional FMO’s approval of operations. At lower national levels of preparedness, the SPA Agency FMO has authority after coordinating with the SPA Superintendent, the BIA Southwest Regional Area Forester, and Pueblo tribal officials. Prescribed burning would be carried out by BIA fire crews in association with trained Pueblo crew members. Burn crews would strictly adhere to BIA and Pueblo safety policies and burn prescriptions established by a qualified burn boss.

Meadow Areas

Five meadow areas have been identified along the common boundary between the Pueblo and Chilili (Figure 4). These meadows would be expanded to historic boundaries by thinning and removal of piñon-juniper.

Material Hauling

Hauling of forest products associated with hazardous fuels reduction projects on neighboring properties in the Manzano Mountains would be allowed over Tribal Roads 12, 206, 207, and 210 by written agreement and authorization of the Tribal Administration in coordination with the BIA. Appropriate best management practices (BMPs) and maintenance requirements would be incorporated in the agreement to minimize and/or prevent erosion from road surface runoff and stream crossings.

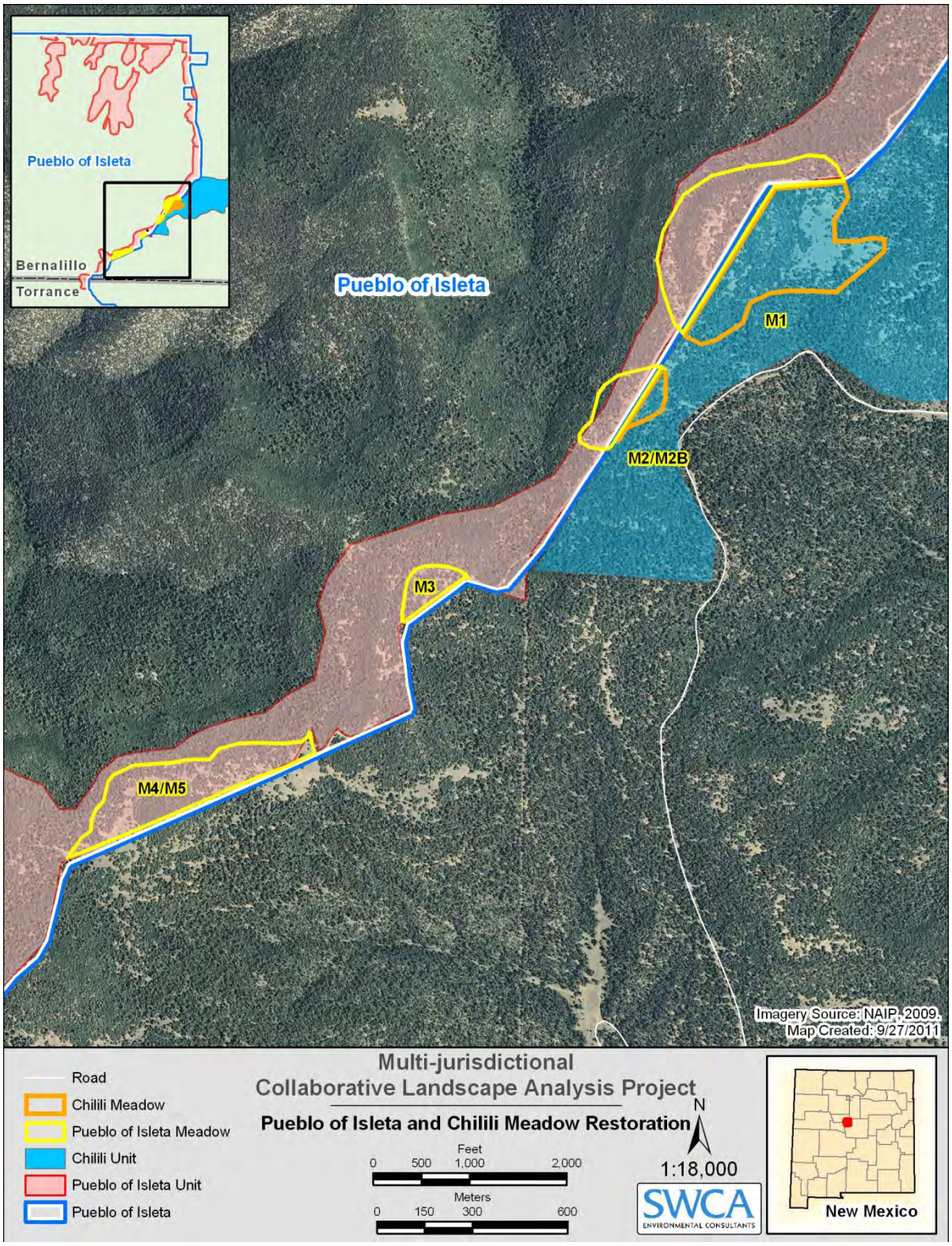

Figure 4. Pueblo and Chilili meadow restoration areas

Herbicide Application

After Gambel oak is removed from some portions of the project area, herbicides would be used to control resprouting and minimize the introduction of undesirable vegetation such as kochia (*Kochia scoporia*), Russian thistle (*Salsola kali*), and cheatgrass (*Bromus tectorum*). The use of herbicides within this project area is considered integral to the long-term success of the restoration efforts, especially since thick Gambel oak understory contributes significantly to the fire hazard in the project area.

The herbicides to be used under the proposed action would be Garlon 3A, Garlon 4, and Roundup. The active ingredient of Garlon 3A and Garlon 4 is triclopyr. The active ingredient of Roundup is glyphosate. Herbicide treatments would follow Pueblo and BIA procedures. Herbicides would be applied using low-pressure techniques with a backpack sprayer or spray bottle, wick (wiped on), or wand (sprayed on). Herbicides can be applied to a tree's circumference of the trunk on the intact bark (basal bark application), to cuts in the trunk or stem (frill), to cut stems and stumps (cut stump), or injected into the inner bark. Aerial applications or broadcast applications are not proposed. All herbicide treatments would be supervised by licensed applicators trained in BMPs to minimize drift to nontarget species and avoid mishandling chemicals (table 2). Chemical treatment would include the application of registered herbicides according to their label instructions and according to Pueblo of Isleta, Department of Interior, BIA and Federal insecticide, fungicide, and rodenticide act requirements.

Table 2. BMPs for herbicide use

Resource	Herbicide BMPs
Vegetation, Including Wetland and Riparian Areas	• Survey all proposed action areas within potential threatened, endangered, or proposed plant habitat to determine presence/absence of the species. • Establish site-specific no activity buffers in areas of occupied habitat within the proposed project area. To protect occupied habitat, treatment activities would not occur within these buffers. • Collect baseline information on the existing condition of threatened, endangered, or proposed plant species and their habitats in the proposed project area. • Assess the need for site revegetation post treatment to minimize the opportunity for noxious weed invasion and establishment. • Review, understand, and conform to the "Environmental Hazards" section on herbicide labels. • Establish suitable buffer zones between treatment sites and populations (confirmed or suspected) of plant species to avoid negative effects to threatened, endangered, and proposed plant species from offsite drift, surface runoff, and/or wind erosion, and site-specific precautions should be taken. • Follow all instructions and labels to avoid spill. Conduct manual spot treatment of undesirable vegetation within buffer zones if it is determined by biologists that this method of herbicide application would not pose risks to threatened, endangered, or proposed plant species in the area. • Use a low boom or wand application during ground applications of glyphosate and triclopyr acid within 0.5 mile of terrestrial threatened, endangered, or proposed plant species. • Do not apply by ground methods at the typical application rate for glyphosate within 50 feet of threatened, endangered, or proposed plant species. • Do not apply by ground methods at the typical application rate for triclopyr within 300 feet of threatened, endangered, or proposed plant species. • Do not apply by ground methods at a maximum application rate for glyphosate of 300 feet of terrestrial threatened, endangered, or proposed plant species. • In areas where wind erosion is likely, do not apply triclopyr within 0.5 mile of threatened, endangered, or proposed plant species.

Resource	Herbicide BMPs
Terrestrial Organisms, Including Wildlife and Special Status Species	• Conduct surveys prior to vegetation treatments within potential or suitable habitat. Where surveys detect birds, do not broadcast spray herbicides. • Do not conduct vegetation treatments within 0.5 mile (or further if deemed necessary) of known nest sites or unsurveyed suitable habitat during the breeding season. • Adjust spatial and temporal scales of treatments to avoid treating all suitable habitat in any given year. • Following treatments, replant or reseed treated areas with native species, if needed. • Closely follow all application instructions and use restrictions on herbicide labels; in wetland habitats use only those herbicides that are approved for use in wetlands. • To minimize risks to terrestrial wildlife, do not exceed the typical application rate for herbicides. • Where practical, limit glyphosate to spot applications in rangeland and wildlife habitat areas to avoid contamination of wildlife food items.
Human Health and Safety	• Use the typical application rate, where feasible, when applying triclopyr to reduce risk to occupational and public receptors. • Wear personal protective equipment, such as long-sleeved shirts, long pants, protective eyewear, shoes plus socks, and chemical-resistant gloves. • Post signs of treated areas at main access points to notify the public of temporary restricted access for 48 hours.
Recreation	• Post signs of treated areas at main access points to notify the public of temporary restricted access for 48 hours.
Cultural Resources	• Do not exceed typical application rates when applying triclopyr in known traditional use areas.

To minimize impacts to nesting birds and surrounding native vegetation, mechanical and herbicide treatment activities would occur in the fall and winter months. Treatments to occur outside of this time period would require a biologist to conduct a nesting bird survey prior to treatment and, if no nesting birds are found, treatments could be conducted during the nesting season. Herbicide applications on the cut stumps would be applied to the cut surface of individual trees within minutes after saw crews cut the larger diameter trees. Root sprouts emerging following treatments would be treated using basal bark treatments the following fall or winter after the initial treatment.

Proposed Action Specific to Chilili

Chilili is currently implementing fuels reduction treatments on a 269-acre NEPA cleared parcel along the common boundary with the Mountainair RD of the Cibola NF&Gs. For this EA, the proposed Chilili treatment area covers approximately 620 acres and is broken into two units, one 100-acre unit north of the existing treatment area and one 520-acre unit south of the existing treatment area (figure 5). Chilili would treat the north and south unit using chain saw crews.

Both units of the project area comprise the ponderosa pine community type and would be treated to meet the northern goshawk desired conditions with treatments following an uneven-aged group selection system. Within groups, designated trees would be thinned from below, spacing of groups would be irregular, and openings between groups would vary in size. Alligator juniper would be retained throughout. Thinning would occur to an average target basal area of 60 square feet per acre. On average at least two snags per acre would be retained for wildlife habitat. Ponderosa pine, Douglas-fir, and white fir that are 16 inches d.b.h. and larger would be retained.

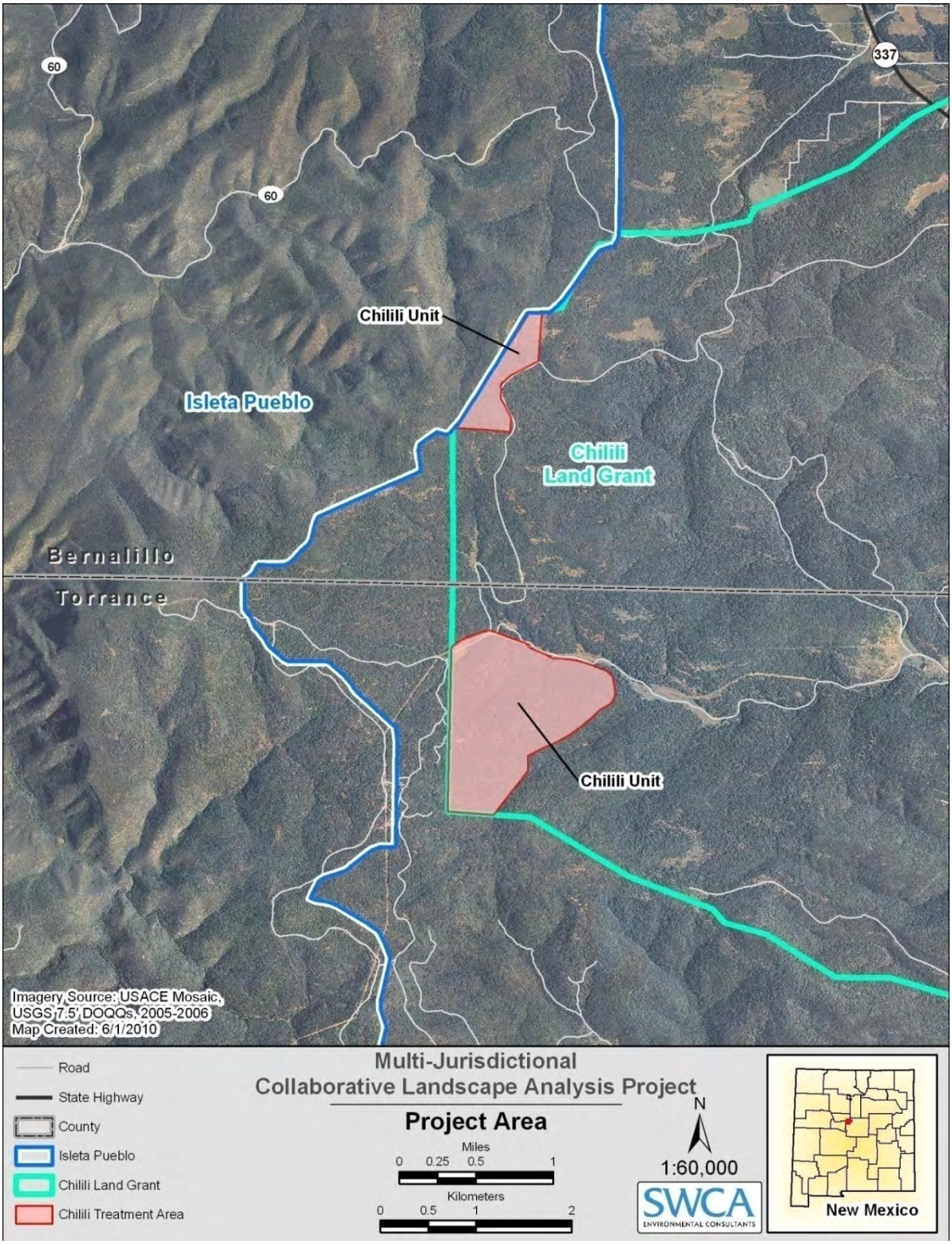

Figure 5. Chilili treatment units

Along the border between Chilili and other land jurisdictions (Cibola NF&Gs and the Pueblo), 20-foot firebreaks would be established in order to protect from fire movement across boundaries and to allow for firefighter access. Along the common boundary with the Pueblo, Chilili would also treat the five meadow areas by thinning and removal of piñon-juniper. Once the hand thinning crews complete the treatment of the northern unit, Chilili would followup with a prescribed broadcast burn on the 620 acres. The burn would use Chilili crews as part of a wider cross-jurisdictional effort.

Proposed Action Specific to Cibola NF&Gs

The existing condition for both ponderosa pine and piñon-juniper woodland is deficient of trees greater than 16 inches d.b.h. and d.r.c.. This project proposes to not cut any trees over this diameter to assist in moving the area to desired condition.

To move these stands toward the desired condition as described above, an uneven-aged silvicultural system would be used. Specifically, a “group selection” treatment (where trees are removed and new age classes are established in small groups; also, where regeneration, growth, and yield are regulated in an aggregation of groups) would be implemented in all forest types except for the oak woodland and mixed conifer forest types.

Piñon-Juniper Treatments

Groups of trees would be established with interlocking crowns, typically 0.25–0.75 acre in size but ranging from a few trees to 2 acres. Spacing of groups would be irregular and openings between groups would vary from 40 to 80 feet with few, if any, trees in this area, which is referred to as the “rooting zone.” Temporary openings would be created for regeneration purposes, up to 4 acres with a maximum width of 200 feet on approximately 10 percent of the area. Three to five reserve trees per acre would be maintained in these openings. Temporary openings would be created away from roads and trails to maintain visual corridors and provide wildlife security. This would create a forest structure as illustrated in Figure 2 above.

Within groups, designated trees would be thinned from below to a residual of 55–92 trees per acre on lands outside PFAs, 119–138 trees per acre in PFAs, and 60–100 trees per acre in nesting areas. All large alligator juniper is preferred for retention. The relative abundance of piñon-juniper within the groups would be maintained so that one species is not favored above another for removal. For example, if the area originally had a ratio of 70 percent piñon pine (*Pinus edulis*) and 30 percent juniper (*Juniperus* sp.), the same ratio would be retained after thinning.

Ponderosa pine, white fir, and Douglas-fir occurring in piñon-juniper woodlands would be maintained as groups or stringers as appropriate to meet wildlife habitat improvement objectives. On average at least two snags and 5 to 7 tons of downed woody debris per acre (including large downed logs) would be retained. Thinning would be accomplished by hand, with mechanized equipment and/or mastication. Commercial contracts and personal use firewood permits would be offered to remove the wood.

Ponderosa Pine Treatments

Groups would be established in the same manner as described in the “Piñon-Juniper Treatments” section.

Within groups, designated trees would be thinned from below to a residual of 73–110 trees per acre on lands outside PFAs, 119–138 trees per acre in PFAs, and a minimum of 30–40 trees per acre in nesting areas. All large alligator juniper is preferred for retention. On average at least two snags and 5 to 7 tons of downed woody debris per acre (including three large logs per acre) would be retained.

Thinning would be accomplished by mechanized harvesting equipment, by hand, and/or mastication. Commercial contracts and personal use firewood permits would be offered to remove the wood.

Oak Woodland Treatments

Prescribed fire would be used exclusively in these areas to develop and maintain a variety of wildlife food and cover habitat by managing the area for the following: (1) 35 percent of the acreage in an early seral stage that would provide browse and forage; (2) 35 percent in a mid-seral stage that would provide browse, forage, and cover; and (3) 30 percent in a late seral stage that would provide mast, forage, and cavities for cavity-nesting birds.

Mixed Conifer Treatments

An analysis was conducted to determine if MSO threshold conditions existed at a district-wide scale and it was determined that both ranger districts were deficient in these conditions. Therefore, all existing tree densities and canopy cover would be maintained in mixed conifer areas within this project. Prescribed fire would be used exclusively in these areas to maintain 10 to 15 tons per acre fuel loading.

Areas Over 40 Percent Slope

Dispersed throughout the project area is approximately 35 acres over 40 percent slope. These areas would not be treated mechanically and would be treated by hand as required by the Cibola forest plan. Tree densities would be reduced by thinning designated trees onsite and prescribe burning or exclusively by prescribed burning.

Slash Disposal

Activity fuel such as bole wood, slash, hand piles, and mastication grindings would be treated as needed to meet fuels reduction objectives through prescribed burning and/or pile burning when conditions allow for safe and effective burning. All prescribed burning would comply with New Mexico State Air Quality Regulations and would be approved through appropriate permitting processes.

Maintenance

Maintenance would be implemented when monitoring data show that the area is beginning to exceed its threshold for desired condition. The treatment methods described above would continue to be used as needed to maintain the desired conditions. Prescribed fire would be the primary tool used to reduce tree densities and undesirable tree regeneration and promote grasses and forbs.

Table 3 describes proposed treatments to meet the desired condition for each forest type based on soil conditions, location, and slope. For location of treatment types as described in the table, refer to figure 6.

Table 3. Proposed treatments to meet the desired condition for each forest type based on soil conditions, location, and slope

Treatment Type	Cutting Methods How will excess trees be cut or otherwise handled?	Tree Removal Will cut trees be removed from the areas?	Slash Treatment What happens to tree tops and other material that remains on the site after cutting?
1 – Satisfactory soils, less than 40 percent slope; approximate acres by forest type: ponderosa pine 1,710 and piñon-juniper woodlands 1,450.	Mechanical mastication	None where mastication occurs.	Masticated material would be spread onsite to a depth of 2 to 4 inches, other cut material lopped and scattered or hand piled; broadcast burning and/or pile burning when management prescription conditions are met.
	Chain saws – contract or USFS Mechanized feller	Commercial firewood, service contracts, and/or timber sale contracts; where good access exists, material removed under permits for personal use firewood.	
2 - Impaired soils with less than 40 percent slope and satisfactory soils with severe erosion hazard rating; approximate acres by forest type: ponderosa pine 2,150 and piñon-juniper woodlands 1,110.	Mechanical mastication	None where mastication occurs.	Masticated material would be spread onsite to a depth of 2 to 4 inches, other cut material lopped and scattered or hand piled; broadcast burning and/or pile burning when management prescription conditions are met.
	Chain saws – contract or USFS Mechanized feller	Commercial firewood, service contracts, and/or timber sale contracts; personal use firewood removal along authorized NFS roads—no cross-country travel permitted.	
3 – Oak woodland 1,120 acres	None - these areas would be prescribe burned only.	None	None
4 – All areas with greater than 40 percent slope; approximate acres by forest type: ponderosa pine 5, piñon-juniper woodlands 15, and mixed conifer 15.	Only hand cutting with chain saws; some areas would not be cut, such as the mixed conifer acres.	None	Cut material lopped and scattered or hand piled; broadcast burning and/or pile burning when management prescription conditions are met.
5 – Mixed conifer less than 40 percent slope set aside as threshold conditions for MSO restricted habitat.	None - these areas would be prescribe burned only.	None	None

Receipts generated from the sale of the harvested material and firewood permits would be retained by the USFS under authority in the Knutson-Vandenberg Act of 1930. These receipts would be used to pay contractors and/or USFS personnel within 1 to 2 years after the project is completed. The rehabilitation activities could include: (1) decommissioning of non-system roads (unauthorized roads) within the project area by ripping compacted soils, installing erosion control features, seeding the impacted areas with native grasses, and using slash to cover impacted

corridors to 80 percent coverage; (2) rehabilitating cross-country travel corridors by ripping compacted soils, installing erosion control features, seeding the impacted areas with native grasses, and using slash to cover impacted corridors to 80 percent coverage; (3) hand piling slash where needed to provide for manageable prescribed fire conditions; (4) lopping and scattering slash not collected through firewood gathering to 24 inches maximum height; and (5) conducting thinning within the project area.

Connected Actions

This project on the Sandia and Mountain RDs has been divided into three unique geographic areas: (1) David Canyon on the Sandia RD, (2) the Dog Head on the Mountainair RD, and (3) Northern Manzano on the Mountain RD. The rationale for recognizing the three unique geographic areas is to develop a defined implementation strategy for (1) mitigation for incidental take of migratory birds and (2) the designation of distinct haul zones, transportation routes, and proposed actions for maintenance and decommissioning of roads.

Migratory Bird Recommendations

This project proposes to develop implementation phases for the three geographic areas mentioned above so that fuel reduction activities and wood product removal can occur while providing mitigation for the incidental take of migratory birds. The recommended Cibola NF&Gs migratory bird timing restriction for no management activity is from April 1 to July 31. This timing restriction would be implemented annually on two-thirds of the project area, while activity would occur throughout the year on the remaining third.

Communities adjacent to this project area are heavily dependent on forest products gathered from the Cibola NF&Gs for subsistence and livelihood. Due to the high demand for personal use firewood and annual operating restrictions through periods of shutdown caused by weather, the Cibola NF&Gs recognizes there is a need to have areas for these communities to work in throughout the year. In these areas it is recognized that unintentional take of migratory birds could occur. To minimize and mitigate this unintentional take, the Cibola NF&Gs proposes to divide each geographic area into three implementation phases. Mechanical management activities would occur annually only within one implementation phase for each geographic area during the migratory bird timing restriction.

For location of implementation phases as described above, refer to Figure 7.

Wood Hauling

No new roads or temporary roads would be constructed for this project. All wood products generated from this project would be removed on National Forest System (NFS) roads or on existing non-NFS roads and trails. The road decommissioning would be coordinated with the implementation phase approach described in the migratory bird recommendations section above.

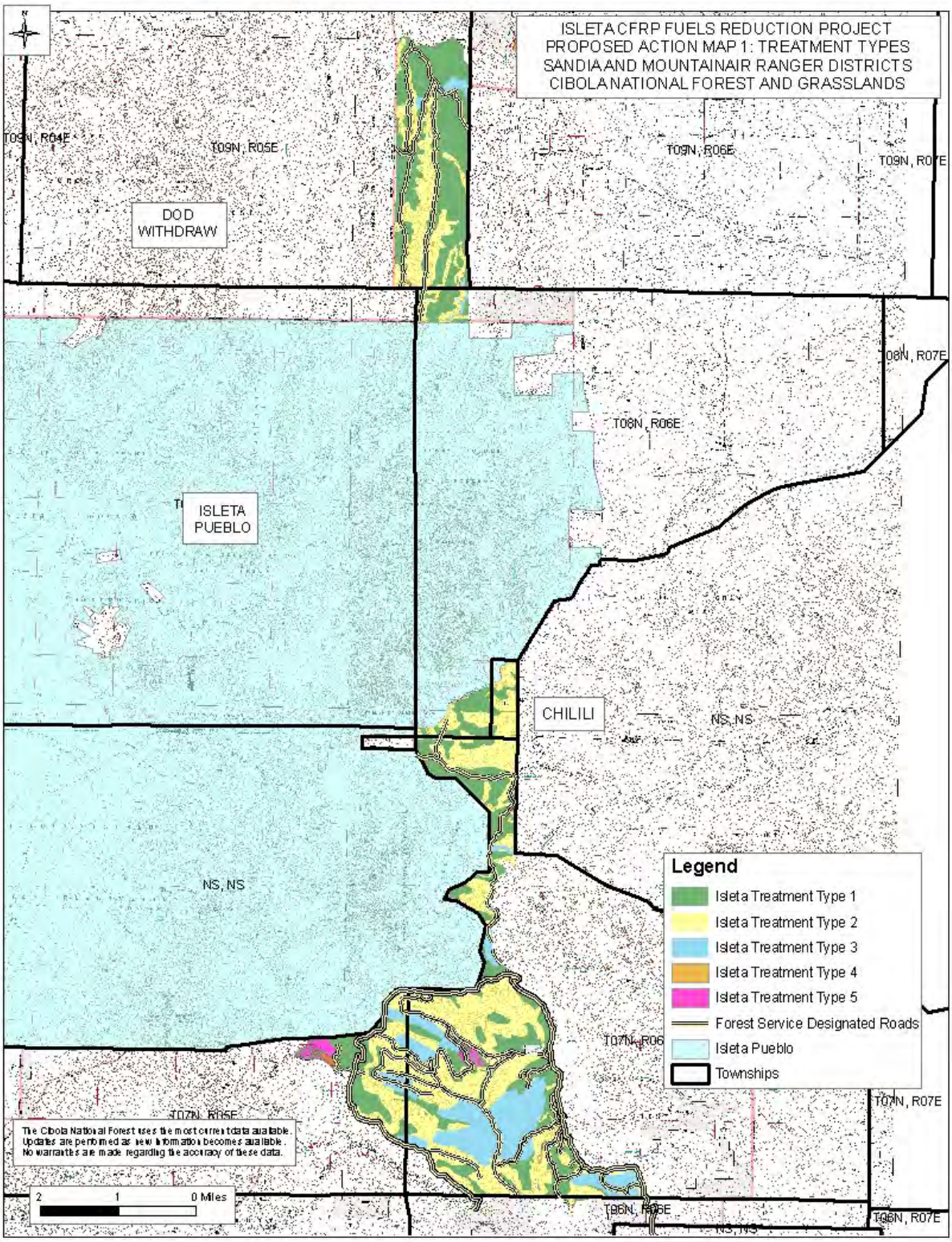

Figure 6. Cibola NF&Gs proposed action treatment types
Source: Cibola National Forest and Grasslands

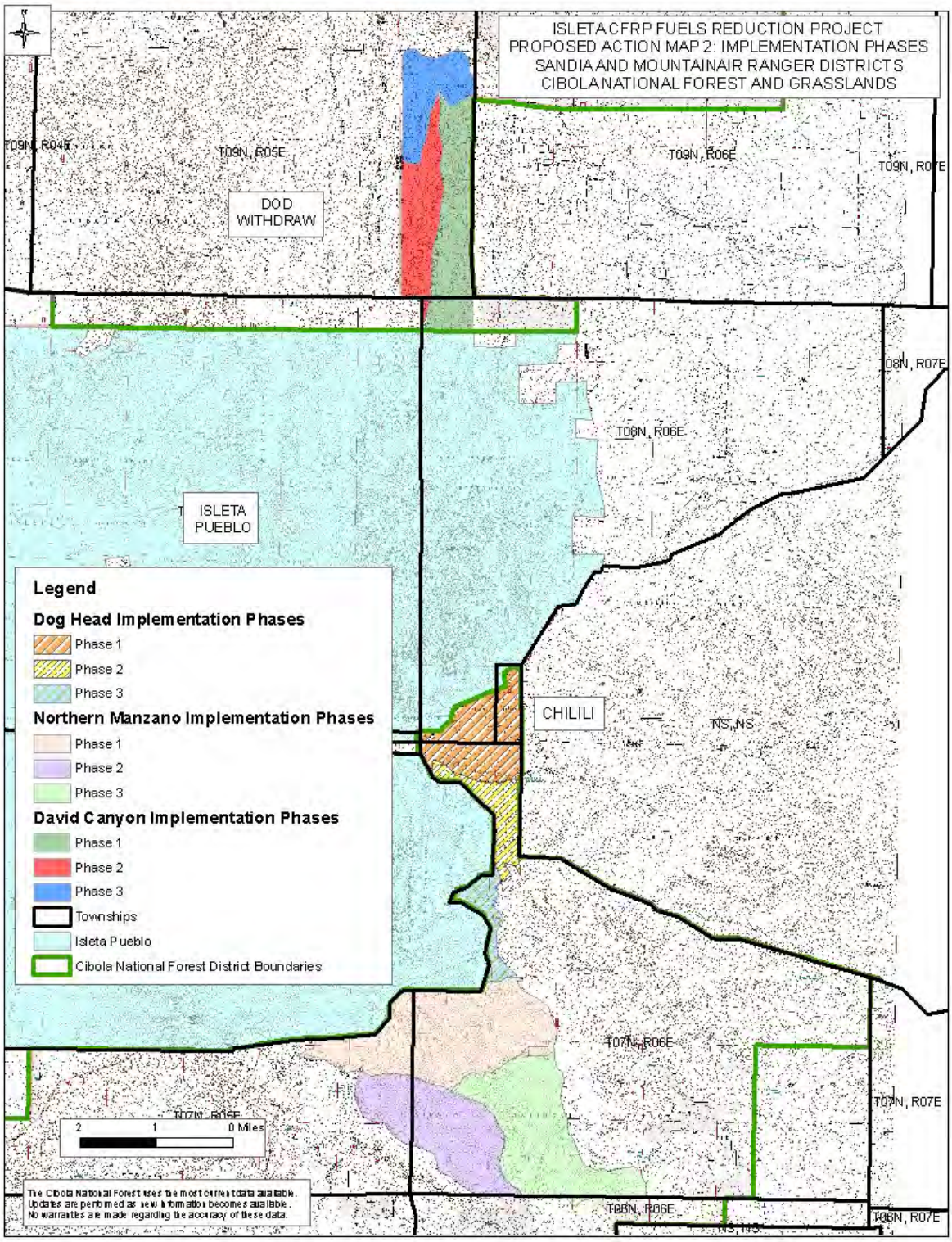

Figure 7. Cibola NF&Gs implementation phases
Source: Cibola National Forest and Grasslands

The transportation system for wood product removal has been separated into four haul zones: (1) David Canyon, (2) Dog Head, (3) Northern Manzano 1, and (4) Northern Manzano 2. The purpose of these haul zones is to clearly define primary routes and vehicle types permitted on these routes. For location of haul zones as described above, refer to Figure 8. This map also displays existing roads within the project area that would be used as access and for removing woody material generated from the fuels treatments. These roads were mapped in the field using global positioning systems (GPS) units by USFS personnel.

David Canyon Haul Zone

All material removed from David Canyon would be hauled from the Sandia RD onto Raven Road to New Mexico Highway 337. Due to the width, condition, and neighborhood location of Raven Road, the USFS would only allow pickup trucks and pickup trucks with trailers to access the area to remove woody material. No log trucks or chip vans would access this area.

Dog Head Haul Zone

Due to existing conditions on NFS Road 260, log trucks and public access is limited into the Dog Head Haul Zone from the Northern Manzano Haul Zone. For this reason access to remove forest products would be hauled from the Dog Head through Chilili to New Mexico Highway 337. This would only occur through collaboration and agreement with Chilili. The Cibola NF&Gs would work with Chilili in selecting a commercial logging company to access and remove the material. The selected contractor would be required to sign a road use agreement with Chilili prior to hauling. In addition to removing material commercially, the Cibola NF&Gs would allow Chilili members to access and remove forest products in the Dog Head Haul Zone through the purchase of Cibola NF&Gs permits.

Northern Manzano 1 Haul Zone

Due to existing conditions on NFS Road 260 and the eastern portion of NFS Road 321, this haul zone is set aside for public forest product gathering and removal. All NFS roads and unauthorized roads in this haul zone would be accessed by the public with pickup trucks and pickup trucks with trailers. Road conditions in this area can provide for these vehicles; however, to access it with log trucks would not be economical due to the need for road reconstruction. For this reason, access to remove forest products (primarily firewood) would be from NFS Road 260 and the east portion of NFS Road 321 to New Mexico Highway 55.

Northern Manzano 2 Haul Zone

Due to existing conditions on NFS Road 55 and the western portion of NFS Road 321, this haul zone is set aside for public forest product removal and commercial forest product removal using pickup trucks and pickup trucks with trailers. Road conditions in this area can provide for these vehicles; however, to access it with log trucks would not be economical due to the need for road reconstruction. All forest products (primarily firewood) would be removed from NFS roads and existing unauthorized roads to NFS Road 321 and then to NFS Road 55 to New Mexico Highway 55.

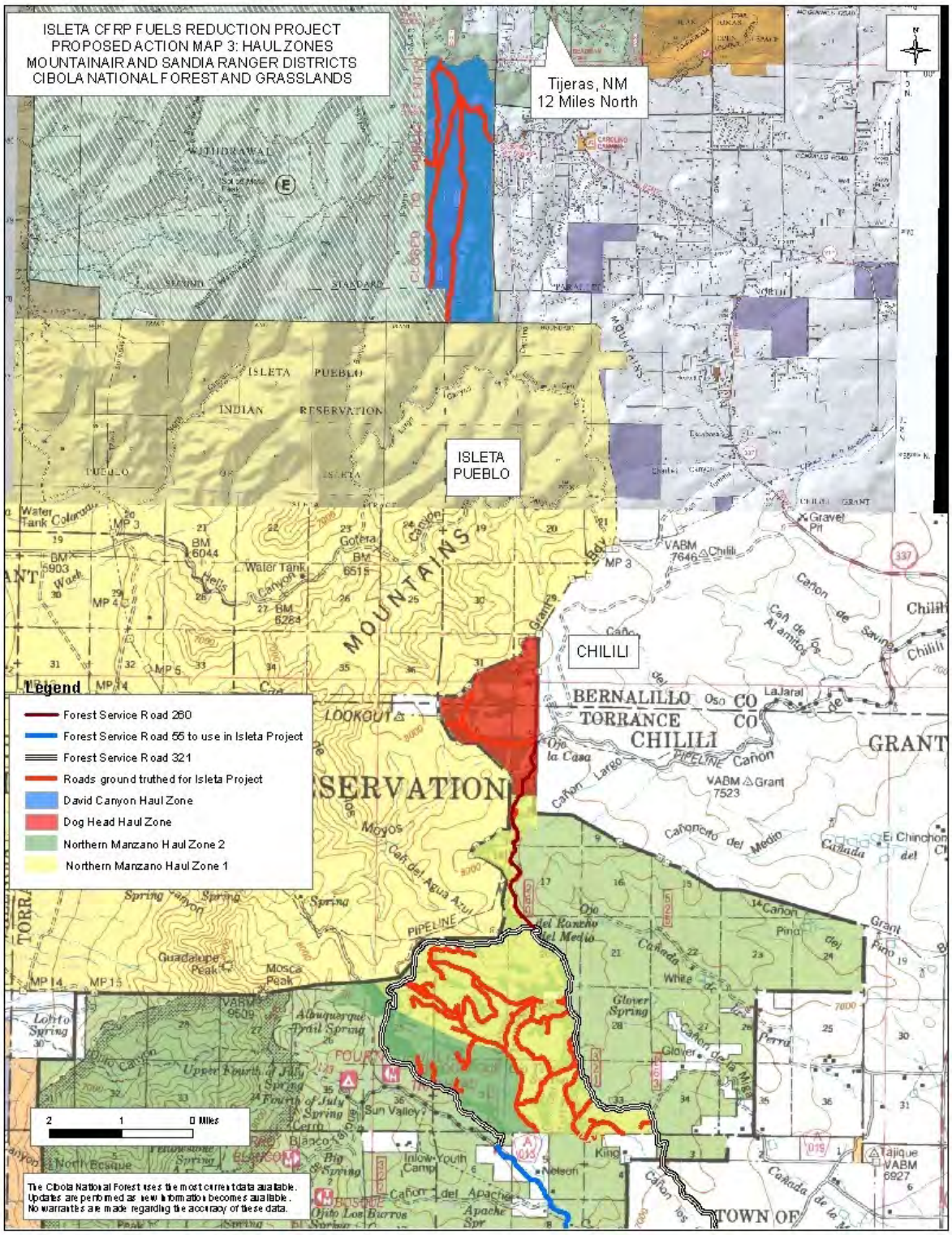

Figure 8. Cibola NF&Gs proposed action haul zones
Source: Cibola National Forest and Grasslands

Road Conditions Pre- and Post-Implementation

The project planning area contains approximately 45 miles of nonpaved NFS roads. These roads were field verified by USFS personnel using GPS data. After the GPS files were downloaded into ArcMap (mapping software used by the USFS), the files were cross referenced with the "Mountainair Ranger District Travel Analysis Process" (TAP) and the "Sandia Ranger District Travel Management Decision." Refer to the "Haul Zone" section above for descriptions of the primary access points into the project area. The only outlying issue using this primary access point would be the need to have USFS personnel or the contractor coordinate with Chilili prior to accessing the Dog Head Haul Zone via Chilili roads as described in the "Haul Zone" section above. Table 4 lists the NFS roads to be used for this project by ranger district, maintenance level, and length in miles (miles are approximate).

Table 4. NFS roads

NFS Road No.	District	Maintenance Level	Length (miles)
335	Sandia	2	4
106	Sandia	2	3
530	Sandia	2	2
321D3	Mountainair	2	1
321D1A	Mountainair	2	2
321D1	Mountainair	2	2
321C	Mountainair	2	2
321	Mountainair	2	8
55	Mountainair	3	2
321D2	Mountainair	2	1
321D2A	Mountainair	2	1
321E	Mountainair	2	0.2
260	Mountainair	2	3
260A	Mountainair	2	1
260A1	Mountainair	2	0.5

The roads in table 5 would have the required maintenance accomplished at various times during implementation to mitigate resource damage and provide for safe use. NFS level 2 roads would have maintenance completed at levels to facilitate access for high-clearance vehicles such as pickup trucks and sport utility vehicles (SUVs). NFS level 3 roads would have maintenance performed at levels to facilitate access for passenger vehicles such as sedans. The level 3 maintenance for this project would occur only on 2 miles of NFS Road 55.

In addition to the roads listed above, there are 11 miles of GPS recorded unauthorized roads within the project area that would be used to facilitate access for fuels treatments, wood removal, and as prescribed burn control lines. During the project, these roads may receive maintenance work to mitigate resource damage and provide for safe use.

At the conclusion of this project, unauthorized roads and other mechanized travel ways within the project and not part of the forest's transportation system will be maintained, closed, decommissioned, or obliterated. Refer to figure 9 for locations of roads described above.

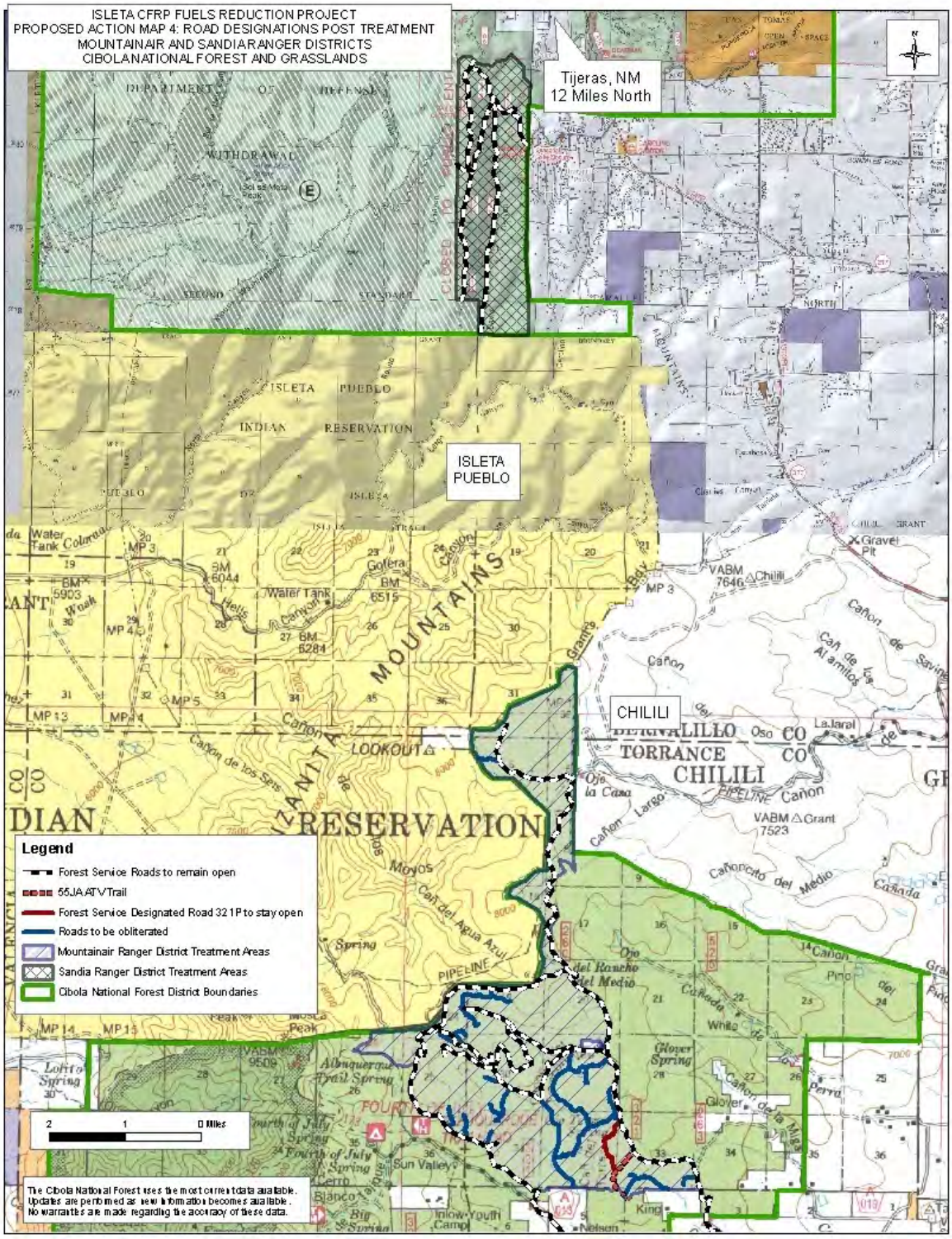

Figure 9. Cibola NF&Gs proposed action road designations post-treatment
Source: Cibola National Forest and Grasslands

Heritage/Cultural Resources

All proposed mechanical activities would avoid inventoried heritage resources and no disturbance of these resources would occur. Prescribed burning activities would avoid all inventoried heritage resources with structural attributes that could be compromised through fire.

Northern Goshawk

Implementation of any of the proposed activities within northern goshawk PFAs and nest areas would occur from October 1 to February 28. Through the environmental analysis process, dispersal PFAs would be designated based on forest plan direction (page 71-7). No timing restriction would apply in this area; however, the desired condition for PFAs would be created within the dispersal area.

As proposed, this alternative would not meet forest plan direction for northern goshawk habitat as described on pages 71-5 through 71-8. This alternative includes a project specific plan amendment that provides for establishment of permanent rooting zones. The plan would be amended as follows:

Standards and guidelines in the forest plan, as amended, are silent on the percentages of area within a stand that should be managed under tree cover and the percentages that should be managed as forest openings (grass/forb/shrub).

The relevant standards and guidelines are:

1. *Manage for uneven-age stand conditions for live trees and retain live reserve trees, snags, downed logs, and woody debris levels throughout woodland, ponderosa pine, mixed conifer, and spruce-fir forest cover types. Manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape. Sustain a mosaic of vegetation densities (overstory and understory), age classes, and species composition across the landscape. Provide food and cover for goshawk prey. (Page 71-5)*

2. *Landscapes outside (Goshawk post-fledging family areas)*

   General: The distribution of vegetation structural stages for ponderosa pine, mixed conifer, and spruce-fir forests is 10 percent grass/forb/shrub (VSS1), 10 percent seedling-sapling (VSS2), 20 percent young forest (VSS3), 20 percent mid-aged forest (VSS4), 20 percent mature forest (VSS5), 20 percent old forest (VSS6). NOTE: The specified percentages are a guide and actual percentages are expected to vary + or - up to 3 percent. (Page 71-7)

   Woodland: Manage for uneven-age conditions to sustain a mosaic of vegetation densities (overstory and understory), age classes, and species composition well distributed across the landscape. Provide for reserve trees, snags, and down woody debris. (Page 71-7)

Because the above standards and guidelines are silent on the percentages of area within a stand that should be managed under tree cover, and the percentages that should be managed as forest openings (grass/forb/shrub), the following is proposed for the Isleta CFRP project:

> *A range (20–60 percent of the area) of forest canopy gaps and openings would be maintained within each stand using terrestrial ecosystem unit inventory (TEUI) to guide*

percentage of gaps and openings (excluding MSO protected and restricted/threshold and northern goshawk nesting areas); the remainder of the stand would be managed for the forest structural stages (VSS classes) distribution of 10 percent, 10 percent, 20 percent, 20 percent, 20 percent, and 20 percent.

This project deviation from the forest plan is needed to meet management objectives primarily in the area of achieving forest restoration objectives while at the same time addressing the other following resource objectives:

1. Forest structure and density to preclude uncharacteristic wildfire; and
2. Forest vegetation composition, structure, and function to provide for properly functioning hydrologic processes.

Alternative C

Treatment on Pueblo and Chilili lands would remain the same as described in alternative B.

This alternative provides for treatments on the Cibola NF&Gs ranger districts of the proposed action but is modified to not include rooting zones. Alternative C was developed in response to scoping comments received during the public scoping comment period initiated on October 10, 2011.

Within the piñon-juniper woodland and ponderosa pine forest types, permanent openings (rooting zones, as shown in Figure 1) **would not** be created. Only temporary openings, for recruitment of Vegetative Structural Stages 1 and 2, would be created.

Piñon-Juniper Treatments

Between the openings described above, designated trees would be thinned from below while favoring trees with the healthiest crowns, to a residual of 55–92 trees per acre on lands outside PFAs, 119–138 trees per acre in PFAs, and 60–100 trees per acre in nesting areas. Approximately 10 percent of this forest type would be converted to temporary openings, resulting in recruitment of the natural regeneration. Ponderosa pine, white fir, and Douglas-fir occurring in piñon-juniper woodlands would be maintained as groups or stringers as appropriate to meet wildlife habitat improvement objectives. On average at least two snags and about 3 tons of downed woody debris per acre would be retained.

Ponderosa Pine Treatments

Between the openings described above, designated trees would be thinned from below to 73–110 trees per acre on lands outside PFAs, 119–138 trees per acre in PFAs, and 30–40 trees per acre in nesting areas. Approximately 10 percent of this forest type would be converted to temporary openings resulting in recruitment of the natural regeneration. On average at least two snags and 5 to 7 tons of downed woody debris per acre would be retained.

Treatment strategies in the mixed conifer and oak forest types would remain the same.

Mitigation Measures Common to Action Alternatives

Mitigation measures were developed to ease some of the potential impacts the various alternatives may cause. The mitigation measures may be applied to any of the action alternatives. Monitoring would be conducted for all resources to ensure that mitigation measures are effective.

Soils/Watershed

1. Project crews should use BMPs outlined in the USFS "Soil and Water Conservation Practices Handbook" (FSH 2509.22) and further described in the BMP to the soil and watershed specialist report (appendix C) to limit impacts to watershed, soil, and riparian resources. The following BMPs will be implemented (see chapter 3 for a discussion of BMPs):
    a. Servicing and Refueling Equipment
    b. Prescribed Burning Treatments
    c. Wetland, Spring, Seep, and Meadow Protection during Tree Removal Activities
    d. Slash Treatments in Sensitive Areas
    e. Log Landing Location
    f. Treatment of Ephemeral and Intermittent Drainages
    g. SMZ Designation
    h. Stream Channel and Wetland Protection
    i. Use of Project Area Maps for Designating Stream Courses for Water Quality Protection
2. Pile placement or jackpot burning (igniting concentrations of fuels on the forest floor, whether they are natural fuels or fuels resulting from treatment) should not be allowed in ephemeral, intermittent, or perennial channels. Soils/watershed specialists will determine appropriate buffers for these actions outside the stream channel.
3. Water barring and other practices as needed would be used on the roads after completion to improve drainage and address related effects such as erosion.
4. Downed woody material would be retained or returned to the sites after proposed activities to ensure appropriate levels to maintain soil quality are present.
5. The areas where soil condition is less than satisfactory or where erosion hazard is severe would not be open to public firewood collecting to limit the amount of soil disturbance.

Scenic Resources

To meet visual quality objectives within the immediate foreground areas adjacent to area trails and residential areas (up to 300 feet), slash treatments would be as follows:

1. Stumps would be cut to a 6-inch height throughout the project area. Within the immediate foreground areas of trails (up to 300 feet), the face cut of stumps would be directed away from the trail, where possible.

2. Piles created in the immediate foreground would be burned to achieve 95 percent or more consumption, and following burning unconsumed slash will be scattered and the ground seeded with the approved seed mixture for this area. The burning of piles created within the immediate foreground between June and September of any year should be burned in September through November of that same year unless fuel or weather conditions are not conducive to attainment of the 95 percent consumption objective. These piles would be burned the following spring as soon as conditions permit. Piles created during a winter harvest operation would not be burned until the following September–November period.
3. For alternative B, slash will be scattered within the foreground of area trails and residences to reduce visual impacts.

Air Quality

1. BMPs for smoke management and compliance with the New Mexico Environmental Department (NMED) Air Quality Bureau (AQB) would mitigate smoke impacts derived from fuel treatment activities. Compliance with the AQB would ensure that Clean Air Act requirements are met.
2. Local area fire weather forecasts will be monitored daily before and during implementation of the prescribed burn. Spot weather forecasts will be obtained daily for the operational periods of the burn. Onsite weather readings will be monitored during operational periods as directed by the burn boss using a belt weather kit. The weather data recorded from the belt weather kit will be the primary weather readings that will be the determination factor for the go/no-go decision and the prescription parameters.
3. The burn boss will ensure that the project complies with all local, county, state, and Federal air quality regulations. The project will be registered with the AQB at least 2 weeks prior to implementation. Notification will be given 24 to 48 hours prior to ignition, and a copy of the spot weather forecast will be faxed to the Mountainair and Sandia RDs. A copy of the smoke monitoring report will also be faxed. Coordination between the Albuquerque Interagency Dispatch Center, the AQB, and neighboring agencies will be established. A burn will be terminated if the AQB or the National Weather Service issues an air stagnation alert.
4. Smoke conditions will be monitored carefully to assess potential impacts to highway traffic and populated areas. Monitoring will be visual and may include instrument monitoring. Adequate ventilation or winds that carry smoke away from traffic or populated areas may be required to minimize impacts. The burn boss will determine if conditions are favorable at time of ignition.

Prescribed Burning

1. Some archaeological sites are located within the proposed project area and mitigation measures would need to be in place before burning. Fire and fuels personnel would coordinate with the district archaeologist prior to broadcast burning and prior to the development of piles so mitigation measures can be taken.
2. The project area has one allotment and several pastures suitable for grazing and multiple range improvements. Fire personnel will coordinate with range staff prior to ignition to determine if the area is suitable for burning and if the permittee has moved off of the

pasture. Direct damage incurred by project implementation to a permittee's fences or other range improvements would need to be repaired. It would be the responsibility of the burn boss and burn overhead to discuss protection requirements with the range staff prior to ignition.

3. The analysis area consists of wildlife habitat that restricts burning, has timing restrictions, or has burning parameters associated. These mitigations are summarized below and are listed in more detail in the wildlife specialist report (in the project record). These actions would leave certain areas untreated and increase the potential for high intensity fire; however, these burn restrictions on a landscape level would not be significant. The actions will increase the cost of burning and complicate burning efforts.
    a. Snags greater than 18 inches and logs over 12 inches in diameter and longer/taller than 8 feet and hardwood species are recognized as habitat for several wildlife species, including the MSO. The proposed action would remove some snags and logs within firebreaks and adjacent areas to control lines for burning. Snags and logs adjacent to these areas can create holding issues for firefighters and compromise firefighter safety. Snags and logs that do not compromise firefighter safety are to be left. Lighting techniques that allow for the retention of large logs and snags should be used.
    b. No burning would be permitted in northern goshawk PFAs from March 1 to September 30.
    c. In mixed conifer stands, no mechanical treatment will be conducted. These areas will require light burning to maintain MSO habitat (see wildlife specialist report).
    d. Northern goshawk PFAs would be lightly burned to retain habitat. Prescription parameters are listed in the wildlife specialist report.

Wildlife

1. This project proposes to develop implementation phases for the three geographic areas mentioned above so that fuel reduction activities and wood product removal can occur while providing mitigation for the unintentional take of migratory birds. The recommended Cibola NF&Gs migratory bird timing restriction for no management activity is from April 1 to July 31. This timing restriction would be implemented annually on two-thirds of the project area, while activity would occur throughout the year on the remaining third.
2. Two Abert's squirrel (*Sciurus aberti*) sites per 100 acres would be maintained except where the basal area of trees over 8 inches d.b.h. is between 150 and 200 square feet per acre; in this case one Abert's squirrel site per 100 acres would be maintained. Abert's squirrel sites consist of at least six trees of 11 to 16 inches d.b.h. in a 0.05-acre group with interlocking crowns.
3. Skid trails, landings and other intensely disturbed areas would be seeded with an approved native grass/forb/shrub seed mix.
4. Large, downed woody materials (12-inch diameter midpoint and greater) and snags would be retained within riparian areas.

5. The implementation of any of the proposed activities within northern goshawk PFAs and nest areas would occur from October 1 to February 28.
6. A dispersal PFA will be designated based on forest plan direction (pg. 71-7). No timing restrictions would apply in this area; however, the desired condition for PFAs would be created within the dispersal area.
7. An analysis determined that MSO threshold conditions (see U.S. Fish and Wildlife Service (USFWS) 1995: 92; forest plan (1985), pg. 71-2) at a district-wide scale were deficient. Therefore, all existing tree densities and canopy cover would be maintained in mixed conifer areas within this project, and prescribed fire would be used exclusively in these areas to maintain fuel loading.

Vegetation

1. Native deciduous species (oak, mountain mahogany (*Cercocarpus* sp.), boxelder (*Acer negundo*), etc.) of 10 inches d.r.c. and larger would be retained. Species with less than 10 inches d.r.c. would be retained within groups where retention would not compromise treatment objectives.
2. Mature (flattened crowns, red/yellow plated bark, little taper) ponderosa pine would be retained, regardless of size.
3. All native tree species with 16 inches or larger d.b.h./d.r.c. would be retained.
4. **Ips Beetles** – Activity slash would be created only from July through December unless woody material greater than 3 inches in diameter can be removed within 30 days of being created, or unless the potential for *Ips* infestation is determined to be low. Creating activity slash would be avoided in the same area multiple years. As much woody material greater than 3 inches in diameter would be removed from the site as possible. Slash would be treated promptly through lop/scatter, chipping, hand pile burning, or prescribed burning. Chipping or masticating would be accomplished in the fall (after August) and early winter when beetles are not actively flying. Concentrations of chipped/masticated material would not be allowed to accumulate over 3 inches in depth or lie immediately adjacent to live standing trees. Chipped/masticated materials would be distributed on slopes where they would dry quickly. Burning of woody material would not be an effective treatment for piñon *Ips* unless accomplished before beetles emerge from the woody material. Mechanical damage would be avoided to residual trees and their root systems to reduce risk of attracting bark beetles. Slash would be monitored during and after treatment for *Ips* beetle infestation. If found, the district silviculturist would be contacted.
5. **Noxious Plants** – Potential sources of introduction of noxious weeds into the project area would be monitored; included are rehabilitation of trails, roads, etc. through grass establishment. New introductions and infestations of weeds discovered in project areas would be minimized. Inspection and cleaning of equipment and vehicles involved in implementation of the project would be required.

Recreation (Cibola NF&Gs)

David Canyon Division

All NFS trails within the project area will be flagged prior to treatment to maintain vegetation buffers on the immediate (both) sides of the trail. Further, to reduce/eliminate potential damage from equipment or vehicles, sites suitable for crossing (low cross slope) will be marked. The West Boundary Trail (unauthorized) will be treated as a NFS trail for treatment purposes. Any other existing unauthorized trails will be removed by placement of slash or some minor ripping and seeding.

Following treatment, trails and crossings will be rehabilitated to pre-project conditions through maintenance or minor trail relocation.

Northern Manzano Division

1. Place signs warning of logging traffic and operations:
   a. at the forest boundary on NFSR 55 west of Tajique;
   b. on NFSR 55 east and west of its intersection with NFSR 321; and
   c. at both ends of NFSR 321.
2. Place warning signs on level 2 roads as needed.
3. Issue and post press releases:
   a. prior to the start and stop of operations, and
   b. when specific roads will be closed to the public.
4. If logging operations occur while Rocky Mountain maples are changing, consider:
   a. Posting traffic control devices, signs, and/or persons at strategic corners and blind spots along NFSR 55.
   b. Not hauling timber/firewood on NFSR 55 during high traffic hours, e.g. from 10:00 a.m. to 4:00 p.m.
5. Use KV Funds and other resources to close roads and other routes to the conditions prescribed under the Travel Management Rule for the Mountainair Ranger District, to discourage illegal and/or public motor vehicle use

New Mexico Forest Restoration Principles

This project has considered all of the guidelines associated with the New Mexico Forest Restoration Principles.

1. **Collaborate**. Landscape scale assessment and project design, analysis, implementation, and monitoring should be carried out collaboratively by actively engaging a balanced and diverse group of stakeholders. *Collaboration has occurred during all phases of the analysis and continues with a varied group of stakeholders, including known interested*

individuals and organizations, environmental and tribal groups, and governmental agencies at local, state and Federal levels (EA, chapter 4, project record).

2. **Reduce the threat of unnatural crown fire.** A key restoration priority must be moving stands toward a more natural restored condition and reduction of the risk of unnatural crown fires both within stands and across landscapes. Specific restoration strategies should vary based on forest vegetation type, fire regime, local conditions, and local management objectives. Forests and woodlands characterized by infrequent and mixed severity fire should be managed toward a stand structure consistent with their historical ranges of variation including, in some cases, high density, continuous stands. Discontinuous stand structure may be appropriate to meet community protection objectives in areas such as the wildland-urban interface for these forest and woodland types. *Reducing the threat of unnatural crown fire is the purpose and need of this analysis (EA, chapter 2).*

3. **Prioritize and strategically target treatment areas**. Key considerations for prioritizing restoration treatment areas are: degree of unnatural crown fire risk, proximity to human developments and important watersheds, protection of old growth forests and habitats of federally threatened, endangered, or listed sensitive species, and strategic positioning to break up landscape-scale continuity of hazardous fuels. Treatments should be done at a landscape scale to decrease forest vulnerability to unnatural stand-replacing fire. This priority setting should take place during fire management planning, land management planning, and community wildfire protection planning. *See discussion in "Background" and "Purpose and Need" sections (EA, chapter 2, fire/fuels report, appendix C).*

4. **Develop site-specific reference conditions.** Site specific historical ecological data can provide information on the natural range of variability for key forest attributes, such as tree age structure and fire regimes that furnish local "reference conditions" for restoration design. A variety of constraints, however, prevent the development of historical information on every hectare of land needing restoration. General goals should be to restore ecological integrity and function. *The varied specialist reports and analyses are based on site-specific inventory information and were used as a basis to restore ecological integrity and function (EA, chapter 3).*

5. **Use low-impact techniques.** Restoration treatments should strive to use the least disruptive techniques and balance intensity and extensiveness of treatments. In many areas, conservative initial treatments would be the minimum necessary to adequately reduce the threat of unnatural crown fire. Wildland fire use or management-ignited fires may be sufficient to reestablish natural conditions in many locations. In the extensive areas where fire alone cannot safely reduce tree densities and hazardous ladder fuels, mechanical thinning of trees may be needed before the introduction of prescribed fire. Patient, effective treatments would provide more options for the future than aggressive attempts to restore 120 years of change at once. In certain areas, however, such as some wildland-urban interfaces (WUIs), tradeoffs with imminent crown fire risks require considerations of rapid, heavy thinning of mostly small diameter trees. *A variety of tools, ranging from mechanical to prescribed fire, and mitigations would be used to meet treatment objectives (EA, chapter 2).*

6. **Utilize existing forest structure.** Restoration efforts should incorporate and build upon valuable existing forest structures, such as large trees and groups of trees of any size with interlocking crowns, excluding aspen (*Populus* sp.). These features are important for some wildlife species, such as Abert's squirrel and northern goshawk, and should not be removed completely just to recreate specific historical tree locations. Since evidence of long-term stability of precise tree locations is lacking, especially for piñon and juniper, the selection of "leave" trees and tree clusters in restoration treatments can be based on the contemporary spatial distribution of trees, rather than pre-1900 tree positions. Maximizing use of existing forest structure can restore historical forest structure conditions more quickly. Leaving some relatively dense within-stand patches of trees need not compromise efforts to reduce landscape-scale crown fire risk. The underlying successional processes of natural tree regeneration and mortality should be incorporated into restoration design. Southwestern conifer regeneration occurs in episodic, often regionwide pulses, linked to wet-warm climate conditions and reduced fire occurrence. Periods with major regeneration pulses in the Southwest occurred in the 1910s–1920 and 1978–1998. Some of this regeneration would have survived under natural conditions. Restoration efforts should retain a proportion of these cohorts. *Working with and retaining, to the extent possible commensurate with project objectives, existing forest structure (including large trees) is an integral part of the design of this project (EA, "Proposed Action and Desired Condition," chapter 2).*

7. **Restore ecosystem composition.** Missing or diminished compositional elements, such as herbaceous understories, or extirpated species also require restoration attention. The forest understory, including shrubs, grasses, forbs, snags, and downed logs, is an important ecosystem component that directly affects tree regeneration patterns, fire behavior, watershed functioning, wildlife habitat, and overall patterns of biodiversity. Similarly, soil organisms—such as mycorrhizal fungi—are vital elements that can influence community composition and dynamics. A robust understory provides a restraint on tree regeneration and is essential for carrying surface fires. The establishment and maintenance of more natural patterns of understory vegetation diversity and abundance are integral to ecological restoration. Restoration planning should include the conservation of habitats for diminished or extirpated wildlife species. Comprehensive forest ecosystem restoration requires balancing fire risk reduction with retention of forest structures necessary for canopy dependent species. Recovery plans and conservation plans for threatened, endangered, and sensitive species should be incorporated to the fullest extent possible in planning for comprehensive forest restoration *(EA, chapters 2 and 3).*

8. **Protect and maintain watershed and soil integrity.** Low impact treatments would minimize sedimentation, disruption of surface runoff, and other detrimental ecosystem effects. Equipment and techniques should be managed according to soil and water conservation "best management practices" applicable to site-specific soil types, physiographic and hydrological functions.

   Reconstruction, maintenance, or decommissioning of existing roads to correct for poor hydrologic alignment and drainage condition can greatly reduce soil loss and sedimentation rates. Projects should strive for no net increase in road density.

Managing forest density and fuels to avoid uncharacteristically intense wildfire events would reduce the likelihood of uncharacteristic post-fire soil erosion and nutrient depletion from forested landscapes. Soil productivity should be protected and maintained by avoiding soil loss and compaction, and managing for onsite nutrient retention. Avoid repeated whole tree biomass removal from the forest to maximize nutrient retention. Whenever feasible, green foliage should be recycled by scattering onsite followed by prescribed burning to release stored nutrients *(EA, chapter 3 and soil and water resources specialist report).*

9. **Preserve old or large trees while maintaining structural diversity and resilience.** Large and old trees, especially those established before ecosystem disruption by Euro-American settlement, are important forest components and critical to functionality of ecosystem processes. Their size and structural complexity provide critical wildlife habitat by broadly contributing crown cover, influencing understory vegetation patterns, and providing future snags. Ecological restoration should manage to ensure the continuing presence of large and old trees, both at the stand and landscape levels. This includes preserving the largest and oldest trees from cutting and crown fires, focusing treatments on excess numbers of small young trees.

   Develop "desired" forest condition objectives that favor the presence of both abundant large diameter trees and an appropriate distribution of age classes on the landscape, with a wide distribution of older trees. It is generally advisable to maintain ponderosa pines larger than 16 inches d.b.h. and other trees with old growth morphology regardless of size (e.g., yellow-barked ponderosa pine or any species with large drooping limbs, twisted trunks, or flattened tops).

   Treatments should also focus on achievement of spatial forest diversity by managing for variable densities. Overall, forest densities should be managed to maintain tree vigor and stand resiliency to natural disturbances. Disease conditions are managed to retain some presence of native forest pathogens on the landscape, but constrained so that forest sustainability is not jeopardized. Guidelines must provide opportunities to apply differing site specific management strategies to work toward attainment of these goals and recognize that achievement may sometimes require more than one entry.

   Stand level even-aged management may be appropriate for some objectives, including disease management, post-wildfire tree regeneration, accelerating development of old growth characteristics, or for forest types for which even-aged stands are characteristic, such as spruce (*Picea* sp.) or aspen. Treatments should be identified through collaboration with key stakeholders. Some ponderosa pine forests contain extremely old trees and dead wood remnants that may be small but are important because they contain unique and rare scientific information in their growth rings. Such trees have become increasingly rare in the late 20th century, and the initial reintroduction of fire often consumes these tree ring resources. Restoration programs should preserve them where possible. *The existing condition for both ponderosa pine and piñon-juniper woodland is deficient of trees greater than 16 d.b.h. and d.r.c.. This project proposes to not cut any trees over this diameter to assist in moving the area to desired condition (EA, chapters 2 and 3).*

10. **Manage to restore historic tree species composition.** Forest density levels and the presence of fire in the ecosystem are key regulators of tree species composition. Where fire suppression has allowed fire-sensitive trees like junipers or shade-tolerant white fir or

spruce to become abundant in historical ponderosa pine forests, treatments should restore dominance of more fire-resistant ponderosa pines. However, fire intolerant species sometimes make up the only remaining large tree component in a stand. Retention of these large trees is important to canopy-dependent wildlife species. In mixed conifer forests, landscapes should be managed for composition and structure that approximates the natural range of variability *(EA, chapters 2 and 3 and vegetation specialist report).*

11. **Integrate process and structure**. Ecological sustainability requires the restoration of process and structure. Natural disturbance processes, including fire, insect outbreaks, and droughts, are irreplaceable shapers of the forest. In particular, fire regimes and stand structures interact and must be restored in an integrated way; mechanical thinning alone would not reestablish necessary natural disturbance regimes. At the same time, fire alone may be too imprecise or unsafe in many settings, so a combination of treatments may often be the safest and most certain restoration approach.

    The single best indicator of whether a proposed approach should be considered as "ecological restoration" is to evaluate if the treatment would help successfully restore the fire regime that is natural for that forest type. Approaches that do not restore natural fire regimes would not achieve full ecological restoration *(EA, chapter 3, vegetation and fuels specialist reports).*

12. **Control and avoid using exotic species.** Seeding of exotic grasses and forbs should be prohibited as ecologically incompatible with good restoration. Once established, exotic species can be extremely difficult or impossible to remove. Seeding should be conducted with certified or weed-free seeds to reduce the risk of contamination by nonnative species or varieties. In general, it is ecologically desirable to allow native herbaceous vegetation to recover incrementally unless there is potential for serious soil erosion or the potential for establishment of nonnative invasive plants. If enhancement of herbaceous vegetation is needed, especially for road closures and recovery, using locally sourced native seeds or transplanting individuals from nearby areas into treatments is ecologically desirable. Restoration treatments should also routinely incorporate early actions to control the establishment and spread of aggressive exotics that can be expected from restoration related site disturbance *(EA, chapter 3).*

13. **Foster regional heterogeneity**. Biological communities vary at local, landscape, and regional scales, and so should restoration efforts. Ecological restoration should also incorporate the natural variability of disturbance regimes across heterogeneous landscapes. Heterogeneity should be fostered in planning and implementing ecological restoration and all spatial scales, including within and between stands, and across landscape and regional scales *(EA, chapter 3, vegetation and wildlife specialist reports—specifically the analysis at the ecosystem management area scale and associated "Cibola National Forest and Grassland Land Management Plan" direction).*

14. **Protect sensitive communities**. Certain ecological communities embedded within ponderosa pine or other types of forests and some riparian areas, could be adversely affected by onsite prescribed burning or mechanical thinning. Restoration efforts should protect these and other rare or sensitive habitats, which are often hotspots of biological diversity, particularly those that are declining in abundance and quality in the region *(EA, chapter 3).*

15. **Plan for restoration using a landscape perspective that recognizes cumulative effects**. Forest restoration projects should be linked to landscape assessments that identify historical range of variation (reference condition), current condition, restoration targets, and cumulative effects of management. Ecosystems are hierarchical; changing conditions at one level arise from processes occurring at lower levels and are constrained, in turn, by higher levels. The landscape perspective captures these complex relationships by linking resources and processes to the larger forest ecosystem. Forest restoration projects should incorporate plans for long-term maintenance of ecological processes *(EA, chapters 2 and 3, specifically the "Purpose and Need" and "Proposed Action" which includes maintenance as monitoring data show that desired conditions are surpassing thresholds).*

16. **Manage grazing**. Grass, forbs, and shrub understories are essential to plant and animal diversity and soil stability. Robust understories are also necessary to restore natural fire regimes and to limit excessive tree seedling establishment. Where possible, livestock grazing after treatment should be deferred until the herbaceous layer has established its current potential structure, composition, and function. *(Livestock grazing only occurs on Chilili land and the Mountainair RD; the Pueblo and Sandia RD do not have grazing. Where grazing occurs on the Mountainair RD portion of this project is within one allotment, the Tajique Allotment, with multiple pastures. There is a single permittee that works cooperatively with the ranger district. This allotment is permitted to be grazed from June through October, so year-round grazing does not occur. The district range staff will work with the permittee prior to and during restoration activities to move the herd to pastures where restoration activity is not occurring. Once the restoration activities have occurred, the district staff will monitor the treated areas to determine changes to the area and work with the permittee to rest the pasture until the monitoring data show if the pasture has recovered and is viable for grazing.)*

17. **Establish monitoring and research programs and implement adaptive management**. Well designed monitoring, research, and documentation are essential to evaluate and adapt ongoing restoration efforts. Monitoring programs must be in place prior to treatment and must evaluate responses of key ecosystem components and processes at multiple scales. Use research and monitoring results from a variety of sources to adjust and develop future restoration treatments. When possible, restoration projects should be set up as experiments with replicates and controls to test alternative hypotheses. The locations and prescriptions for all restoration treatments should be archived in a geographic information system (GIS), so that land managers and researchers have access to site-specific records of restoration treatments. (*Monitoring would occur during all phases of project implementation. In addition the Cibola NF&Gs will actively seek out partners with an interest in restoration to assist with monitoring. This protocol has been established using the CFRP.)*

18. **Exercise caution and use site-specific knowledge in restoring or managing piñon-juniper ecosystems and other woodlands and savannas**. These systems are diverse and complex. Knowledge of local reference structure, composition, processes, and disturbance regimes is lacking or uncertain for many piñon-juniper ecosystem types. Given the diversity, variability, and complexity of piñon-juniper systems, identification of local reference conditions is critical to the development of restoration objectives. Exercise caution and use best available science and site-specific knowledge in planning

and implementing ecological restoration projects. Active management may be appropriate to mitigate soil erosion, community wildland fire hazard, or degraded hydrologic function in cases where historical ecological dynamics are insufficiently understood to justify ecological restoration. Piñon-juniper sites may be particularly susceptible to ecological damage from treatments; for example, soil erosion and invasion by nonnative plants. *The varied specialist reports and analyses are based on site specific inventory information and were used as a basis to restore ecological integrity and function (EA, chapter 3).*

Comparison of Alternatives

Table 5 serves as an executive summary of the effects of implementing each alternative and references the detailed information included in chapters 1, 2, and 3. Information in the table is focused on the main resources that would be affected by project activities.

Table 5. Comparison of alternatives

Topic	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Stand structure modified to reduce crown fire potential	Conditions that support crown fires (high tree densities, "ladder fuels," homogeneous vertical/horizontal stand structures) would continue. The crowning index, the potential for a fire that reaches the canopy to continue as a crown fire would remain low, meaning crown fires would be sustained at relatively low wind speeds. The potential for large and uncharacteristic fire growth would still exist.	This action alternative is based on a fuels reduction prescription and would have fewer trees, especially small diameter trees that act as ladder fuels and increase the risk of torching, and an open canopy with lower crown bulk density, which reduces the risk of sustained crown fire. The ecosystem should be resilient to natural disturbance events including fire, drought, disease, and insect infestations. A desired future condition would allow fire to play its natural role in the environment and be maintained in a manner to alleviate resistance to control. Desired future conditions would mimic natural ecosystem traits, having a diverse mosaic of fuels that are arranged in a fashion not subject to uncharacteristic wildfire. This alternative would create a stand structure reducing the potential for crown fire although the potential for fine fuels such as grasses increases. Fine fuels could create an environment where ground fire moves faster, but fires would demonstrate low to moderate fire behavior with low resistance to control. This condition would be the case in the majority of the rooting zones and temporary openings.	This alternative would also create a stand structure reducing the potential for crown fire, although the potential for fine fuels such as grasses increases. Fine fuels could create an environment where ground fire moves faster, but fires would illustrate low to moderate fire behavior with low resistance to control. Wildfires within the Isleta CFRP area would more likely be contained before they entered either private land or wilderness. The tree removal prescription would create an open stand structure with a much lower stand density index. This open stand structure would also create a much lower crown bulk density due to the increase in canopy spacing and lowering in trees per acre. In the open thinned areas, the trees would also be limbed up to remove the ladder fuels resulting in a much higher c.b.h. This type of canopy spacing and limbing would result in an environment much less likely to support crown fire initiation or sustainment of a crown fire burning into the area.
Firefighter/ public safety and private property	Areas to safely control fire with emergency response would remain extremely limited and a defensive tactical approach may become necessary. Flame lengths, even during normal conditions, would preclude direct attack with ground forces. This would greatly increase the resistance to control. Areas to safely control fire with emergency response would remain extremely limited. This could result in delayed tactical implementation and the potential for larger fire growth with	Fine fuels (grasses) could create an environment where ground fire moves faster, but fires would show low to moderate fire behavior with low resistance to control. Wildfires within the Isleta CFRP project area are more likely to be contained before they entered either private land or wilderness. Crown fires entering the Isleta CFRP project area from either private land or wilderness could potentially go back to a surface fire, giving emergency personnel a chance to safely contain the fire.	Fine fuels (grasses) could create an environment where ground fire moves faster, but fires would show low to moderate fire behavior with low resistance to control. Wildfires within the Isleta CFRP area would more likely be contained before they entered either private land or wilderness. Crown fires entering the Isleta CFRP area from either private land or wilderness could potentially go back to a ground fire giving emergency personnel a chance to safely contain the fire. This would be a direct result from the reduction in canopy bulk density, increase in canopy base height, and an overall lowering of

Topic	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
	high resistance to control.		the stand density index. Maintenance of the Isleta CFRP through selected removal of understory and low intensity prescribed fire would help ensure the effectiveness of this project.
Effects to Resources – Air Quality	The potential exists for wildfire to spread beyond the analysis area, resulting in increased emissions from wildfire and impaired air quality.	Creation of fine particulate matter from prescribed and pile burning would occur. This would be mitigated by following mitigations described in the fire/fuels report and public notification of Bernalillo and Torrance County requirements for air quality management.	Creation of fine particulate matter from prescribed and pile burning would occur. This would be mitigated by following mitigations described in the fire/fuels report and public notification of Bernalillo and Torrance County requirements for air quality management.
Effects to Resources – Scenic Resources	Little perceived change is expected. Uncharacteristic wildfire potential remains a greater risk; if this occurs, views of a fire altered landscape may dominate.	Reduced vegetation density, arrangement, and temporary openings (overall, a more open forest appearance) would be visible from Tranquillo Pines and area subdivisions. The difference between treated (project area) and untreated (wilderness/private lands) would provide a linear contrast between those areas. Stumps, slash, and ground disturbance would dominate the view in the immediate foreground of area trails. A decrease in the sense of solitude and diminished scenic quality would occur in those same areas. The landscape would exhibit a managed appearance at least in the short term (up to 10 years). Visual impacts from prescribed and pile burning would be apparent for many years.	There may be perceived as diminished scenic quality for residents and travelers who are familiar with the area. However, the proposed action under alternative C would be a thinning from below while favoring trees with the healthiest crowns so the residual stand structure would appear less unchanged than alternative B that would create large openings between clumps of trees. For the casual observer, they would likely not notice the changes as viewed from a distance.
Effects to Resources – Vegetation	Forest vegetation would continue to grow but at reduced rates due to high tree densities, overcrowding, and competition for limited nutrients, water, and sunlight. Trees, both on an individual and landscape basis, would continue to be stressed and more susceptible to drought and insect/disease attack. Higher rates of mortality resulting from these causes could be expected. Vertical and horizontal stand structure would remain	The forest would move toward a more sustainable condition through reduction in tree densities, improved vertical and horizontal structure, and overall more open growing conditions. Tree growth/vigor would be improved. Recruitment of understory grasses, forbs, and shrubs would be enhanced. Desired VSS class distribution would be enhanced through the recruitment of seedlings and saplings over approximately 10 percent of the piñon-juniper and ponderosa forest types, and further development of the mature and old forest classes in all forest types. The potential for insect/disease outbreaks would be	The environmental consequences of implementing alternative C are similar to those discussed for alternative B with the following differences: a. In the forested areas between the 10 percent of the area to be placed in temporary openings, stand structure would be more uniform and continuous. b. Re-entry, to maintain desired conditions, would occur at more frequent intervals (estimated 15–20 years) as tree crowns close upon one another and tree densities

Topic	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
	homogeneous. Recruitment and enhancement of old growth conditions would occur at a slower pace. No perceptible changes in existing vegetative structural class distribution would occur in the near term unless caused by natural events (wildfire, etc).	reduced. Stand structure would move towards uneven-aged conditions and away from homogenous, even-aged conditions. This alternative includes a project-specific plan amendment that provides for establishment of permanent rooting zones.	increase. Attainment of desired conditions, specifically managing for uneven-aged stand conditions for live trees to include tree groups and openings, would occur at a slower rate as groups would be recruited on only 10 percent of the area in each entry.
Effects to Resources – Wildlife: Threatened and Endangered Species	Continuation of fuels buildup and small diameter (ladder) trees, leading to a potential crown fire if wildfire occurs in the area. Important habitat features such as large diameter trees, snags, and large downed logs could be burned.	This alternative would reduce ladder fuels; maintain snags, downed logs, and residual basal area on 131 acres of mixed conifer habitat. No tree cutting would occur in mixed conifer, and prescribed burns would only occur outside of the MSO breeding season (Mar. 1 – Aug. 31).	This alternative would reduce ladder fuels; maintain snags, downed logs and residual basal area on 131 acres of mixed conifer habitat. No tree cutting would occur in mixed conifer, and prescribed burns would only occur outside of the MSO breeding season (Mar. 1 – Aug. 31).
Effects to Resources – Wildlife: Sensitive Species	This alternative would allow fuels to build up, leading to a potential crown fire if wildfire occurs in the area. Crown fires could remove habitat components (large diameter trees) important to sensitive species.	Implementation of this alternative would improve habitat conditions for northern goshawk prey species and reduce potential for a crown fire if wildfire occurs in the area. This alternative proposes permanent openings surrounding rooting zone which will cause fragmentation that could reach levels decreasing goshawk prey availability and increasing inter-specific competition, as well as direct predation of goshawk young. This alternative does not meet forest plan direction for the northern goshawk.	This alternative would treat the dense, overstocked stands of ponderosa pine in the project boundary to the standards set forth in the Cibola forest plan. Implementation of this alternative would improve habitat conditions for both the northern goshawk and its prey species and meet forest plan direction for the northern goshawk.
Effects to Resources – Wildlife: Management Indicator Species (MIS)	Habitat would not be improved since there would be no change to tree age and class structure, and the existing dense forest would not provide understory forage. Large trees would not be protected from drought and fire effects. Project-level populations of MIS are not expected to change. In the long term, not taking any action would not affect the forest-level population or habitat trend of MIS unless cover and forage habitat were completely removed as a result of a uncharacteristic wildfire.	In general there would be no change in the population or habitat trend of MIS at the forest level. Implementation of this alternative would result in short-term displacement due to treatment activity (noise and human presence). Snags used by cavity nesting MIS birds would be retained. In the long term, forage condition and availability would improve for all species due to reduced canopy cover and retention of oaks and other shrubs. The risk of stand-replacing wildfire would be reduced.	In general there would be no change in the population or habitat trend of MIS at the forest level. Implementation of this alternative would result in short-term displacement due to treatment activity (noise and human presence). Snags used by cavity nesting MIS birds would be retained. In the long term, forage condition and availability would improve for all species due to reduced canopy cover and retention of oaks and other shrubs. The risk of stand-replacing wildfire would be somewhat reduced.

Topic	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Effects to Resources – Wildlife: Migratory Birds	No change in habitat condition in the short term. This alternative would not result in unintentional take of migratory birds due to treatment activities. There would be a decrease in habitat condition in the long term due to continuing habitat loss associated with fire suppression and the potential for uncharacteristic fires.	This alternative would result in unintentional take of migratory birds on potentially one-third of the project area due to tree cutting during the breeding season. Mitigation would be provided to eliminate this effect annually on the remaining two-thirds of the treatment area substantially benefitting migratory birds. This alternative would decrease habitat condition in the short term due to disturbance of adult birds resulting in nest abandonment and direct loss of young in nests, but habitat condition would improve in the long term due to increased foraging potential and decreased disturbance due to wildfire risk. Mechanical treatments would result in high quality older growth forest with a relatively open understory. Taller, older trees in mature habitat would be retained, benefitting these species.	This alternative would result in unintentional take of migratory birds on potentially one-third of the project area due to tree cutting during the breeding season. Mitigation would be provided to eliminate this effect annually on the remaining two-thirds of the treatment area substantially benefitting migratory birds. This alternative would decrease habitat condition in the short term due to disturbance of adult birds resulting in nest abandonment and direct loss of young in nests, but improves habitat condition in the long term due to increased foraging potential and decreased disturbance due to wildfire risk. Mechanical treatments would result in high quality older growth forest with a relatively open understory. Taller, older trees in mature habitat would be retained, benefitting these species.
Effects to Resources – Soils and Watershed	**Soil and Watershed Condition** Direct Effects – No changes in current conditions. Indirect Effects – Continued risk of uncharacteristic wildfire would have an adverse effect on soils in the project area, should a large intense fire occur. Uncharacteristic wildfire would result in adverse effects in soil hydrophobicity, altered infiltration, increased runoff, sedimentation/erosion and nutrient recycling. **Water Quality** Direct Effects – No changes. Indirect Effects – Uncharacteristic wildfire would result in increased sedimentation and associated effects decreasing to undetectable levels in 10 years.	**Soil and Watershed Condition** Direct Effects – Localized increased erosion/sediment delivery resulting from removal of ground cover. Changes in runoff rates and water yield would not be considerable since the watershed is being treated in implementation phases. Soil moisture would be reduced by exposure to evaporation. Indirect Effects – Overall watershed health, including soil function, would show a steady improvement to desired conditions. These portions of the watershed would be protected from wildfire. Herbaceous ground cover would increase. **Water Quality** Direct and Indirect Effects – There would be little direct or indirect effects on surface water quality from alternative B. There may be some increased sedimentation during runoff events from soil disturbance and road use within the project area. Since storm runoff waters often include sediment, it is not	**Soil and Watershed Condition**—Alternative C is similar to alternative B, except that no permanent openings would be created in the piñon-juniper and ponderosa pine vegetation types. Temporary openings would be created on 10 percent of these two vegetation types. Except for steep slopes, soil disturbance could occur on the soils below these two vegetation types as a result of the proposed thinning activities. Using the same assumptions to calculate acres of ground disturbance, proposed activities relating to this alternative would lead to less soil disturbance than alternative B. **Water Quality**—There would be little direct or indirect effects on surface water quality from alternative C. There may be some increased sedimentation during runoff events from soil disturbance and road use within the project area. Since storm runoff waters often include sediment, it is not likely to be detectable in these

Topic	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
	Riparian Resources and Spring Flows Direct Effects – In the absence of uncharacteristic wildfire, riparian resources would remain stable. Indirect Effects – Uncharacteristic wildfire would decrease watershed stability and increase debris flows and soil movement. Recovery of vegetation would vary by fire intensity.	likely to be detectable in these flows. The creation of permanent and temporary openings across up to 60 percent of the project area would increase water reaching the surface, leading to more runoff. **Riparian Resources and Spring Flows** Direct Effects – None due to utilization of buffers. Indirect Effects – Protection of riparian areas by reducing the risk of wildfire.	flows. The creation of temporary openings on 10 percent of the project area would increase water reaching the surface, leading to more runoff. **Riparian Resources and Spring Flows** Similar to alternative B.
Effects to Resources – Recreation	Direct Effects – Little perceived change. No immediate impact on recreational visitors would be noticed. Indirect Effects – Uncharacteristic wildfire is a greater risk in the no action alternative. A wildland fire in the area would displace users, possibly for many years. Without fire or treatment, fuel loads would likely increase, increasing the risk of wildfire.	Direct Effects – Temporary closure of roads or trails to recreation use. Some recreation visitors would shift their use to trail and recreation site locations outside the project boundary. Some unofficial trails would be eliminated due to slash debris. People using designated trails and the wilderness near the project boundary would likely hear chain saws running, and may encounter other noise, dust, and smoke related to treatments. This may decrease the quality of their hiking experience for the duration of the project. Residents on adjacent lands are likely to hear chain saws, and may observe noise, dust, and smoke during project treatments. This could be a concern to area residents. Indirect Effects – Effects include displacement of recreational visitors because of noise, dust, slash, and other harvest related effects in the vicinity of recreation sites and trails. Short-term reduction in visitation may also result from publicity through local and regional media about project area issues and actions. Some recreational visitors would shift their use to trail and recreation site locations outside the project boundary. Increased tread width and additional user trails are possible.	Direct Effects – Same as alternative B. Indirect Effects – Same as alternative B.

Chapter 3. Affected Environment and Environmental Consequences

This section summarizes the physical, biological, social, and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. Complete USFS specialist reports for the USFS portions of the project area are available in appendix C.

Fuels and Fire Behavior

Historic Conditions of Forest Types and Fire

Historically, frequent, low intensity surface fires burned throughout the majority of the Middle Rio Grande valley encompassing the Sandia and Manzano Mountains, creating a mosaic of different stages of vegetative structure across the landscape (Baisan and Swetnam 1997). Patterns of widespread and frequent (every 5 to 10 years) surface fires in these areas have been documented by a number of authors (Cooper 1960; Dietrich and Swetnam 1984) to have occurred prior to 1880 when increased land use and grazing became a dominant force in these areas.

Beginning in the early 1900s, the Federal policy for handling wildland fire leaned heavily toward suppression, and over the years many Federal agencies have adopted fire suppression as the proper means for protecting the Nation from wildfire. As a result, many areas now have excessive fuel buildups, dense and continuous vegetative cover, and tree and shrub encroachment into open grasslands. In addition, contemporary population growth has led to increased development close to the WUI and increased the number of residents and structures at risk from wildfire.

Ponderosa Pine Forest

In a study of the Manzano Mountains, Baisan and Swetnam (1997) found that in the late eighteenth to early nineteenth centuries, the mean fire return interval (FRI) for this area (around Capilla Peak and Canyon de Turrieta), as recorded in tree ring surveys, was 7.4 years. From the synchrony and spatial pattern of scarred trees on these ponderosa pine and dry mixed conifer sites, the authors hypothesized that fires were largely surface fires covering large areas. Generally, estimates of FRI in ponderosa pine forests range from a minimum of about 2 years to a maximum of nearly 40 years, and many agree that fires were frequent and generally of low severity (Cooper 1960; Covington and Moore 1994; Richardson 1998). According to Cooper (1960), crown fires were not a component of the historical fire regime. The majority of fires occurred in late spring and early summer, before the onset of the summer monsoons (Hunter et al. 2007). Local deviations from this general rule are also recorded (Hunter et al. 2007) and on a landscape scale a mixture of open woodlands, meadows, and more dense forests are typical of this forest type (Savage 1991). The effects of fire exclusion on forest structure are thought to be most profound in forests that previously sustained frequent, low intensity surface fires (Westerling et al. 2006), and it is likely that fire exclusion was a primary cause of departure from historical conditions in ponderosa pine forests. For the most part, frequent fire consumed fuels on the ground surface and culled young trees to maintain an uneven age distribution and mosaic pattern throughout the forest (Allen et al. 2002). Frequent fire disturbance maintained an open, park-like forest structure with canopy openings and an abundant herbaceous and shrubby understory (Weaver 1947; Cooper 1960; Biswell 1973).

Mixed Conifer Forests

Often forest patches affected by low- and high-severity fire are closely juxtaposed in a transition zone made up of a forest type known as mixed conifer (Fulé et al. 2003). Fire histories in mixed conifer forests vary with forest composition, landscape characteristics, and human intervention, but tend to exhibit mixed-severity fire regimes, with both low intensity surface fires and patchy crown fires (Touchan et al. 1996). Mixed-severity fire regimes are the most complex fire regimes in the western United States because of their extreme variability (Agee 1998). A mixed-severity fire regime exists where the typical fire, or combination of fires over time, results in a complex mix of patches of different severity, including unburned, low severity, moderate severity, and high severity (Agee 2003).

Ponderosa pine was once more prevalent in many mixed conifer forests with relatively open stand structures, but fire suppression has allowed the development of dense sapling understories, with regeneration dominated by the more fire sensitive Douglas-fir, white fir, and Engelmann spruce (*Picea engelmannii*). Herbaceous understories have been reduced by denser canopies and needle litter, and nutrient cycles have been disrupted. Heavy surface fuels and a vertically continuous ladder of dead branches have developed, resulting in increased risks of crown fires (Touchan et al. 1996).

Grasslands

Many authors have suggested that the historical fire return intervals for grasslands throughout the 17th to early 19th centuries may have been every 5 to 10 years (Leopold 1924; Swetnam et al. 1992; McPherson 1995). Fire suppression policies may have contributed to declining fire frequency in this cover type as well, but other factors may have contributed. Intensive livestock grazing around the time of the Civil War is thought to have been responsible for a decline in grassland fires (West 1984). Heavy grazing reduced the fuel available to propagate fire spread and also reduced competition with herbaceous plants, tipping the balance in favor of the woody species. Woodland encroachment, increased tree density, and altered fire behavior characterize many former grasslands in the project area. Much of what is now piñon-juniper woodland in the project area may once have been juniper savanna, dominated by grasses and forbs and containing no more than 10 to 15 trees per ha (Brockway et al. 2002). Once woody plants become dominant, their long lifespans and their ability to extract both shallow and deep soil moisture can maintain a woodland condition indefinitely (Burgess 1995). Frequent fire plays a significant role in grassland nutrient cycling and successional processes, and long-term exclusion may produce irreversible changes in ecosystem structure and function (McPherson 1995).

Piñon-Juniper Woodlands

One of the most common vegetative communities in the project area is piñon-juniper woodland. These woodlands are some of the most poorly understood ecosystems in terms of fire regimes, but recent research suggests that fire may have been a less common and less important disturbance agent in piñon-juniper woodlands as compared with adjacent ponderosa pine and grassland ecosystems. In a recent review of piñon-juniper disturbance regimes, Romme et al. (2007) subdivided the piñon-juniper cover type into three subtypes: areas of potential woodland expansion and contraction, piñon-juniper savannas, and persistent woodlands. These categories are helpful in separating the broad piñon-juniper cover type into distinct communities, which are subject to different climatic, topographic, and disturbance conditions.

As mentioned previously, several grasslands in the project area have been colonized by trees as a result of a complex interplay of environmental factors. It is believed that greater landscape heterogeneity existed previously in many of these areas that are now uniformly covered with relatively young trees (Romme et al. 2007).

Persistent woodlands, characteristic of rugged upland sites with shallow, coarse soils tend to have older and denser trees. Herbaceous vegetation within this community was typically sparse. Research from persistent woodlands provides strong evidence to support the theory that the natural fire regime of piñon-juniper woodlands was dominated by infrequent but high-severity fires and that FRIs may have been on the order of 400 years (Baker and Shinneman 2004; Romme et al. 2007).

In contrast to ponderosa pine, piñon pines and junipers produce relatively small volumes of litter. Understory fuels, either living or dead, must be sufficiently contiguous to carry a low intensity surface fire. In the absence of fine surface fuels, fires that spread beyond individual trees were most likely wind driven and spread from crown to crown (Romme et al. 2007). Fire extent was greatest in higher density woodlands and was limited by both fuels and topography in sparse, low productivity stands on rocky terrain. These hypotheses are supported by the fact that wind-driven crown fire was observed locally in some areas of dense piñon-juniper woodland during the Ojo Peak Fire in November 2007. Most scientists agree that fire was more common in savannas and areas of expansion and contraction than it was in persistent woodlands, but debate remains on the exact range of fire frequency. Overall, frequent, low intensity surface fires were not the predominant fire regime in piñon-juniper woodlands. Therefore, fire exclusion may not have altered forest structure as dramatically in this forest type.

Fire Regimes and Fire Regime Condition Classes

In order to classify, prioritize, and plan for fuels treatments across a fire management region, methods have been developed to stratify the landscape based on physiographic and ecological characteristics.

Fire Regime Classifications

A natural, or historical, fire regime (FR) is a general classification describing the role fire would play throughout a landscape in the absence of modern human intervention but including the influence of burning by Native American groups (Agee 1993; Brown 1995; Hann et al. 2003).

FR classes are based on the average number of years between fires (also known as fire frequency or mean FRI) combined with the severity (i.e., the amount of vegetation replacement) of the fire and its effect on the dominant overstory vegetation (Hann et al. 2003).

The five FR classes are:

Fire Regime I – This system includes the lower and mid-elevation forested plant associations, ponderosa pine, and Douglas-fir. These regimes historically had a high FRI (0–35 years) preventing high fuel loadings and produced limited layers within the system. The net result was more frequent and less severe fire occurrence.

Fire Regime II – This system is also in the lower to mid-elevation range; however, it includes grassland plant associations. These regimes have a high FRI (0–35 years) with a mix of low-

and high-severity fires. This system includes piñon-juniper, mountain mahogany, and other dry mountain shrub species.

Fire Regime III – This system consists of forest plant associations located at mid-elevation. Species found there are consistent with higher moisture availability such as Douglas-fir and higher elevation bunch type grasses and forbs. The FRI is 35 to 100+ years with a mix in fire severity. Stand replacement fire may occur but are usually rare events. This regime is typically a heterogeneous landscape.

Fire Regime IV – This system is characterized by forested species at mid to high elevation. Spruce and subalpine fir plant associations are included within this group. This regime is generally considered as having a fire free period of 100+ years. This usually results in a stand replacement, high-intensity fire occurrence.

Fire Regime V – This is a high elevation system, and the plant associations depend on high local moisture availability. Due to the very long FRI in excess of 200 years, this regime is generally considered fire free. Rock and lack of fuels and other combinations of the physiographic setting typically inhibit propagation of fire.

Fire Regime Condition Class (FRCC)

The FRCC is a measure of the degree of departure from reference conditions, possibly resulting in changes to key ecosystem components, such as vegetation characteristics (e.g., species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances, such as insect and disease mortality, grazing, and drought (Hann et al. 2003). Several factors, such as fire suppression, timber harvesting, livestock overgrazing, introduction and establishment of nonnative species, introduced disease and insects, and other management activities are all possible causes of this departure from historical conditions (Schmidt et al. 2002; Hann et al. 2003).

The three FRCC rankings are:

1. *FRCC 1* areas are generally within or near the historical range and do ***not*** predispose the system to risk of loss of key ecosystem components. Vegetation groups are intact and functioning within the natural range of variability.
2. *FRCC 2* areas develop as one or more FRIs are missed, resulting in continued growth of understory and species reproduction. Vegetation composition and structure have a ***moderate*** departure from the natural range of variability and are predisposed to risk or loss of key ecosystem components. Fires will burn with greater intensity making them difficult to suppress and will result in changes in biodiversity, soil productivity, and water quality.
3. *FRCC 3* can be described as a ***significant*** departure from the natural range of variability and predispose the system to a high risk of losing key ecosystem components. Large-scale insect damage and disease are usually present and may become uncharacteristic while increasing available fuels. Extreme fire behavior is typical with this departure state and usually will result in a complete stand replacement occurrence.

FRCC describes the overall vegetative condition of the ecosystem comparing the current condition to historical condition. In addition to describing the FRCC, fire regimes categorize major fuel types and the natural FRI.

Wildland Fire Hazard, Risk, and Occurrence

In the wildland fire vernacular, "hazard" generally refers to wildland fuel in terms of its contribution to fire behavior and its resistance to control when combined with terrain and weather features. Fire "risk" refers to the chance of a wildfire starting, as determined by the presence and activity of causative agents (National Wildfire Coordinating Group 1998) and other variables that may impact people living in these areas such as dead end roads and proximity to fire response facilities.

Lightning ignition is historically the most common cause of fires within the project area. Lightning is widespread throughout monsoon season, which usually takes place from June through August. Most fires are detected early and suppressed before they gain acreage; however, given the right conditions, some fires may grow large and become difficult to suppress, as was seen with the Ojo Peak, Trigo, and Big Springs Fires of 2007 and 2008. Fire occurrence within the project area has fluctuated over the last 40 years with high frequency years recorded in 1974, 1976, 1990, 2000, and 2005 (Figure 10).

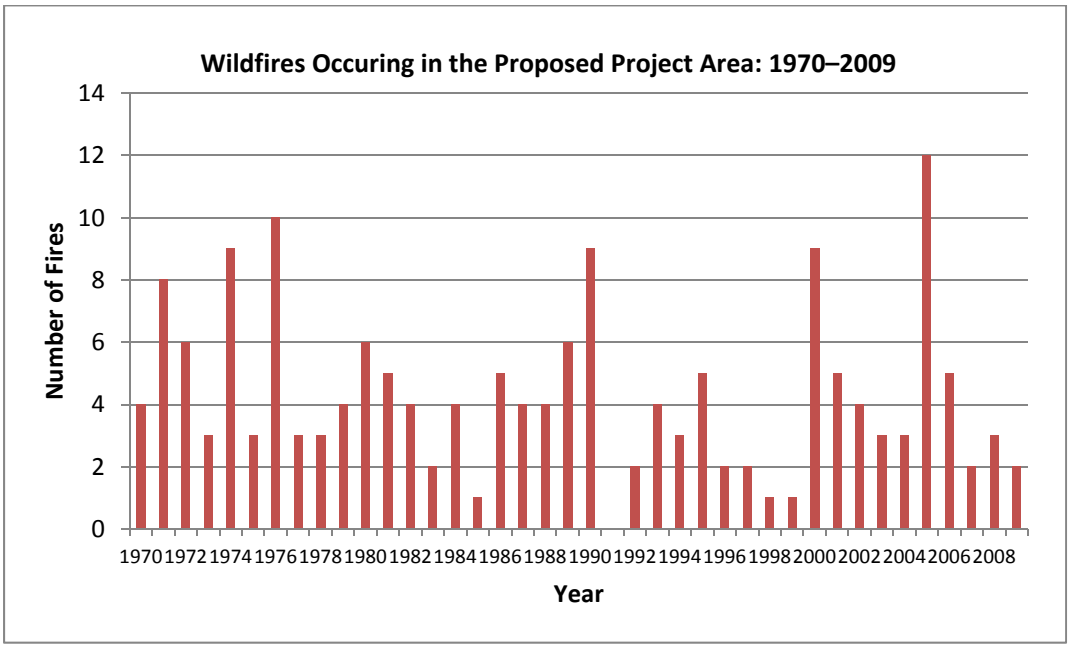

Figure 10. Annual fire occurrences within the proposed project area and 5 miles from the project boundary from 1970 to 2009 (Source: Bureau of Indian Affairs, State of New Mexico and Cibola National Forest wildfire records).

From 1970 to 2009, there were 165 fires that occurred in the proposed project area or within 5 miles of its boundary. The majority of the fires have taken place in the piñon-juniper and ponderosa pine communities. The highest incidence of fire occurrence is along the WUI corridor of the Manzano Mountains where a large number of communities and structures exist. The Ojo

Peak Fire that burned 7,500 acres in November 2007 forced the evacuation of approximately 100 families and eventually burned 7 structures, including 3 homes. The fires also impacted local watershed values as drainages were choked with ash. The Trigo Fire in May 2008 burned 13,709 acres and destroyed 59 homes and 40 other structures. In June 2008, the Big Springs Fire was ignited by lightning and burned 5,478 acres and destroyed six homes in the Manzano Mountains just north of the final Trigo burn perimeter. All fires occurred in the Cibola NF&Gs, and surrounding private land and exhibited extreme fire behavior including crown fire spread, spotting, and torching.

A primary concern of residents in the WUI is the growing number of human-caused ignitions, particularly with the development and improvement of roads, residences, and recreational opportunities in wildland areas. Human-caused fires account for approximately 58 percent of the wildfires recorded in Torrance and Bernalillo Counties from 1970 to 2009, and approximately 82 percent of the human-caused fires within that time period have taken place within the last 15 years (Famweb 2010). Although the majority of fires take place during the summer months, the recent increase in the number of human-caused ignitions has resulted in an increase in fire numbers throughout the year.

Priority treatment areas for this project were developed with the aid of a fire risk/hazard assessment that was developed as part of the Torrance County, East Mountains, and Middle Rio Grande Bosque CWPPs (SWCA 2006, 2008a, 2008b). The risk/hazard assessment illustrates the extreme risk associated with the project area, particularly around the Pueblo's eastern boundary, the Chilili western boundary, and USFS lands in the Dog Head region and along the southern boundary of the Pueblo (see appendix A). This extreme risk is associated with the potential for uncharacteristic fire behavior such as crown fire runs, heightened spot fires, extreme fire line intensity and flame lengths, and rapid rates of fire spread. This kind of extreme fire behavior was demonstrated during the 2007 and 2008 fire season as described above. In order to mitigate the potential for extreme fire, the Torrance County and East Mountain CWPPs recommended hazardous fuels reduction treatments across all jurisdictions involved in this collaborative effort. These recommendations are incorporated into the treatments proposed in this project.

Pueblo and Chilili Affected Environment

Existing Conditions

For the modeling of existing conditions, as well as modeling the alternatives in terms of potential fire behavior, two different fuel model sets were used. Rothermel's (1972) guide to fire spread uses a 13-fuel model set, while Scott and Burgan (2005) have developed a 40-fuel model set. Appropriate models were chosen from both sets that most closely match the conditions on the ground both pre- and post-treatment.

Piñon-Juniper Woodland

The piñon-juniper woodland type occupies approximately 572.6 acres of the analysis area. This forest type is typically a mix of piñon pine and one-seed/Rocky Mountain juniper (*Juniperus scopulorum*) with scattered ponderosa pine, alligator juniper, wavyleaf oak (*Quercus undulata*), and Gambel oak. The dominant habitat type is piñon pine/blue grama (*Bouteloua gracilis*). Scott and Burgan (2005) Fuel model SH7 (equivalent to the original Rothermel (1972) Fuel Model (FM) 6) is best representative of this piñon-juniper fuel in the project area. The primary carrier of fire in SH7 is woody shrubs and shrub litter with a heavy shrub load with depths of 4 to 6 feet.

Spread rates are high and flame lengths are very high in this fuel type particularly with higher wind speeds over 8 miles per hour. The piñon-juniper throughout the project area is thick with continuous canopies with potential for extreme fire behavior.

Ponderosa Pine Forest

The ponderosa pine forest type occupies approximately 1,895 acres of the analysis area. Typically this is the “dry” end of the ponderosa pine forest type and has scattered piñon pine and one-seed/alligator juniper, as well as Gambel/wavyleaf oak. The dominant habitat type is ponderosa pine/Gambel oak. Timber Understory 5 (TU5) (equivalent to the original Rothermel (1972) FM 9) is best representative of the ponderosa pine forest type. The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory, in this case made primarily of Gambel oak and ponderosa pine regeneration and small diameter pole-sized trees. Spread rate is moderate; flame length is moderate.

Mixed Conifer Forest Type

The mixed conifer forest type occupies only 36.2 acres of the analysis area and is made up of ponderosa pine, Douglas-fir, and white fir with a Gambel oak understory. The natural fire regime, which created a mosaic of age classes across the landscape, has not been allowed to burn in this type since the early 1900s. The type, therefore, is becoming dense and homogenous across the landscape. Downed woody fuel loadings are unnaturally high. Current conditions are such that susceptibility to insects and diseases is increasing. The probability of an uncharacteristic, stand-replacing fire in the mixed conifer forest type is high. Fuel model TL9 (equivalent to the original Rothermel (1972) FM 10) is best representative of the mixed conifer forest type in the project area. The primary carrier of fire in the TL9 model is heavy needle drape. Spread rate is moderate and flame lengths are moderate.

Fire Regime Condition Class

LANDFIRE data collected as part of the “Torrance County CWPP” (SWCA 2008b) suggest that lands within the Pueblo and Chilili portions of the project area fall almost entirely into FRCC 3. FRCC 3 lands are considered to be an extreme departure from historic reference conditions, possibly resulting in changes to key ecosystem components, such as species composition, structural stage, canopy closure, fuel composition, fire frequency and severity, and other associated disturbances.

Crown Fire Potential

Wildland fire is classified into ground (subsurface), surface, or crown categories based on where the fuel strata burning occurs (Pyne et al. 1996). Crown fire is further subdivided into passive, active, and independent (Van Wagner 1977). Passive crown fires occur when surface fire transitions into the crown, largely as a consequence of wind and crown base height (c.b.h) (Scott and Reinhardt 2001). Active crown fires burn the entire surface canopy fuel complex and are contingent upon the canopy bulk density of the stand—the density of the foliage and fine twigs in the canopy. Passive crown fire may not occur if the c.b.h. is high, but active crown fire could occur independently of passive crown fire if there is high crown bulk density (c.b.d.) and continuous canopy cover (Roccaforte et al. 2008).

The average c.b.h. and presence of ladder fuels can influence the transmission of surface fire into the canopy initiating crown fire. Crown base height is the vertical distance from the ground to the bottom of the live crown of an individual tree. When trees with low crown base heights are removed through fuels reduction treatments like thinning from below or prescribed burning, the potential for crown fire spread is reduced (Scott and Reinhardt 2001). The average c.b.h. across the Pueblo and Chilili portions of the project area for all species is 15.1 feet (11.2 feet on Pueblo lands and 19 feet on Chilili lands).

Ladder fuels are the arrangement of vegetation that provide a vertical structure allowing fire to move from the surface up into the canopy. Fuel reduction treatments that focus on the removal of small diameter trees help to reduce ladder fuels. When an overabundance of ladder fuels dominates the stand, the average c.b.h. is lowered increasing the likelihood for crown fire transmission. The project area has numerous pole-sized trees and shrubs and areas with abundant regeneration that contribute to heavy concentrations of ladder fuels, thus the risk of a crown fire is high. Following treatment, prolific regeneration that could produce future ladder fuels needs to be controlled.

Cibola NF&Gs Affected Environment

Analysis Method

In order to determine the existing conditions, common stand exams and Brown's transects were used to collect vegetation and fuels data. This data and field reconnaissance was accomplished by professional foresters, fuel specialists, and fire management officers. Vegetation data within the project area were collected in 2011. Within the Manzanita/Manzano Ecosystem Management Area, inventory data were collected in 1997, 2003, 2005, and 2006 and are available over an estimated 60 percent of the area. Where inventory data were not available, information from the "midscale" analysis was used.

The data were used to quantify the following existing conditions: (1) trees density, (2) tons of fuel loading per acre, (3) c.b.h., (4) c.b.d., and (5) tree species composition. All of these metrics were then used to define the current potential for fire behavior.

Forest Vegetation Simulator (FVS) and BehavePlus were used to simulate and model growing conditions and fire behavior over time. BehavePlus was also used to simulate fire behavior at the following three conditions: (1) 50th percentile or normal conditions, (2) 90th percentile or severe conditions, and (3) 97th percentile or extreme conditions.

The BehavePlus fire modeling system is a program that is a collection of mathematical models that describe fire and the fire environment. This program is used to predict surface fire rate of spread, heat per unit area, fireline intensity, flame length, and crown fire transition ratio within the project area.

FSVeg is where the Isleta CFRP existing stand data is stored. These data include, but are not limited to, location and site numeric identifiers, acres, basal area, stand density index, and fuel model. The data are taken from FSVeg and entered into FVS to create a treatment and prescribed fire simulation.

FVS is an individual tree, distance independent, growth and yield model (Dixon 2002). It has been calibrated for specific geographic areas (variants) of the United States (Figure 11). FVS can

simulate a wide range of silvicultural treatments for most major forest tree species, forest types, and stand conditions.

Existing Conditions

The Cibola NF&Gs lands in the Isleta CFRP have three primary stand types: piñon-juniper, ponderosa pine, and mixed conifer. District fire personnel and contractors have conducted fuel transects throughout the project area to gather an overall baseline of tons per acre fuel loading. The findings are that some mortality is occurring due to trees stressed from competition and drought, therefore, they are more susceptible to loss from insects and disease. As trees die and fall over, surface fuel loads increase. In these semiarid systems, where rates of biotic accumulation exceed the normal rate of decay, fire plays a critical role in recycling biomass (Baisan and Swetnam 1995).

Figure 11. Piñon-juniper woodland, note high tree density and continuous vegetative cover

Piñon-Juniper Woodland

The piñon-juniper woodland type occupies approximately 2,600 acres of the analysis area. This forest type is typically a mix of piñon pine and one-seed/Rocky Mountain juniper with scattered ponderosa pine, alligator juniper, wavyleaf oak, and Gambel oak. The dominant habitat type is piñon pine/blue grama.

There is a high confidence that tree density and canopy coverage have increased in many or most persistent woodlands during the 20th century, although the precise magnitude of increase, causes, and geographic applicability are not adequately known. Some of these woodlands are sufficiently open to subdue a running crown fire but dense patches do exist that could sustain this type of fire behavior.

FM 6 is best represented by the existing conditions of the piñon-juniper woodland type (Figure 11). FM 6 is where fires carry through the shrub layer where the foliage is more flammable than FM 5, but this requires moderate winds, greater than 8 miles per hour at mid-flame height. Fire would drop to the ground at low wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of FM 4, nor do they contain as much fuel as FM 4. A broad range of shrub conditions is covered by this model.

Ponderosa Pine Forest

The ponderosa pine forest type occupies approximately 3,900 acres of the analysis area. Typically this is the “dry” end of the ponderosa pine type and has scattered piñon pine and one-seed/alligator juniper, as well as Gambel/wavyleaf oak. The dominant habitat type is ponderosa pine/Gambel oak.

Past management activities and wildfire suppression activities have established unnaturally dense stands of suppressed young trees. This condition threatens any remaining legacy trees through competition and by fueling increasingly extensive crown fires due to vertical continuity of the stand (Covington and Moore 1994; Omi and Martinson 2002). There is a lack of herbaceous understory but plenty of dead pine needles, which are conducive to stand replacement wildfire under severe and extreme weather conditions. Crown fires in the ponderosa pine type are absent in the historic, local, and regional fire scar records (Touchan and Swetnam 1991), indicating that current stand conditions are an aberration attributable to past management and fire suppression activities.

TU5 is best representative of the ponderosa pine forest type (Figure 12). The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory. Spread rate is moderate; flame length is moderate.

Figure 12. Even-aged ponderosa pine stand; note dense tree stocking and lack of herbaceous understory

Mixed Conifer Forest

The mixed conifer forest type (at least 40 percent composition of Douglas-fir and white fir) occupy approximately 131 acres of the analysis area (Figure 13). The natural fire regime, which created a mosaic of age classes across the landscape, has not been allowed to burn in this type since the early 1900s. The type, therefore, is becoming dense and homogenous across the landscape. Downed woody fuel loadings are unnaturally high. Current conditions are such that susceptibility to insects and diseases is increasing. The probability of an uncharacteristic, stand-replacing fire in the mixed conifer forest type is high.

Figure 13. Mixed conifer stand; note abundant regeneration creating ladder fuels

The fuel model that best represents the mixed conifer forest type in the project area is dead and downed fuels, which include greater quantities of 3-inch or larger limbwood resulting from overmaturity or natural events that create a large load of dead material on the forest floor (see Figure 13). The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties.

Fire Regime

Potential vegetative groups have been mapped for the Cibola NF&Gs and are assimilated with fire regimes. The dry mixed conifer forest group including ponderosa pine sites and lower elevation conifer is most closely represented by FR I. The hot, dry shrublands and woodlands group including piñon-juniper is represented by FR II. The mid-elevation mixed conifer group is best represented by FR III. The mid to high elevation spruce-fir vegetative group is represented by FR IV. Finally, the high elevation shrub group including Gambel oak is represented by FR V.

Table 6 displays the fire regimes and existing condition class within the USFS portion of the project area.

Table 6. Fire regimes and condition classes

FR Group	Historic Fire Return Interval	FRCC	Approximate Percentage within the Project Area
I	0–35 years	2	0
I	0–35 years	3	5
II	0–35 years	3	55
III	35–100+ years	3	40
IV	35–100+ years	3	0
V	>200 years	3	0

Crown Base Height and Crown Bulk Density

Crown base height (c.b.h). and crown bulk density (c.b.d.) influence fire behavior and can be directly managed by thinning or similar forest treatments (Graham et al. 1999).

Crown base height is the measurement in feet from the ground to the base of the crown. Often ladder fuels play an important role in establishing a crown fire. Ladder fuels are vegetation arrangements that allow fire to climb up vegetation into the crowns of the overstory. Thinning from below and prescribed burning often result in higher crown base heights, thus reducing the potential for crown fire initiation. The project area has numerous pole-sized trees and areas with abundant regeneration that contributes to heavy concentrations of ladder fuels, thus the risk of a crown fire is high. Using the modeling program BehavePlus, managers can view the possibility of a fire transitioning from the ground to the crowns called transition ratio.

The transition ratio is the surface fire line intensity divided by the critical surface intensity. If the transition ratio is greater than or equal to 1, then the surface fire intensity is sufficient for a crown fire. This is important to analysis to show the potential for a crown fire.

Crown bulk density (c.b.d) is an indicator of the incidence of interlocking crowns, which can tell managers how a crown fire can spread. Crown bulk density is the primary controlling factor of crown fire behavior and it depends on both species composition and stand density (Graham et al. 1999). Crown bulk density is measured in kilograms per meter cubed (kg/m^3) and is the amount of mass in the canopy of a stand. In general, the lower the c.b.d., the higher the wind speed has to be to sustain a crown fire. Crown bulk densities of 0.08 kg/m^3 and above are considered high.

Pueblo and Chilili Environmental Consequences

Alternative A (No Action)

Under alternative A, the potential for extreme wildfire would continue to increase due to increasing fuel loading and potential for disease and mortality. The lands would continue to be in a FRCC of 3, significantly departed from their historical condition. Stand structures that are conducive to crown fire initiation (dense stands with closed canopies, abundant ladder fuels, and low crown base heights) and spread would dominate, and the potential for large, uncharacteristic crown fire that poses a risk to local communities and firefighters would continue. Large fires could become resistant to control and containment within project and jurisdictional boundaries

would be difficult. Adverse impacts to local communities, public safety, and property would remain a constant threat.

Under alternative A, meadow encroachment that has been observed on both Pueblo and Chilili lands would continue unabated. Herbaceous understory production is known to decline as crown cover increases in the overstory of piñon-juniper woodlands (Arnold et al. 1964; Brockway et al. 2002). If meadow areas are continually encroached upon, herbaceous biomass, cover, and diversity would continue to decline, impacting grazing for both wildlife and domestic species. Furthermore a closed canopy of woodland species increases the threat of rapid crown fire spread.

Alternative B (Proposed Action)

Alternative B would create a stand structure that would reduce the potential for uncharacteristic wildfire, thereby reducing the risk that wildfire poses on local communities. By selectively removing trees, the project area would exhibit a stand structure with a lower stand density and lower canopy bulk density. The proposed treatment requires that trees be limbed up (through thinning or prescribed fire) and small trees removed to raise the c.b.h. and, therefore, limit transmission of fire through ladder fuels. This method has proven the most successful in reducing fire severity in other studies across the West (Cram et al. 2006; Omi and Martinson 2007; Strom and Fulé 2007) by reducing crown fire initiation and limiting the opportunity for sustained crown fire spread.

The treatment provides a diversity of habitat types for wildlife by requiring the clumping of trees in groups across the landscape. By breaking up the continuous cover of trees, this also serves to slow wildfire spread. Areas where the canopy is removed may experience an increase in fine fuels through growth of the herbaceous layer; such conditions would support the spread of surface fire. However, by reducing tree density and raising crown base heights the potential for crown fire to be generated from surface fire is limited and fire severity and resistance to control is greatly reduced, thus maintaining firebreak integrity.

The effectiveness of the treatment in reducing the potential for uncharacteristic crown fire is also dependent on slash treatment and management of residual materials; thin-only treatments where ground slash has not been treated are found to be ineffective in reducing fire severity (Omi and Martinson 2007). Thinning followed by pile burning and/or broadcast burning as proposed here should ensure that the treatment effectively reduces the buildup of hazardous fuels. Similarly wood utilization by Pueblo and Chilili residents would ensure that residual timber that could increase fuel loading is removed offsite.

With a reduction in fire behavior, if wildfires are initiated in the project area, the probability of controlling them before they gain size is greatly increased and public and firefighter safety is, therefore, improved significantly. In order to ensure that the hazardous fuel reduction treatments are effective over the long term and the firebreak integrity ensured, regular maintenance would be needed to selectively remove regenerating trees and sprouts from the treatment area. Studies have shown that treatments that reduced surface fuels were effective for up to a decade in mixed conifer forests (Omi and Martinson 2007). Since Gambel oak is the dominant understory species on Pueblo lands, selective herbicide treatment of oak stumps would help to maintain treatment areas and mitigate regrowth of this species. Project partners should ensure that maintenance activities are dictated by constant monitoring of treatment areas; trigger points should be set beyond which maintenance activities should commence.

Meadow enhancement proposed under alternative B would remove degraded piñon-juniper cover and convert woodland habitat to a more open grassland ecosystem. Similar treatments in the Mountainair RD of the Cibola NF&Gs have shown that overstory removal produces an increase in foliar cover, biomass, and diversity through time (Brockway et al. 2002). Graminoid species would be expected to increase significantly within a year of treatment, reducing the degree of soil exposure and potential for erosion post treatment. Based on similar treatments, foliar nutrient status and soil chemical properties are expected to remain the same following treatment, and rates of soil erosion are expected to be low (Brockway et al. 2002). Removal of overstory piñon-juniper woodland also opens up the canopy and reduces the potential for woodland crown fire spread. Although understory herbaceous species would add to the fine fuel mix, fire behavior in grasslands is less intense in comparison to timber fuels, so meadow enhancement could provide tactical areas for suppression activities and firefighter safety zones. Managed roads and trails could also be effectively utilized for fire line construction during an emergency or during fuel treatment projects. During fuel treatments, there is increased human activity and equipment that could start fires. However, that can be mitigated by starting the project during favorable weather conditions and limiting it to certain times of the year.

Alternative C

Alternative C is only proposed for USFS lands and is not analyzed for Pueblo and Chilili lands.

Cibola NF&Gs Environmental Consequences

Alternative A (No Action)

The no action alternative would result in no treatment of the existing forest vegetation conditions. The forest ecosystem would remain susceptible to the adverse effects of uncharacteristic wildfires consistent with increased population, public use, and fuel loading, as well as vulnerable to insect/disease outbreaks.

Stand diversity would remain low and competition for water, nutrients, and space would remain high. All developments and resource values in this project area could be lost in a single burning period. Public and firefighter safety would not improve in situations where wildfire ignites.

The following tables (table 7–table 9) display fire behavior based on existing conditions through BehavePlus simulations for each forest type within the project area.

Table 7. Ponderosa pine, fuel model TU5

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	2.7	4.0	4.7
Heat per unit area (BTU/square feet)	2,705	3,078	3,233
Fireline intensity (BTU/square feet/second)	134	224	276
Flame length (feet)	4.3	5.4	6.0
Transition ratio	1.27	2.13	2.62

BTU = British thermal units

Table 8. Piñon-juniper, fuel model 6

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	7.2	12.4	16.1
Heat per unit area (BTU/square feet)	486	590	640
Fireline intensity (BTU/square feet/second)	64	134	186
Flame length (feet)	3.1	4.3	5.0
Transition ratio	0.77	1.60	2.26

BTU = British thermal units

Table 9. Mixed conifer, fuel model 10

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	2.2	3.2	3.8
Heat per unit area (BTU/square feet)	1,365	1,571	1,656
Fireline intensity (BTU/square feet/second)	55	93	114
Flame length (feet)	2.9	3.6	4.0
Transition ratio	0.36	0.61	0.74

BTU = British thermal units

Alternative B

This action alternative is based on the fuels reduction prescription and would have fewer trees, especially small diameter trees that act as ladder fuels and increase the risk of torching, and an open canopy with lower c.b.d, which reduces the risk of sustained crown and overall fire behavior. The ecosystem should be resilient to natural disturbance events, including fire, drought, disease, and insect infestations. A desired future condition would allow fire to play its natural role in the environment and be maintained in a manner to alleviate resistance to control. Desired future conditions would mimic natural ecosystem traits, having a diverse mosaic of fuels that are arranged in a fashion not subject to uncharacteristic wildfire.

The following tables (table 10–table 12) for each forest type with the project area display fire behavior based on the proposed action for alternative B and BehavePlus simulations.

Table 10. Ponderosa pine, fuel models TL8 (60 percent) and GR2 (40 percent)

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	4.3	8.2	10.8
Heat per unit area (BTU/square feet)	733	860	913
Fireline intensity (BTU/square feet/second)	31	75	114
Flame length (feet)	2.2	3.3	4.0
Transition ratio	0.29	0.13	0.19

BTU = British thermal units

Table 11. Piñon-juniper, fuel models 8 (60 percent) and GR1 (40 percent)

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	2.6	4.7	6.6
Heat per unit area (BTU/square feet)	195	233	250
Fireline intensity (BTU/square feet/second)	7	16	26
Flame length (feet)	1.1	1.6	2.0
Transition ratio	0.02	0.04	0.06

BTU = British thermal units

Table 12. Mixed conifer, fuel model TL5

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	1.0	1.6	2.0
Heat per unit area (BTU/square feet)	357	434	471
Fireline intensity (BTU/square feet/second)	7	13	17
Flame length (feet)	1.1	1.4	1.6
Transition ratio	0.02	0.04	0.06

BTU = British thermal units

Alternative C

This action alternative is a traditional thin from below prescription. The specifics of the prescription can be found in greater detail in the “Water Resources” section, as well as the

"Proposed Action." This alternative would also create a stand structure, reducing the potential for crown fire and fire behavior.

The following tables (table 13–table 15) for each forest type within the project area display fire behavior based on the proposed action for alternative C and BehavePlus simulations.

Table 13. Ponderosa pine, fuel models TL8 (90 percent) and GR2 (10 percent)

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	2.0	3.5	4.4
Heat per unit area (BTU/square feet)	733	860	913
Fireline intensity (BTU/square feet/second)	31	75	114
Flame length (feet)	2.2	3.3	4.0
Transition ratio	0.29	0.13	0.19

BTU = British thermal units

Table 14. Piñon-juniper, fuel models 8 (90 percent) and GR1 (10 percent)

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	1.0	1.6	2.2
Heat per unit area (BTU/square feet)	195	233	250
Fireline intensity (BTU/square feet/second)	7	16	26
Flame length (feet)	1.1	1.6	2.0
Transition ratio	0.02	0.04	0.06

BTU = British thermal units

Table 15. Mixed conifer, fuel model TL 5

Attribute	50th Percentile	90th Percentile	97th Percentile
	Normal Conditions	Severe Conditions	Extreme Conditions
Rate of spread (chains/hr)	1.0	1.6	2.0
Heat per unit area (BTU/square feet)	357	434	471
Fireline intensity (BTU/square feet/second)	7	13	17
Flame length (feet)	1.1	1.4	1.6
Transition ratio	0.02	0.04	0.06

BTU = British thermal units

Cumulative Effects on All Jurisdictions

For this project, the cumulative effects area was considered to be the project area and ongoing or reasonably foreseeable actions that could affect fire and fuels. These actions include the planning of the Isleta CFRP project that is surrounded by multiple jurisdictions such as the Pueblo, Chilili, private land, and the U.S. Department of Defense.

Fuel break treatments along the eastern boundary of the Pueblo, as well as adjacent landscape-scale treatments on the western boundary of Chilili (close to the USFS Dog Head area) as part of a previous CFRP project, have also reduced fuel loading along the common boundaries. These treatments have improved suppression capabilities on that land should a fire occur.

Previous treatments on Cibola NF&Gs lands were implemented in 2001 within David Canyon. These treatments were never maintained and are no longer effective to accomplish the purpose and need of this project. Previous treatments were also implemented within the last 10 years in the northern Manzano portion of the project on Cibola NF&Gs lands; however, these treatments were small, isolated wildlife opening treatments that did not provide for landscape treatments and are not effective to accomplish the purpose and need of this project.

In addition to the treatments being proposed under the Isleta CFRP on Cibola NF&Gs lands, the Cibola NF&Gs is currently in the initial phases of an environmental analysis on portions of the Sandia RD that would connect to the Isleta CFRP project area. This area is referred to as the Cedro project area and encompasses 13,500 acres. Once the environmental analysis is accomplished on the Cedro project area, this would allow contiguous treatments to occur.

Soils

The project area is located in the highland section of the Basin and Range Province physiographic zone along the eastern half of Bernalillo County and western portions of Torrance County, New Mexico. Specifically, the project area is on the eastern portions of the Manzano and Manzanita Mountains, just south and east of Albuquerque.

Climate

In the area covered by this analysis, precipitation seasonality varies due to the influence of the Arizona monsoon (a.k.a., the southwest monsoon). Areas affected by the southwest monsoon receive greater amounts of summer precipitation from moist air masses derived from the Gulf of Mexico and Gulf of California. Most of the annual precipitation comes in the form of rain originating from convective thunderstorms during the months of July through September. Higher elevations of the analysis area may also receive some cool season moisture in the form of snow. In addition to temporal variability of precipitation, spatial variability of precipitation is also a characteristic within the analysis area. Topography and storm type are two factors that control the spatial variability of precipitation. At the local scale, precipitation tends to increase with elevation due to the effects of orographic lifting. Summer precipitation tends to have more spatial variability than winter frontal storms.

Within the analysis area, average annual precipitation is generally less than 14 inches per year. Precipitation intensity (amount of water per unit of time) tends to be very high in this part of the state due to the convective nature of the storms. For example, the intensity of precipitation at the nearby Sandia Park weather stations (35.2167 N 106.45W, 10,459 feet) shows that the 2-year, 1-

hour storm can produce upward of 0.85 inch of water. Antecedent soil and vegetation conditions can help determine whether this amount of precipitation results in beneficial infiltration or erosion generating runoff.

Droughts are common in New Mexico due to the overall low amount of annual precipitation and the previously described spatial and temporal variability of that precipitation. Regional precipitation patterns are regulated by global-scale fluctuations in ocean surface temperatures. Over the long term, the Pacific Decadal Oscillation tends to influence the precipitation regime in this part of New Mexico. Studies of 20th century precipitation patterns show that there have been three distinct precipitation regimes. The first was a relatively wet period from 1905 to 1941. Next was a dry period from 1942 through 1977. This was followed by a period of wet from 1978 through 1998. The years since 1998 have marked a shift back to a dry period and suggest that New Mexico could be in for another 1 to 3 decades of drier than average conditions. This information has important implications on ecosystem management due to the influence of precipitation on disturbance regimes and the capacity of ecosystems to resist or recover from those disturbances.

Pueblo and Chilili Affected Environment

Existing Conditions

The north-south oriented Manzano and Manzanita Mountains formed as part of the eastern flank of the Rio Grande Rift (McMillan et al. 2000). The soils within the project area are primarily loams and rock outcrops, with some deep, well drained soils and little clayey soils (table 16).

Table 16. Soils in the project area

Soil Type	Acres of Project Area	Characteristics
Laporte-Rock outcrop complex (LBE)	857.1	A 45 percent Laporte loam that has 15–30 percent slopes and 40 percent rock outcrop. Laporte series are characterized by shallow, well drained soils that form in residuum from weathered limestone bedrock and mountain foothills. This soil has rapid runoff and a moderate to severe hazard of water erosion. Native vegetation is primarily piñon pine, juniper, ponderosa pine, and blue grama. The rock outcrop is mainly limestone, but sandstone and granite may exist.
Rock outcrop-Laporte complex (RLF)	226.32	A 55 percent rock outcrop and 30 percent Laporte loam with 20–45 percent slopes. This soil type is characteristic of the steeper slopes of the Manzano range and Pueblo. Rock outcrop is limestone bedrock with rapid runoff, while the Laporte loam is characteristic of areas where water erosion is moderate to severe.
Pino-Rock outcrop association (PR)	831.31	A 40 percent Pino silt loam and 30 percent rock outcrop with 3–15 percent slopes. Pino series consist of moderately deep, well drained soils that form from weather limestone and shale that occur on mountain ridges. These soils occur in areas where runoff is medium and hazards for water erosion are moderate. Native vegetation is piñon pine, juniper, ponderosa pine, blue grama, and sideoats grama (*Bouteloua curtipendula*). Rock outcrop is limestone with some sandstone.

Seis-Silver complex (SHF)	27.34	A 50 percent Seis very stony loam that mainly has 30–60 percent slopes, and 35 percent very stony Orthids that have 40–80 percent slopes. The Seis series consists of moderately deep, well drained soils that formed from weathered limestone on the sides of the Manzano Mountains. Typically found near the Cibola NF&Gs, the surface layer of the soil is a very stony loam with rapid runoff with a severe hazard of water erosion. Native vegetation is mainly blue grama (*Bouteloua eriopoda*), black grama, piñon pine, one-seed juniper, Gambel oak, and small soapweed (*Yucca glauca*).
Silver and Witt soils (SwC)	1.66	A 55 percent Silver very fine sandy loam and 25 percent Witt very fine sandy loam. The silver series consists of deep, well drained soils that formed from sedimentary rocks on piedmonts in old alluvium. The Witt series consists of deep, well drained soils that formed from upland sediments. Typically found on the eastern sides of the Sandia and Manzano Mountains, runoff is rapid and water erosion hazard is moderate to severe. Native vegetation is mainly blue grama, ring muhly (*Muhlenbergia torreyi*), piñon pine, one-seed juniper, and western wheatgrass (*Pascopyrum smithii*).
Crest stony loam (Ct)	4.19	Occurring on the eastern extents of the Manzano Mountain crest, this soil has moderate to steep slopes. Decomposing forest litter covers the surface of this soil and the top 6 inches are characterized by dark gray and light brown friable silt loam. Severe erosion results if fire destroys the vegetation (Torrance Soil Survey 1970). Native vegetation is primarily Gambel oak, ponderosa pine, and Douglas-fir, and an understory of maple (*Acer* sp.), yarrow (*Achillea millefolium*), and sedge (*Carex* sp.). Runoff is medium.
Pino silt loam (Pw)	15.91	Pino series consist of moderately deep, well drained soils that form from weather limestone and shale that occur on mountain ridges. These soils occur in areas where runoff is a medium hazard for water erosion. Native vegetation is piñon pine, juniper, ponderosa pine, blue grama, and sideoats grama. Rock outcrop is limestone with some sandstone.
Tampico loam (Ta)	10.16	This soil is characteristic of canyon bottoms and flood plains in the mountains. Soil is dark and clayey in the subsoil. This soil is subject to occasional or frequent overflow from flooding streams and from runoff of nearby steep soils. Head-cuts and gullies are the primary source of erosion in locations where the surface gets little protection from vegetation. Because of its organic compounds, this soil has a high potential for the production of commercial timber. Additionally, the soil is suited for recreational activities and facilities, as well as forage production for wildlife species.
Wilcoxson stony loam (Wf)	407.47	Occurring on the north- and east-facing slopes of ridges on the eastern extents of the Manzano Mountains, this soil is stony and forested, moderately deep, and brownish. Water erosion can be a serious hazard on this steep soil, especially when plant cover is destroyed by fire or excessive logging (Torrance Soil Survey 1970). The soil is primarily used for production of timber and wildlife habitats. Native vegetation is primarily ponderosa pine, piñon, juniper, Gambel oak, New Mexico locust (*Robinia neomexicana*), sideoats grama, and other cool season grasses.

Wilcoxson stony loam (Wg)	0.11	Occurring on the south-facing slopes of ridges on the eastern extents of the Manzano Mountains, this soil is more shallow and stony than the north- and east-facing soils described above (Wf). Runoff is slow to medium and erosion is slight, but can become a serious hazard when plant cover is destroyed by fire or excessive logging (Torrance Soil Survey 1970). Native vegetation is primarily ponderosa pine, Douglas-fir, piñon, one-seed and alligator juniper, Gambel oak, Oregon grape (*Mahonia aquifolium*), blue grama, Junegrass (*Koeleria* sp.), and squirreltail (*Elymus elymoides*).
Witt loam (Wp)	22.15	The Witt series consists of deep, well drained soils that formed from upland sediments. Typically found on the eastern sides of the Sandia and Manzano Mountains, runoff is rapid and water erosion hazard is moderate to severe. The soil is moderately fertile and native vegetation includes blue grama, ring muhly, piñon pine, one-seed juniper, and western wheatgrass. Soil is used primarily for native forage and irrigated farming.

Cibola NF&Gs Affected Environment

The following effects related to the proposed action were identified during internal and external scoping of this project.

- Soil condition may be reduced.
- Watershed conditions may be changed.
- Water quality may be impacted.
- Water quantities and timing may be affected.
- Riparian areas conditions may be affected.

These effects can be grouped in the categories of soil, water, and watershed condition. Each of these would be discussed in terms of existing condition and the potential effects of the proposed alternatives.

Existing Conditions

Soils and Terrestrial Ecosystem Units

Soils on the Cibola NF&Gs portion of the project area were assessed using the Cibola TEUI (Strenger et al. 2007). The survey consisted of mapping and interpreting ecosystems through a systematic classification and integration of the primary ecosystem components, such as soil, vegetation, and climate. This TEUI information is part of the basis for developing this project. TEUI was used to evaluate and adjust land uses to the limitations, such as existing soil condition and erosion hazard. Canopy estimates provide an understanding of the tree densities that different ecosystems historically supported (Abella 2010). These densities are useful for assessing site capability and preparing prescriptions.

Soil condition is an evaluation of soil quality based on the interrelationship between soil hydrology, soil stability, and nutrient cycling. Soil condition categories reflect soil disturbances resulting from both planned and unplanned events. Guidance for determining soil condition is given in the USFS Manual Supplement 2509.18-99-1. Soil condition ratings are tied to a given soil type found within terrestrial ecological units (TEUs) (Strenger et. al. 2007). These data are

further substantiated by field data provided by stand exams that provide information about woody material on the ground and site productivity. Figure 14 and Figure 15 illustrate the mapped locations of the TEUs in the project area.

Terrestrial Ecosystem Units in the Project Area

Map Unit 87

This map unit is found in valley plains. This map unit makes up 4 percent of the project area. There is a slight limitation for roads and trails; however, the revegetation potential is high. Soil condition in this unit is satisfactory. Erosion hazard rating is slight. Trees in the potential natural community comprise about 16 percent canopy cover, largely made up of ponderosa pine with lesser amounts of juniper and piñon. Plant communities in this TEU are the result of a combination of microclimatic and soil conditions created by the topography—in this case, the bottom of David Canyon.

Map Unit 267

This map unit is found on steep south-facing slopes in the project area. This map unit has a high percentage of rock fragments and is shallow. This map unit makes up 1 percent of the project area. Soil condition in component 1 of this unit is impaired. Component 2 of this unit is in unsatisfactory condition. Erosion hazard rating is moderate. Trees in the potential natural community comprise about 40 percent canopy cover, equal amounts of juniper and piñon. Plant communities in this TEU differ from those related to climate largely due, in this case, to the parent material of limestone.

Map Unit 268

This map unit is located on steep slopes of all aspects. There is a high percentage of rock fragments. This unit is located on less than 1 percent of the project area. Soils are alkaline, thereby limiting productivity. Soil condition in this unit is impaired. Erosion hazard rating is severe. Trees in the potential natural community comprise about 40 percent canopy cover, with equal amounts of juniper and piñon. Plant communities in this TEU differ from those related to climate largely due, in this case, to the parent material of limestone material.

Map Unit 269

This map unit is found on elevated plains on less than 1 percent of the project area. Map unit 269 has two major components. The soil condition for this unit is rated as impaired due to high percentage of bare soil and low amounts of ground cover. Erosion hazard rating in component 1 is moderate. Trees in the potential natural community comprise about 55 percent canopy cover of piñon and juniper with oak shrub. Plant communities in this TEU differ from those related to climate largely due, in this case, to the parent material and the resultant alkaline soils. The potential natural community for component 2 is 15 percent canopy cover of piñon and juniper with oak shrub. This community is influenced by the topography in addition to soil and microsite conditions. Erosion hazard is rated as slight for component 2; however, many areas have high amounts of bare soil and gullies. In the project area, this TEU occurs in the far southeast corner and is mostly made up of component 2 with pockets of component 1.

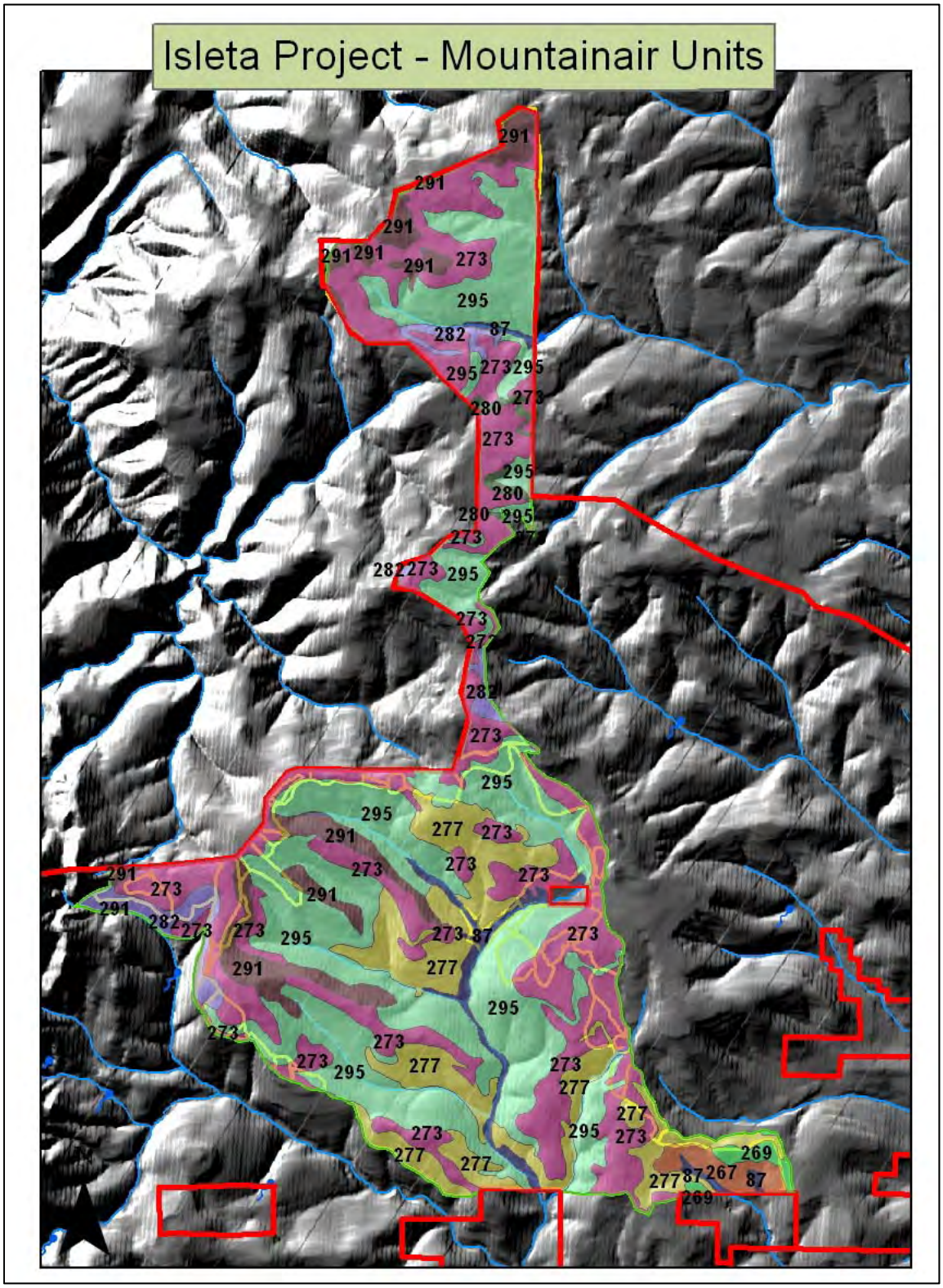

Figure 14. TEUs in the Mountainair RD of the Isleta CFRP Project
Source: Cibola National Forest and Grasslands

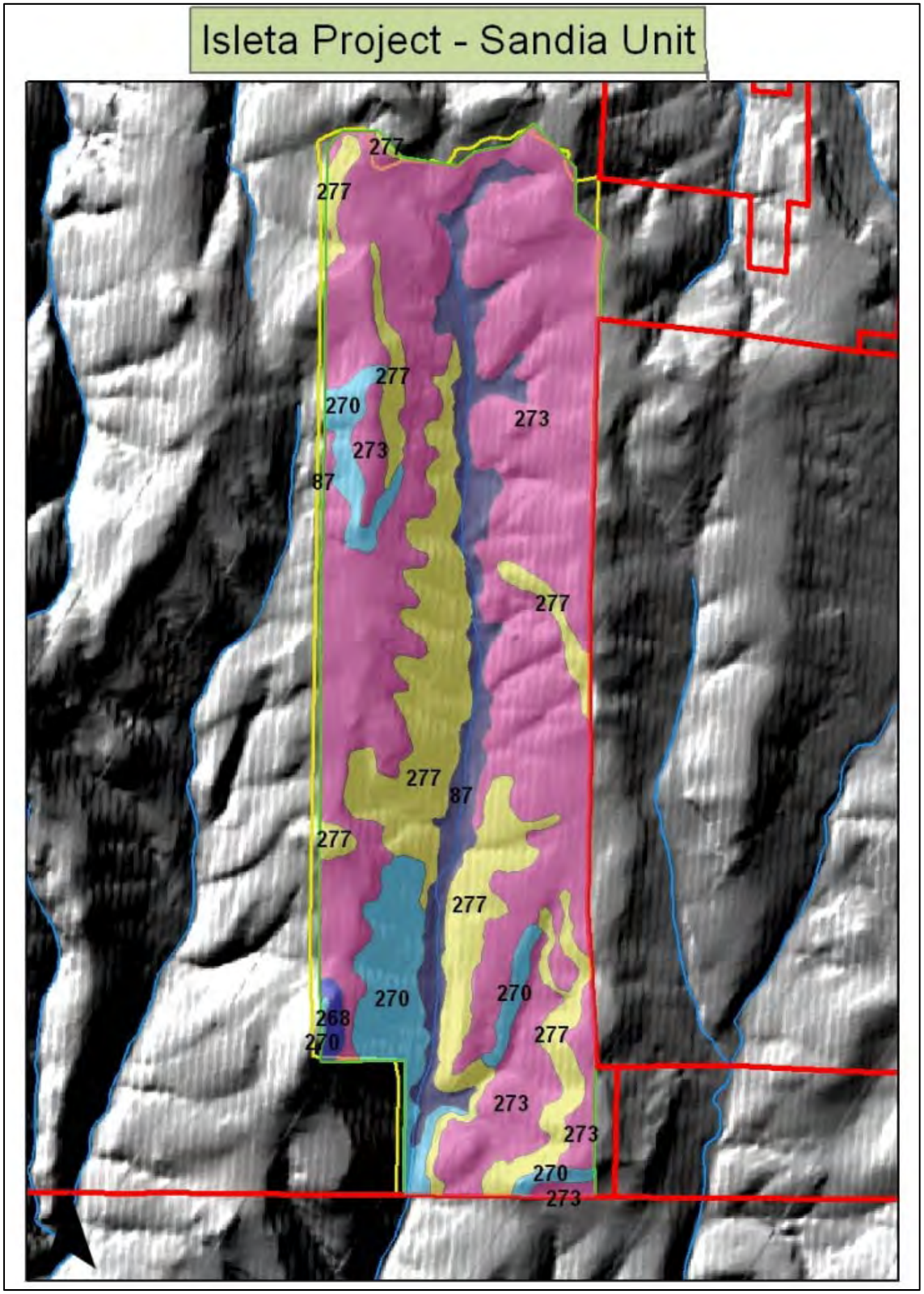

Figure 15. TEUs within the Sandia RD of the Isleta CFRP Project
Source: Cibola National Forest and Grasslands

Map Unit 270

This map unit has a satisfactory rating for soil condition. It has a low potential for revegetation due to alkaline soil conditions. Map unit components 1 and 2 have a severe erosion hazard and severe plant competition from oak. This unit is located on 2.4 percent of the project area in the Sandia RD, with component 1 mostly found on the steeper slopes on the west side of the southern end of David Canyon. Trees in the potential natural community comprise about 50 to 75 percent canopy cover of piñon, juniper, with oak shrub. Plant communities in this TEU differ from those related to climate largely due, in this case, to the parent limestone material.

Map Unit 273

This map unit is located on gently sloping elevated plains with north-facing aspects. This unit occurs on 40.1 percent of the project area. Soils are moderately deep loams with very stony and fine sandy components. A low soil bearing strength is somewhat limiting. Soil condition in this unit is currently satisfactory, except for a few localized areas. Erosion hazard rating is moderate. Trees in the potential natural community comprise about 50 to 60 percent canopy cover with mostly ponderosa pine, lesser amounts of piñon and juniper, with oak shrub. Plant communities in this TEU differ from those related to climate largely due, in this case, to the parent limestone material.

Map Unit 277

This map unit is located on steep hill slopes of all aspects on 16 percent of the project area along both sides of David Canyon. It is also found in the south end of the project area along Cañon de Troncon Negro. Soils are moderately deep and include very gravelly clay loams, cobbly sandy clay loams, and cobbly loams. A low bearing soil strength is somewhat limiting. Soil condition in this unit is impaired. Erosion hazard rating is moderate. Trees in the potential natural community comprise about 50 to 60 percent canopy cover with mostly ponderosa pine, lesser amounts of piñon and juniper, and oak shrub. Plant communities in this TEU differ from those related to climate largely due, in this case, to the parent material, the San Andreas Limestone.

Map Unit 280

This map unit is located on east-facing slopes with moderate to steep slopes. Soils are deep loams with a moderately deep gravelly sandy clay loam component. A low bearing soil strength is somewhat limiting. Soil condition in this unit is satisfactory. Erosion hazard rating is severe. This unit is found on less than 1 percent of the project area. The potential natural community has a potential total canopy cover of 60 to 80 percent, dominated by oak. Trees make up 10 to 15 percent of the canopy cover with mostly ponderosa pine, white fir, and juniper. Plant communities in this TEU are influenced by topography and the effect of fire.

Map Unit 282

This map unit is located on steep side slopes of all aspects on 2.2 percent of the project area at the north end of the Mountainair unit near the watershed divide. Soils are deep loams with components of very cobbly clay loam and sandy loam. The unit is productive but low soil bearing strength limits use. Soil condition in this unit is satisfactory. Erosion hazard rating is moderate. The potential natural community has a potential total canopy cover of 75 percent. Trees make up

most of this with Douglas-fir, ponderosa pine, some juniper, and substantial amount of oak—the result of fire influences. Component 2 in this unit has little oak.

Map Unit 291

This map unit is unique to the Manzano Mountains. It is located on north-facing steep side slopes on 5 percent of the project area on the west side of the Mountainair RD. Soils are moderately deep loams with a small component of cobbly clay loams. The potential natural community has a potential total canopy cover of 75 percent. Trees make up most of this with big-tooth maple (*Acer grandidentatum*), Douglas-fir, ponderosa pine, some juniper, and some oak. Soil condition in this unit is satisfactory. Erosion hazard rating is severe.

Map Unit 295

This map unit is located on 28.1 percent of the project area on steep, north-facing hill slopes making up a large part of the Mountainair RD. Soils are moderately deep stony loams and loams. Stones in the profile limit along with a low soil bearing strength. Soil condition in this unit is impaired. Erosion hazard rating is severe. The potential natural community has a potential total canopy cover of 75 percent. Trees would make up most of this with ponderosa pine, some juniper, including alligator juniper, and some oak.

Soil Condition

Soils were classified into three condition groups: satisfactory, impaired, and unsatisfactory. The definition of each category is given below.

- **Satisfactory** – Soil function is being maintained and is operating as expected.
- **Impaired** – Ability of the soil to function properly has been limited or it has less resistance to the forces of degradation. Changes in management or mitigation measures may be appropriate.
- **Unsatisfactory** – Loss or degradation of vital soil functions have occurred resulting in the inability to maintain resource values, sustain outputs, and recover from impacts. Soils rated in this category are candidates for improved management or active restoration designed to recover soil functions.

Soil condition within the Cibola NF&Gs lands within the project area is displayed on Figure 16 for the primary component in each TEU. Approximately 54 percent of these soils on the USFS lands in the project area have satisfactory soil condition; 46 percent are in impaired condition. There is variation in these numbers because smaller pockets of unsatisfactory soils, impaired, and satisfactory soils occur within the larger mapped areas. Many of the impaired soils are located on steeper slopes. **Figure 17** and Figure 18 are maps of soil conditions across the project area.

The causes of impaired soils within the analysis area generally stem from physical surface disturbances and the lack of woody material on the ground. This leads to an altered ecosystem state that has increased erosion/redistribution of soil (including organic matter and nutrients) by wind or water, lower cover/vigor of herbaceous vegetation, lower stability and protection of soil, and lower site resistance/resilience to extreme drought. All of the above mentioned effects can be found within the analysis area resulting in the present soil conditions.

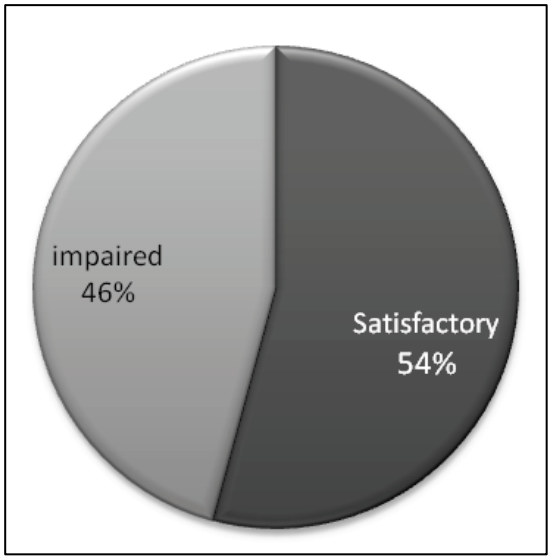

Figure 16. Soil condition of the primary TEUs in the project area

Where soils are currently impaired, high erosion rates and lack of woody material on the ground are the greatest causes. High erosion rates are related to the lack of ground cover and litter; in the piñon-juniper forest type, the loss of biotic crusts is widespread. The lack of woody material is largely the result of past management practices. In particular, large woody material greater than 16 inches in diameter is lacking in many areas, including wood that is in an advanced state of decay. This type of wood provides nutrients to the soil and habitat for soil biota.

There are woody material data on 37 percent of the area of the NFS lands in the project area. These data are available for the Sandia RD and the north end of the Mountainair RD (Dog Head area). Table 17 shows the woody material information for the project area. These data show the mean for those areas with woody material data in the ponderosa pine-oak vegetation type are less than the amount needed for satisfactory soils. The mean woody material in piñon-juniper and oak vegetation types is enough for satisfactory soil condition. There are no data for woody material within mixed conifer stands in the project area. These data suggest that woody material is lacking in the ponderosa pine forest type. Overall, oak and piñon-juniper forest types appear to have adequate woody material.

Table 17. Available woody material information for the project area

Vegetation Type	Percent Project Area	Acres with Data	Range of Woody Material for Satisfactory Soils	Acres with Satisfactory Levels	Mean of Woody Material (tons/acre)
Ponderosa pine-oak	50%	978	5–10 tons/acre[1]	273	3.1
Piñon-juniper	34%	1,817	2–8 tons/acre[2]	1,245	6.6
Oak	15%	57	3–10 tons/acre[3]	23	8.0
Mixed conifer	1%	0	8–16 tons/acre[1]	NA	NA

[1] U.S. Department of Agriculture (USDA 1999) FSM 2509.18-99-1, Soil Condition Rating Guide.
[2] Ernest et al. (1993).
[3] Inferred from USDA (2006) and Abella (2008).

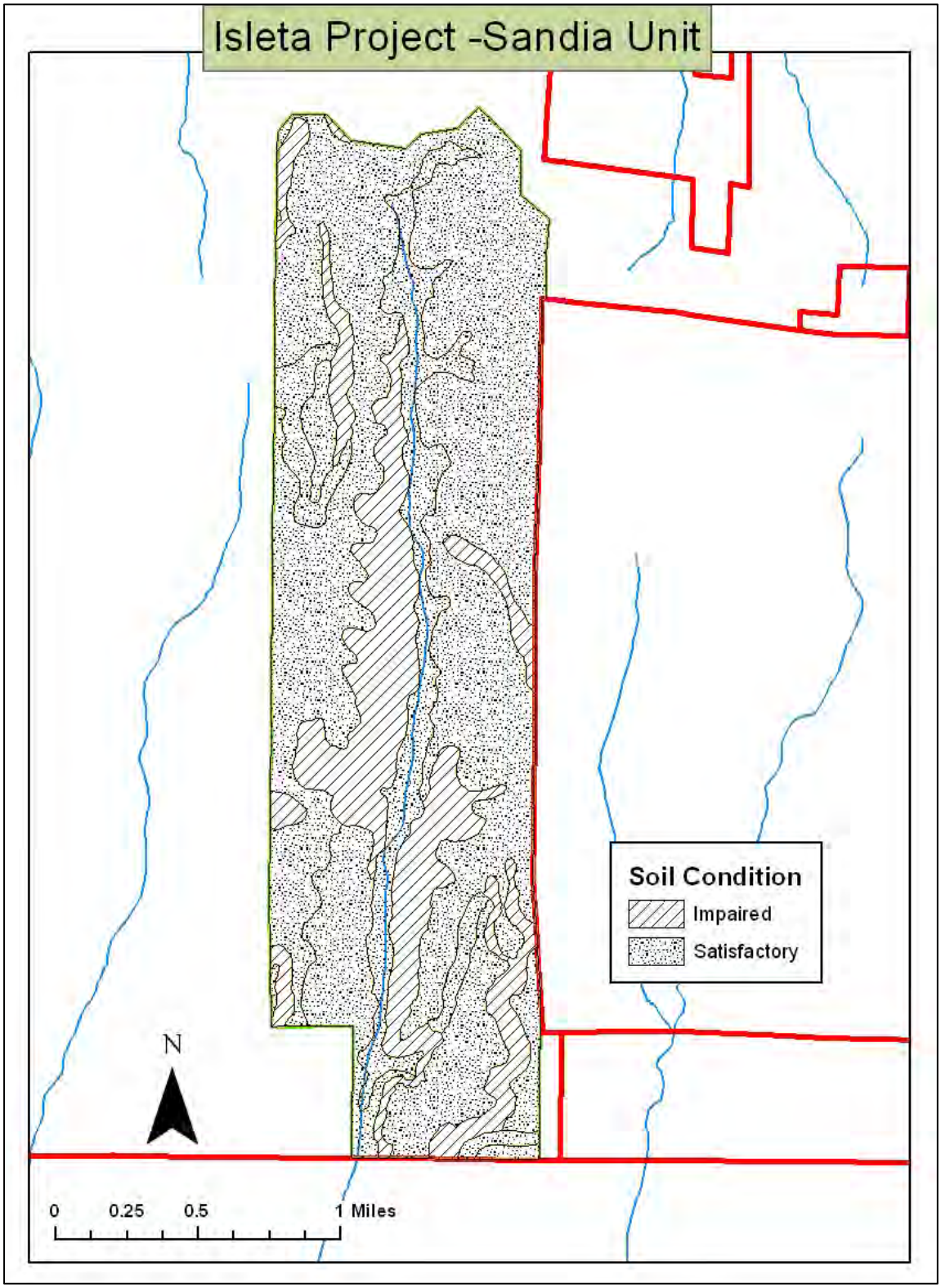

Figure 17. Soil condition in the Sandia RD
Source: Cibola National Forest and Grasslands

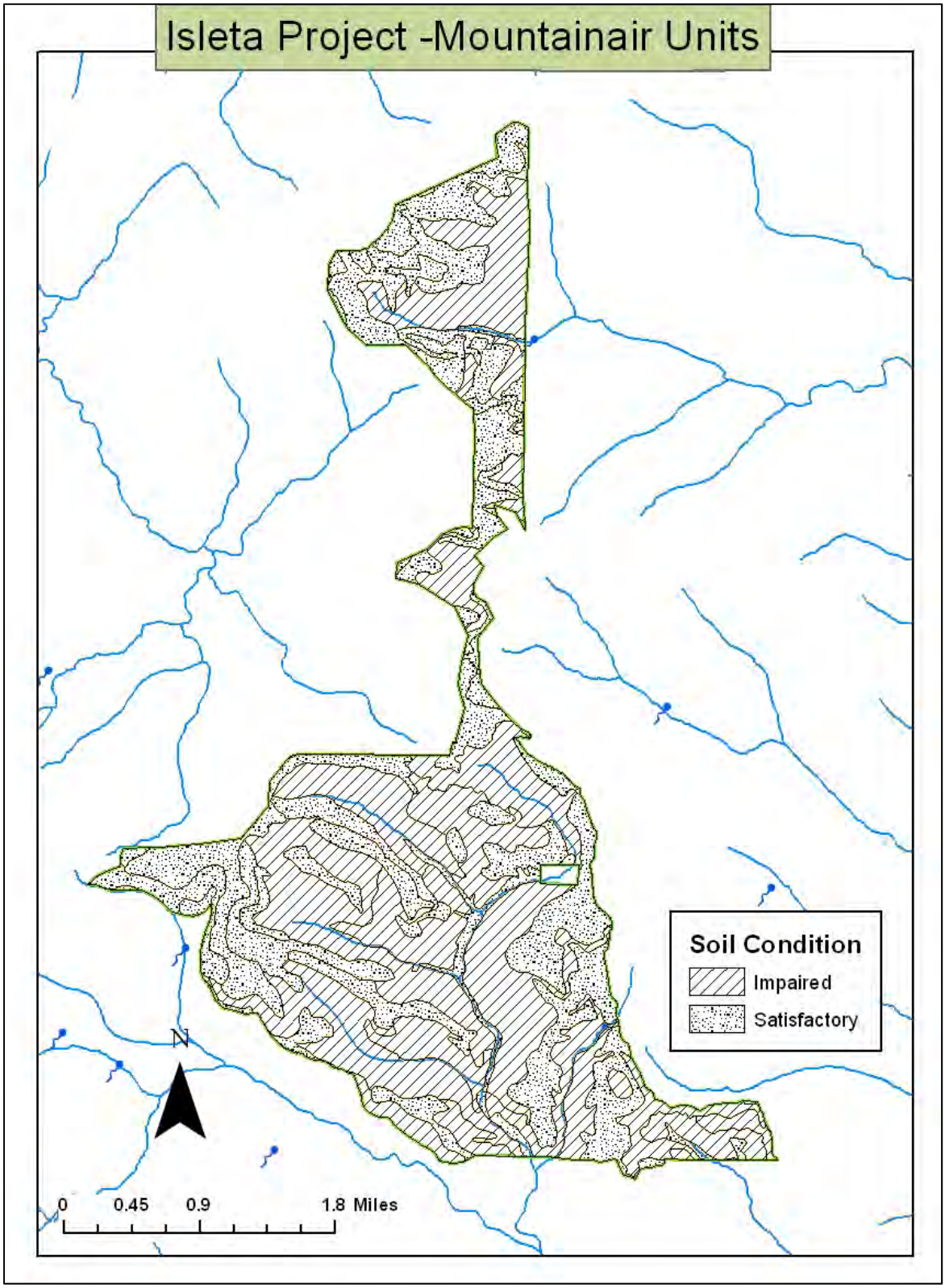

Figure 18. Soil condition in the Mountainair RD
Source: Cibola National Forest and Grasslands

Pueblo and Chilili Environmental Consequences

Alternative A (No Action)

Under the no action alternative, the direct effect on soil resources would remain unchanged. Existing erosion and deposition processes would continue. Without treatment the risk of uncharacteristic fire remains high throughout the project area, the potential for adverse impacts to soils following high-severity wildfire, therefore, remain high. If a large, high-severity wildfire moved through the project area, soils would be exposed to increased runoff with resultant erosion and sedimentation, hydrophobicity (making soils water repellent), and reduced or altered infiltration and impacts to water quality. The organic composition of the soil could also be altered, impacting soil productivity and nutrient cycling. Furthermore, the no action alternative would perpetuate the lack of herbaceous cover in the project area, and areas soils would continue to exhibit limited integrity, low productivity, and high potential for erosion.

Although the no action alternative would generate the least direct effect to soils and geology, the indirect effects of an uncharacteristic wildfire are greatly increased.

Alternative B (Proposed Action)

Under alternative B, direct and indirect effects to soils and geology include short-term impacts such as erosion and sedimentation related to removal of the ground cover surface and impacts to nutrient fluxes associated with vegetation removal. Impacts would be site specific depending on soil type and structure.

Because some areas would undergo a basal area reduction of up to 50 percent, runoff rates and water yield would be expected to increase on a temporary basis until understory herbaceous layers are able to establish and protect the soil. During very wet periods, project area soils such as the Laporte-Rock outcrop complex and Seis-Silver complex could undergo severe erosion due to their shallow profiles and rapid runoff. The majority of soils throughout the project area are classified as having a moderate to severe erosion potential. Potential erosion could be mitigated by spreading slash throughout the treated area. Retaining slash also ensures that nutrients stored in the vegetation would not be fully lost from the system. Slash retention would also ameliorate some of the negative effects associated with exposed soil. Although project soils are at risk of immediate soil erosion following treatment, losses associated with vegetation removal are not expected to have any long-term adverse effects since regeneration of the herbaceous layer that would result from opening of the canopy is expected to be rapid and would stabilize the soil against future erosion.

Beneficial effects of thinning on soils would also be expected. By exposing bare mineral soil to light, resultant soil surface heating can stimulate seed germination and nutrient cycling. This effect can only be achieved where slash is removed from the site.

A careful balance is needed to ensure that slash provides positive benefits to the project area. Slash retention can enhance soil surface stability and reduce the potential for erosion, but can impinge upon plant regeneration and recovery of the herbaceous layer. Overriding the physical effects of slash on soils, however, is among the fire risk factors that are associated with leaving residual surface fuels in the project area. Strict guidelines regarding slash bed depth should, therefore, be followed following all treatments.

Prescribed burning proposed throughout the project area would cause some temporary effects to soils. The most important physical characteristic affected by fire is soil structure because the organic matter component can be lost at relatively low temperatures (Neary et al. 2005). This can reduce soil porosity making the soil more prone to postfire runoff and erosion. Crest stony loam and Wilcoxon stony loam soils found in the project area are at particular threat of erosion post fire because of their higher organic matter content. Soil heating and its impact on organic matter can also influence soil chemistry. When organic matter is combusted, the stored nutrients are either volatilized or changed into available forms that can be taken up by soil microbes and vegetation; the increased availability of stored nutrients, however, can make them susceptible to loss from the system through runoff. The greatest losses are associated with high and moderate severity fires and not with low severity prescribed fire, which have been shown to release nutrients making them available to germinating and resprouting plants (Boerner et al. 2006). Fire can also impact soil biology depending on the fire intensity and severity. Most soil microbes have been found to be highly resilient to fire, rapidly recolonizing to preburn levels. Prescriptions that consume extensive areas of litter and duff, however, are found to be more damaging to soil microorganisms. Low intensity burning that protects the forest floor and humus layers are recommended (Neary et al. 2005).

Some short-term impacts to soil associated with increased activity in the project area are expected. The use of mechanized equipment and increased road traffic associated with access by crews and removal of timber may cause increased soil compaction along roads and staging areas. BMPs should be followed to reduce erosion related to heavy road use, such as water barring and appropriate selection of staging areas dependent on slope and soil vulnerability. Access should be restricted or limited in areas that are particularly vulnerable to soil erosion for a period sufficient for soil and surface vegetation recovery.

Cibola NF&Gs Environmental Consequences

Soil Condition

The analysis area for soil condition is the Cibola NF&Gs portion of the project area boundary. This is because the soils within the project area have the potential to be directly and indirectly affected by the proposed activities. The measures for soil condition are woody material on the ground, acres of disturbance, the transition ratio, an indicator of the susceptibility for crown fire, and the heat per unit area, as modeled at the surface. Crown fire is associated with severe wildfires that are very hard to control. Severe wildfires result in greater amounts of damaged soil. The heat per unit area at the surface provides information about the heat the soil would be subject to under the modeled scenarios of the alternatives. The amount of woody material on the ground is a useful measure since lack of woody material has been observed and measured across the project area. Soil disturbance is an indicator where the soil is disturbed, resulting in soil loss and erosion. Compaction quickly occurs during the first few passes across soil, and in the piñon-juniper zone cryptogamic crusts are destroyed. The time period for analysis is 10 years, since this time period allows time for soils to recover from the treatments.

Alternative A (No Action)

Under the no action alternative, none of the proposed activities would occur. The greatest effect of this, an indirect effect, is not implementing activities that would improve control opportunities for wildfire. Wildfires would be harder to control and burn hotter as indicated by the transition

ratios and heat per unit area at the surface, summarized in Table 18. Susceptibility to crown fire is indicated by the model results for the no action alternative, with surface temperatures ranging from 590 to 3,078 British thermal units (BTU) per square feet. These temperatures are well above the values where organic matter is destroyed, amino acids are lost, and nitrogen is volatilized (Hungerford et al. 1990). Fire related effects include soil hydrophobicity, altered infiltration, increased runoff, sedimentation, and erosion. Nutrient cycling is also changed by heating of both organic and inorganic compounds. The effect would be dependent on fire behavior, but soils are likely to be heated, changing the physical and biotic characteristics of the soil. With high burn severity, soils may become water repellent, which increases runoff during storm events because water is not able to infiltrate.

There would be no direct effects on soil resources, such as ground disturbance or loss of tree cover. Locations where erosion is occurring such as roads and trails, both designated and user created, would continue to contribute to soil loss. Areas where soil condition is less than satisfactory due to lack of woody material would remain in this condition. Recruitment of woody material is likely to occur as trees die.

Alternative B (Proposed Action)

Under this alternative, the activities of removing trees, adding woody material to the ground, prescribed fire including the potential for pile burning, driving on soils, and using and maintaining roads cause direct effects to soil resources. These direct effects lead to indirect effects. Creating the proposed openings would result in soil disturbance from mechanized equipment, removal of trees, mastication, and prescribed fire. Removing trees and soil disturbance exposes soil to precipitation events leading to erosion and sediment transport. Soil disturbance would be mitigated as described in the proposed action and through BMPs as described in chapter 2 and appendix B of the soil and water specialist report. Erosion hazard and existing soil condition guide the method of vegetation removal and slash treatment. Changes in microclimate occur when canopy cover is removed. However, leaving woody material on the ground improves soil condition where woody material is lacking and provides protection to soil during rainfall, making up for the loss of vegetative cover. Subsequent prescribed burning would remove masticated material, while vegetation grows back in. Masticated material would be left in the openings and burned in later years. Downed woody material would be retained or returned to the sites after proposed activities to ensure appropriate levels to maintain soil quality are present.

Driving on soils and the use and maintenance of roads related to the proposed action would cause compaction and increased sediment yields in these areas. Existing roads are already compacted; however, when masticators or other equipment are used off road to remove trees, compaction occurs quickly. The existing road system would be used, with no new roads planned. Some of these are currently in poor condition with limited drainage features. As part of the BMPs prescribed for this area, water barring and other practices as needed would be used on the roads after completion to improve drainage and related effects such as erosion. For the purposes of analysis, it is assumed that 100 percent of the openings in the piñon-juniper and ponderosa pine vegetation types could be subject to ground disturbance. Within the groups of trees, up to 50 percent of soil disturbance is assumed. As a result, up to 5,147 acres could have ground-disturbing activities occur on them, including large equipment such as masticators, pickups, or ATVs.

Field observations reveal that public firewood collecting greatly disturbs soils. As a result, where soil condition is less than satisfactory and erosion hazard is severe, personal use firewood collecting through cross-country travel would not be used to remove wood. This project design feature would protect sensitive soils from these disturbance effects.

Research suggests that thinning can increase nitrogen transformations into available nitrogen (Kaye and Hart 1998) but that repeated prescribed burning for maintenance may result in increased nitrogen mobility (Wright and Hart 1997), leading to nitrogen losses from soils. Results from research on mastication and soil suggest that masticated material can reduce soil temperatures and increase soil moisture (Owen et al. 2009). Over time, mastication may negatively affect nitrogen dynamics (Gottfried and Overby 2009). The same study showed that pile burning increases soil temperatures, reduces soil moisture, changes soil structure, and causes nitrogen to be leached away.

Pile burning would only be used when wood loads are too great to be treated any other way. If pile burning occurs, several BMPs could be used to mitigate the effects to soil such as burning piles in the winter.

The indirect effect of reducing uncharacteristic wildfire behavior as a result of the proposed vegetative treatment is a benefit to soil resources. Thinning activities are a preferable alternative to wildfire, resulting in less impact to watersheds (Dore et al. 2010; Ffolliott et al. 2011). As displayed in the tables in the “Fuels Environmental Consequences” section, the results of fire behavior model, BehavePlus, for this alternative show that when weather conditions are severe crown fire is less likely to occur in piñon-juniper and ponderosa pine as a result of the proposed action. The mixed conifer vegetation type would also have a decreased susceptibility to crown fire under this alternative. In the all vegetation types, the model results for heat per unit area at the surface are reduced.

Alternative C

Alternative C is similar to alternative B, except that no permanent openings would be created in the piñon-juniper and ponderosa pine vegetation types. Temporary openings would be created on 10 percent of these two vegetation types. Except for steep slopes, soil disturbance could occur on the soils below these two vegetation types as a result of the proposed thinning activities. Using the same assumptions to calculate acres of ground disturbance, proposed activities relating to this alternative would lead to less soil disturbance than alternative B as shown in Table 18. Woody material would be retained and added, as needed, in the same manner as proposed in alternative B. Susceptibility to crown fire would also be improved under this alternative in all vegetation types to the same extent as alternative B. In addition, the range of heat during a potential wildfire is reduced by the proposed activities in this alternative to 233 to 860 BTU per square feet. This is more favorable for satisfactory soil condition than the no action alternative.

Alternative Comparison for Soil Condition

Table 18 shows the comparison of the alternatives for the measures for soil condition. There would be no ground disturbance under the no action alternative. This increases under the proposed action due to activity being concentrated in the created openings. Expanding the thinning activities to all of the piñon-juniper and ponderosa pine vegetation type outside of steep slopes increases the potential for ground disturbance by 40 percent. The susceptibility to crown

fire is high under the no action alternative, but is reduced to less susceptible under both action alternatives. Surface heating, as indicated by heat per unit area in BTU per square feet, decreases under both action alternatives to less impacting levels.

Table 18. Comparison of alternatives for soil condition

Alter-native	Potential Acres of Distur-bance	[1]Transition Ratio (risk of crown fire likely if >1 under severe weather conditions)			Heat per Unit Area (BTU under severe weather conditions per square feet)			Woody Material (tons per acre)			
		P-J	PP	MC	P-J	PP	MC	P-J	PP	MC	Oak
A	0	1.60	2.13	0.61	590	3,078	1,571	6.6	3.1	NA	8.0
B	5,147	0.04	0.13	0.04	233	860	434	5–7	5–7	10–15	5–7
C	3,538	0.04	0.13	0.04	233	860	434	5–7	5–7	10–15	5–7

[1] Transition ratios and heat per unit area information is in the Fire/Fuels Report.
P-J = piñon-juniper; PP = ponderosa pine; MC = mixed conifer; Oak = oak woodlands.

Water Resources

Pueblo and Chilili Affected Environment

The project area is divided between the Western Estancia and Rio Grande-Albuquerque watershed. Water resources on the eastern face of the Manzano and Manzanita Mountains flow from the many higher elevation subbasins (e.g., Torrean and Tajique) of the region east toward the Estancia subbasin, a subbasin of the Western Estancia watershed, located 62 miles southeast of Albuquerque.

Existing Conditions

One recorded spring exists at Chilili but falls outside of the proposed project area. A spring is also present on Pueblo lands outside the project area, but below a steep slope that would be thinned during treatment. No perennial streams exist within the entire proposed project area. Accordingly, residents of the area depend mostly on the area's groundwater resources. The region's groundwater, a consequence of ancient water resources that deposited water-bearing fill over older bedrock, is extracted primarily for irrigated agriculture, the area's largest economic activity. The recharge for this groundwater depends almost exclusively on the upstream resources that originate in or near the project area as precipitation or snowmelt.

The portions of the project area residing in the Western Estancia Basin are rural, with both minimal infrastructure and development. Along with being in or near the headwaters, this is likely the reason the U.S. Environmental Protection Agency (EPA) lists no approved total maximum daily loads (TMDLs) or reported causes of impairment for these waters (EPA 2010). Any impairment to waters originating in the proposed project area is likely a result of vehicular and recreational activities.

The drainages in the project area are classified as intermittent or ephemeral and are not considered riparian. The riparian areas within the project area are not associated with the known spring at Chilili. There are no known riparian areas that fall within the Pueblo or Kirtland portions of the project area.

Water resources on the western face of the Manzano and Manzanita Mountains, draining west, are a component of the Rio Grande-Albuquerque watershed. Much like the ephemeral streams of the Estancia basin mentioned above, the headwaters of the streams that drain into the Rio Grande-Albuquerque watershed have their headwaters in the higher elevations of the Manzano and Manzanita Mountains and, thus, are located in or near the proposed project area.

Ephemeral waters that could originate and/or flow through the project area are not any of the five named water bodies of the Rio Grande-Albuquerque watershed that are listed as impaired by the EPA (2010). The EPA listed causes of impairment of the Rio Grande-Albuquerque watershed are E. coli, benthic, eutrophication, aluminum, and ambient biomass. Because the proposed area has little development and minimal human impact, the waters originating in or flowing through the project area are not likely to contribute to these impairments. Additionally, the EPA lists the currently approved TMDLs as E. coli, fecal coliform, and aluminum (EPA 2010). Like the impairments to these water bodies, the waters originating in or flowing through the project area are not contributors to these approved TMDLs.

Cibola NF&Gs Affected Environment

Existing Conditions

Surface water is scarce within the project area. There is one spring within the USFS proposed project boundary, Ojo Terreo in the Mountainair RD. Tajique Creek is perennial and drains off the east side of the Manzano Mountains into the Estancia Basin. Streamflow in Tajique Creek is variable with snowmelt dominating spring runoff, tapering off to summer low flows until the summer monsoons result in sudden high flows that drop off to low flows in the winter. There are additional small segments of perennial water that have not been mapped.

Riparian areas are associated with Tajique Creek, springs, and in numerous intermittent streams where groundwater is close to the surface. There is only data for Tajique Creek outside of the project area. Tajique Creek was assessed using the T-Walk method (Ohlander 1998) in 2002 (Cibola NF&Gs 2002). This assessment showed that Tajique Creek has been impacted by major sediment sources resulting in loss of productivity and diversity. Pools have been filled by sediment and the gravel/cobble bed of Tajique Creek has been changed to a streambed covered in fine sediment. In addition, a properly functioning condition (PFC) assessment was completed along Tajique Creek in 2002 (Cibola NF&Gs 2002). Entrenchment, bank destabilization, and head cutting were observed along several reaches. Both assessment methods, T-Walk and PFC, determined that the adjacent road, NFS Road 55, as well as dispersed and developed recreation sites are largely responsible for this condition.

Water Quality

A review of the 2008–2010 State of New Mexico’s Integrated Clean Water Act 303(d)/305(b) report indicates that no impaired streams or freshwater reservoirs are within the project’s analysis boundaries (NMED 2012). However, this is not a good indicator of water quality in the project area since the state has not assessed any streams in the project area.

Basic water quality data are lacking in the project area. There are some data for downstream areas of Tajique Creek from the 1960s, 1970s, and 1990. Tajique Creek pH data varied from 7.4 to 8.25. Sulfate levels were between 23 and 49 parts per million (ppm). Hardness varied from 208 to 306 ppm. This is considered “very hard” using Dufor and Becker’s (1964) classification system.

In 1975, specific conductivity (umbos/cm) was measured at 650 in May and 328 in December of 1975. These values are within the ranges expected in this region.

Watersheds

Watersheds were used to assess the effects of the project on watershed condition, flow timing, and flow quantity. Watersheds are identified with numbers called the hydrologic unit code (HUC).

All of the sixth code watersheds across the forest have been classified using the Watershed Condition Framework (WCF) (U.S. Department of Agriculture (USDA) 2011). The WCF allows an interdisciplinary team to assess the risks to the condition of NFS lands within each watershed using defined criteria, leading to a rating for each watershed. Watersheds with less than 10 percent of NFS lands are not rated. Twenty-four different criteria, including terrestrial physical and biological indicators and aquatic physical and biological indicators, were used to rate the watershed conditions. The resulting ratings indicate that the watershed condition on NFS lands are “functioning properly” (good), “functioning at risk” (fair), or “impaired” (poor). Of the seven watersheds in the project area, two were not rated; two rated as functioning at risk, while the remaining three rated as functioning properly as shown in table 19 and figure 19.

Table 19. 12-digit Hydrologic Unit Code (sixth code) watersheds

HUC 6 Name	HUC 6	Watershed Condition Class on NFS Lands
Arroyo de Chilili	130500010402	Properly functioning
Arroyo de Tajique	130500011102	Functioning at risk
Arroyo de Yrisam	130500010401	Not rated
Middle Hells Canyon	130202030402	Not rated
Milbourn Draw	130500011103	Properly functioning
Upper Hells Canyon Wash	130202030401	Properly functioning
Upper Tijeras Arroyo	130202030201	Functioning at risk

Pueblo and Chilili Environmental Consequences

Alternative A (No Action)

Under alternative A, there would be no direct effects to water quality. Indirect effects in the event of an uncharacteristic wildfire would increase sedimentation and produce short-term changes to turbidity and other chemical parameters.

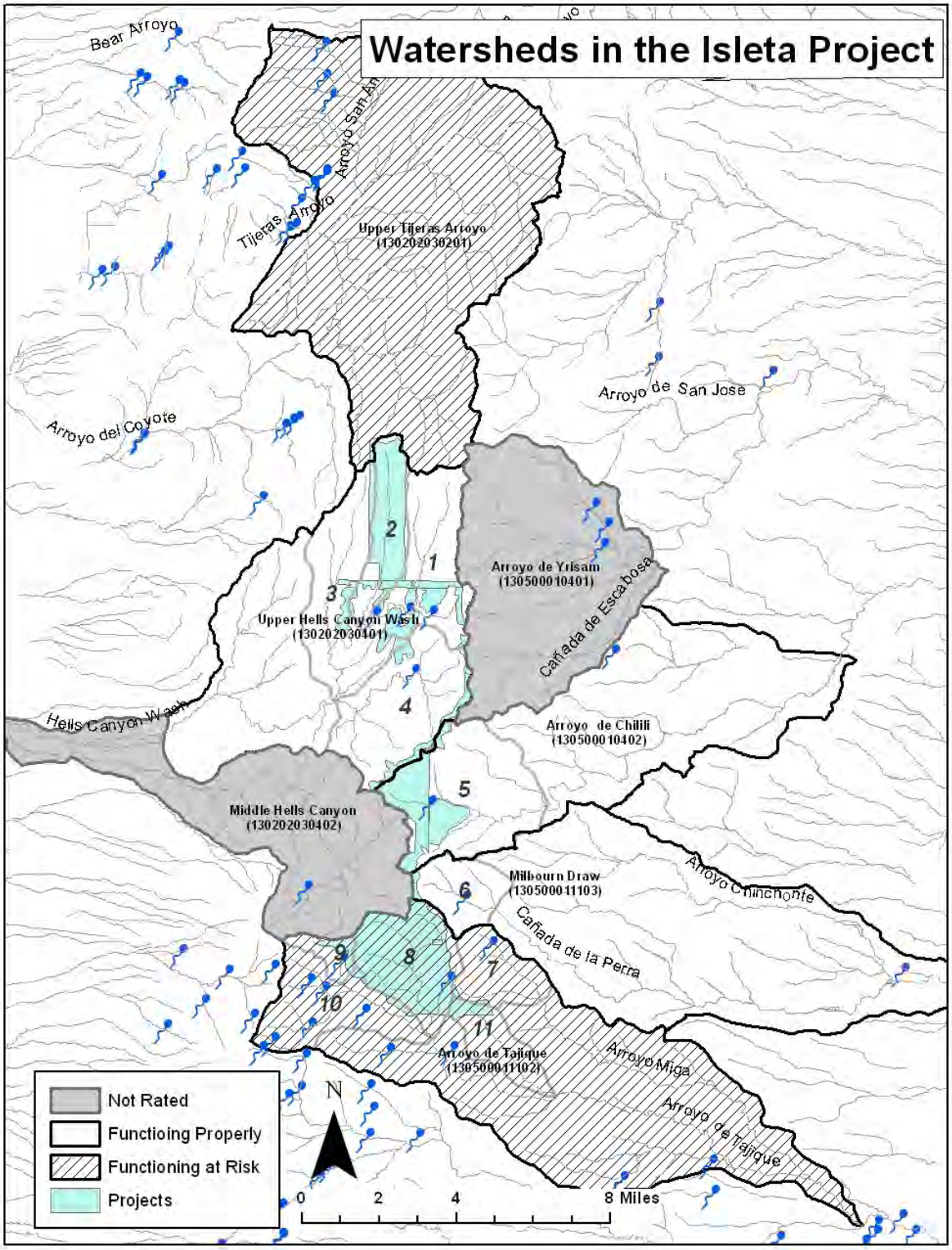

Figure 19. Sixth code watersheds, project watersheds, streams, and springs
Source: Cibola National Forest and Grasslands

Alternative B (Proposed Action)

There would be little direct or indirect effect to water quality as a result of alternative B (the proposed action). Water resources in the project area are limited and at a distance from treatment areas, so ephemeral, intermittent, and stream waters that are described in the affected environment would remain largely unchanged. Soil disturbance during and following vegetation removal may increase sedimentation following heavy runoff events but due to the small-scale and patchy nature of the proposed treatments, water resources in the project area would experience minimal impact. Areas around springs—for example, the spring located on Chilili lands and the spring that drains below a treatment area on Pueblo lands—would be avoided to prevent sedimentation of the water source. Treatment upstream from the spring would likely have beneficial effects to springs close to the project area by increasing groundwater recharge by removing dense canopy. BMPs are proposed below to limit impacts of treatment on water quality.

Cibola NF&Gs Environmental Consequences

The potential water resource effects assessed are:

- The condition of water resources features such as streams, springs, and riparian areas may be affected.
- Water quality may be impacted.
- Water quantities and timing may be affected.
- Watershed conditions may be changed. This is a cumulative effect and is discussed in the “Cumulative Effects” section.

The water resource features within the project area include stream channels, Ojo Terreo spring, and smaller unmapped riparian areas. The following BMPs would protect water resources features by avoiding direct effects to these features:

1. **Use of Project Area Maps for Designating Stream Courses for Water Quality Protection**

   Locations of protected stream channels and filter strips (Streamside Management Zones (SMZs)) would be delineated on the project area and contract maps. Riparian areas designated for protection would also be delineated on the implementation documents such as contracts or permits.

2. **Stream Channel and Wetland Protection**

   Stream channels and other water resources to be protected would be shown on the project maps, along with their associated SMZs, if applicable. SMZs would be designated along intermittent and perennial stream channels and selected ephemeral channels. Stream channels would be crossed at designated crossings only and would be preapproved by the USFS authorized officer. Unless approved otherwise by the authorized officer, SMZ BMPs may prohibit, limit, or constrain mechanized activities within all or part of the SMZ. There would be no skidding or road construction longitudinally within stream channels. There would be no decking and machine piling of slash within stream channels. Lead-out ditches or water bars would not be constructed in such a manner as to divert runoff into stream channels. Unless designated by the authorized officer, debris generated from treatment activities would be removed from stream channels. Trees designated for

removal would be felled outside the stream channel. Trees in or on the banks of stream courses that are providing bank and stream channel stability are not to be removed. The authorized officer would identify exceptions where restoration or additional thinning is needed for resource concerns. The authorized officer would use his or her authority for skid trail and log landing location to protect, as needed, stream courses that were not designated on the project contract map.

3. **SMZ Designation**

   SMZ width is based on the nature of resource values at risk (such as the presence of aquatic Endangered Species Act species or its potential introduction), special concerns for water quality degradation, erosion hazard, existing vegetative groundcover conditions, streambank and riparian conditions, natural geologic features, and flow regime. SMZ widths would be designated using the matrix at the end of this section as a guide.

   For SMZs along perennial and intermittent streams, directional falling of trees would be away from the stream channel. Ground skidding, decking of logs, and machine piling are permitted only on existing roadbeds that are located within SMZs. Road construction and burning of concentrated slash are prohibited within SMZs. Stream channels to be protected within SMZs would be identified on watershed and project area contract or permit maps.

4. **Treatment of Ephemeral and Intermittent Drainages**

   Ephemeral drainages are recognized in the following ways. They form the lowest spot of the surrounding ground and obvious channel continuity along its length and join with more obvious channels downstream. Ephemeral drainages show evidence of having run water on previous occasions, i.e., litter and vegetation has moved or there is a lack of litter in the channel.

   The water quality objectives for harvest treatments within proximity to ephemeral drainages is to provide for or retain sufficient amounts of ground cover possible to mitigate sediment input to stream system, maintain channel stability, and minimize the number of crossings to retain streambank and stream bottom stability. No specific stream buffers are recommended; however, there are harvest techniques that aid in the retention of ground cover and are considered BMPs. The following are recommended BMPs for harvesting activities around ephemeral drainages, whether designated on a map or not:

   a. No skidding would be allowed up or down ephemeral and intermittent drainages.

   b. No road construction would be allowed in or immediately adjacent to ephemeral and intermittent drainages except at designated crossings.

   c. All skid trails crossing drainages would be designated and approved by the authorized officer prior to activity and would be at right angles to streambanks.

   d. The number of skid trail and road crossings would be minimized across these channels.

   e. An undisturbed filter strip of vegetation and litter would be maintained between skid trails/log decks/roads and the channel wide enough to prevent sediment from entering the channel.

f. Water control features (water bars, lead-out ditches, etc.) would be constructed on these skid trails and roads.

g. The amount of logging debris deposited in ephemeral and intermittent drainages would be minimized and excess debris would be removed by hand or end lining except where woody material is needed for watershed health identified by a watershed specialist.

h. Trees would not be cut where the root system is important in maintaining the integrity of the bank.

i. No log decks would be located within or immediately adjacent to the ephemeral and intermittent drainages.

j. Slash can be placed to drive equipment over to reduce rutting and soil disturbance.

k. Water control features would be placed so there is adequate filter distance between structure outlets and stream channel (minimum of 50 feet and increase width as slope steepness increases).

5. **Log Landing Location**

   Log landings (or decking areas) would not be allowed in or within 300 feet of meadows, riparian areas, stream channels, or springs.

6. **Slash Treatments in Sensitive Areas**

   Mechanical slash piling would not occur in meadows or water resource features such as stream channels, seeps, springs, and riparian areas.

7. **Wetland, Spring, Seep, and Meadow Protection During Tree Removal Activities**

   A 300-foot buffer zone would be placed around Ojo Terreo to exclude mechanized equipment. Smaller riparian areas as found in the project area would also be protected. Nonnative vegetation may be removed in these areas using manual methods.

8. **Prescribed Burning Treatments**

   For the retention of long-term soil productivity, to maintain the sediment filtering capacity of streamside management zones, and to reduce erosion, prescribed burns will allow for low to moderate burn intensities.

   Fire control lines on slopes greater than 40 percent or within designated areas would be constructed by hand. Exceptions would be approved by a local district ranger, and specific mitigations would be determined and documented at that time. Lines would be treated (water bars, seeding, etc.), preventing concentrated waterflows and sediment to streams.

   Ignition would be above slope breaks of channels. When adjacent upland zones have not recovered hydrologically from project entries, fire would be limited to 15 percent or less of the SMZ.

   The BMPs for prescribed fire are to schedule burning when the soil moisture conditions would minimize heat conductivity into the soils. SMZs or buffers along stream channels can provide shade for stream temperatures and provide filter strips for sediment and nutrients as described later. Streamside buffers are often difficult to exclude from a prescribed burn, but the soil and vegetation are usually moist and do not burn.

9. **Servicing and Refueling Equipment**

During servicing or refueling of equipment, pollutants would not be allowed to enter any waterway, riparian area, or stream course. Service and refueling areas would be selected well away from wet areas and surface water, and berms would be constructed around such sites to contain spills. Spill prevention, containment, and countermeasures plans are required if the fuel exceeds 660 gallons in a single container or if total storage at a site exceeds 1,320 gallons. The project contract administrator would designate the location, size, and allowable uses of service and refueling areas. The authorized officer would be aware of actions to be taken in case of a hazardous substance spill.

The contractor would take all reasonable precautions to prevent pollution of all Cibola NF&Gs soil and water. Equipment operators would maximize the recovery and proper disposal of all fuels, fluids, lubricants, empty containers, and replacement parts. Refuse resulting from the contractor's use, servicing, repair, or abandonment of equipment would be removed from NFS lands by the contractor to the appropriate disposal facilities. Any leaks originating from contractor equipment would be repaired or the equipment replaced in a timely manner.

Through the implementation of these practices, water resource features would be undisturbed. In the case of stream channels, downcutting or aggradation would not occur, and streambanks and side slopes would remain stabilized. Ojo Terreo Spring would not be impacted by disturbance due to the buffer. Stream channels and the spring would be protected by BMPs to preserve their functions.

Since these BMPs would be implemented regardless of the action alternative selected, there is no difference between the action alternatives in direct and indirect effects to water resources features. However, there is a difference between the alternatives in regards to the risk of uncharacteristic wildfire. The transition ratio modeled in the fuels report is the measure used to assess the potential of wildfire effects on water resource features. The timeframe for analysis is 10 to 20 years since this is the length of time fuel treatments are expected to be effective, depending on the site characteristics.

The analysis area for water quality is surface waters in the project area. This includes Ojo Terreo and seasonal waters in intermittent streams. The water quality components most likely to be affected by the proposed activities are dissolved nutrients such as nitrogen and sediment. Ecosystems accumulate and cycle large quantities of nutrients. Fire and loss of vegetation can disrupt this cycle and cause nutrient leaching, volatilization, and transformation (USFS 2010). Wildfire releases more nitrogen into surfaces waters than prescribed fire (Stednick 2000). If vegetation is quickly reestablished, nutrient exports are short lived and usually do not represent a threat to water quality (USFS 2010). Because of this, nitrogen effects are not carried through the analysis.

Sediment is the result of soil disturbance, increased erosion, and subsequent transport to a stream channel or other water resource feature. Stream channels adjust to increased sediment loads. Fine sediment in channel bottoms can cause changes to microinvertebrates and changes in stream type. Increased site disturbance would result in increased soil erosion and subsequent sediment production (USFS 2010). The measures for the potential to change sediment are acres of ground disturbance. Roads are the source of much of the sediment related to harvest activities (USFS 2010). Increased traffic on roads related to tree removal activities leads to increased erosion and sediment from these

roads and adjacent areas. The measurements for sediment area are acres of ground disturbance, miles of road used for vegetative treatment activities, and miles of unauthorized road to be obliterated. The timeframe for analysis is 10 years since projects should be implemented by then.

Removing vegetation has the potential to increase water yields, change the timing of flow, and increase floods within a watershed (USFS 2010). Generally, at least 20 percent of the basal area needs to be removed before any change in annual water yield is observed (Stednick 1996). To assess this water quantity and timing, smaller project watersheds are delineated in the analysis area. The boundaries for these watersheds were delineated so that project activities are included within the boundaries. These watersheds are called project watersheds and are numbered from 1 to 12, shown in Figure 20. There were a few areas not carried through the analysis for watershed effects where project boundaries cross watershed boundaries at ridges. The small areas comprise less than 1 percent of a watershed, which would be drawn to include their boundaries. This small amount is not enough to cause changes to water quantity (Bosch and Hewlett 1982; Stednick 1996), especially since they are located along ridges. Changes to peak flows can also be related to harvest levels within the project watersheds. These watersheds are mostly in the transition zone between rain and snow dominated precipitation. In this region, the mean of reported change in peak flows begins to be important when about 15 to 20 percent of the watershed is harvested (Stednick 1996; Grant et al. 2008). These changes in peak flow are most evident during times of high soil moisture, such as spring and summer, and in flows of moderate frequency and magnitude. Extreme flood events are not affected measurably by timber harvest. The timeframe for changes to annual water yield and small to moderate peak flows is 10 years, since within this timeframe, most potential water resource effects become undetectable with natural variability. The measure is percent of each project watershed with proposed activities. This effect is analyzed using all proposed projects, including the Pueblo and Chilili, since it is a watershed effect.

Alternative A (No Action)

There would be no direct effects on water resources or watersheds from the no action alternative. This is because there would be no active activities occurring that would cause ground disturbance to water resource features or loss of vegetative cover.

Water resource features such as ephemeral, intermittent streams, Ojo Terreo, and localized riparian areas would remain as described in the “Affected Environment” section. Under this alternative, existing forest conditions could lead to uncharacteristic wildfire with susceptibility to crown fire and high surface heating across large portions of the project area, as evidenced from recent wildfires in the area. The modeled transition ratio is above 1 for all vegetation types under the no action alternative as shown in Table 21 below. Wildfire removes vegetation and causes bare soil, leading to increased erosion, sedimentation, and runoff (USFS 2010). As a result, channels adjust and water quality changes depending on the severity and extent of the fire. Should this happen, most of these effects would decrease to undetectable levels within 10 years as revegetation occurs and water resource features such as channels and springs recover.

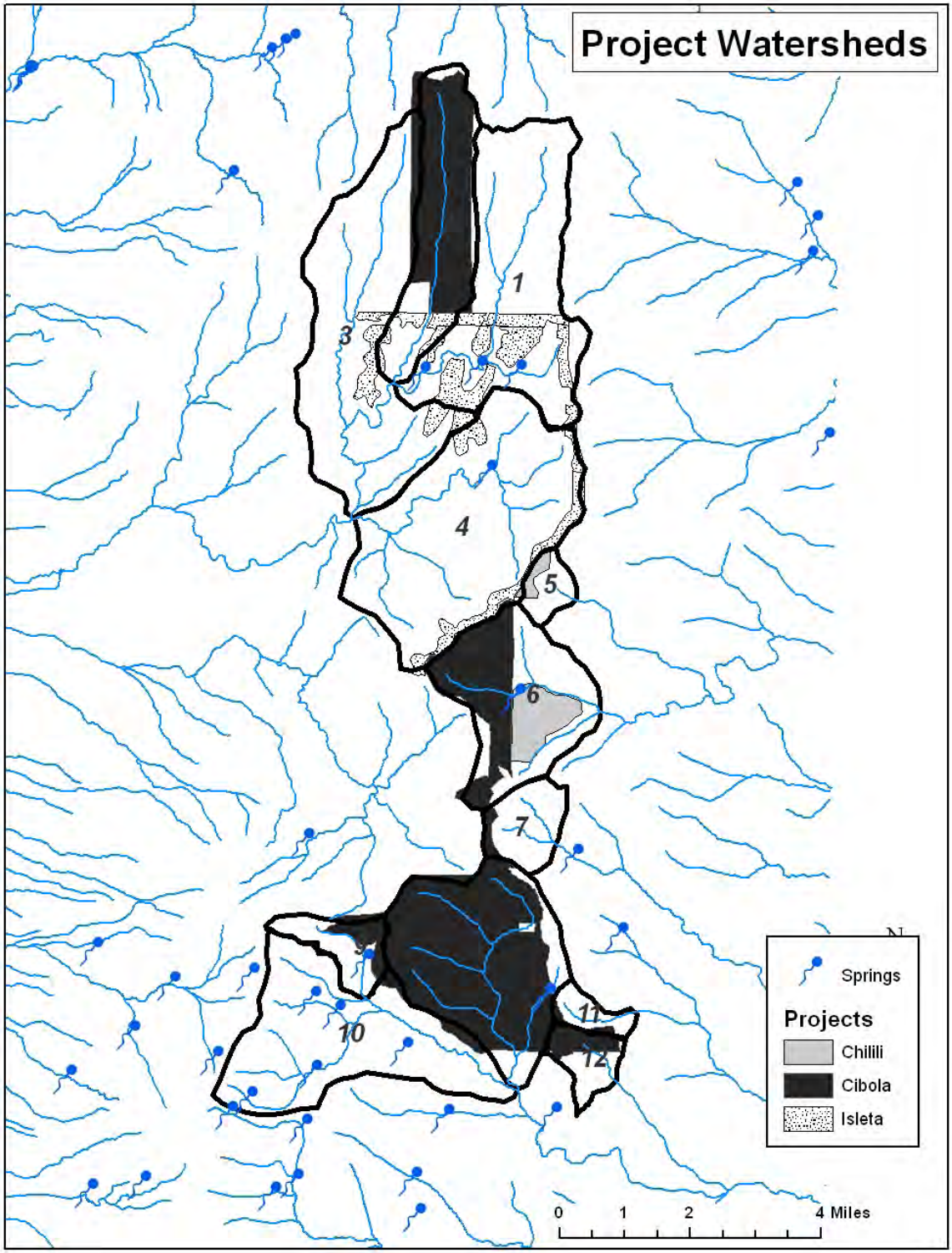

Figure 20. USFS project watersheds
Source: Cibola National Forest and Grasslands

Water quality in the project area would remain much the same, with the continued susceptibility to uncharacteristic wildfire and sediment yield related to roads, including unauthorized roads. Unauthorized roads are not designed to a specification or maintained by the USFS. Because of this, they are a greater source of sediment and soil loss than maintained NFS roads.

Under the no action alternative, none of the unauthorized roads in the project area would be obliterated after the project is completed. Since there would be no increase in road use related to the proposed activities, sediment yields from the 32.7 miles of NFS roads would remain the same. No additional maintenance would be done on these roads to improve them for project activities. However, regular maintenance activities would still occur.

Change to water yields as a result of the no action alternative depend on whether a wildfire occurs within the timeframe of analysis—10 years. Tree densities are likely to increase in many areas. Since streams in the project area are already intermittent and ephemeral, streamflow patterns are unlikely to change. Increased trees further increase the risk of wildfire. As mentioned, the susceptibility to crown fire is greatest under this no action alternative in the project area. Control opportunities for fighting wildfire would not be created under this alternative, leading to less control opportunities which could lead to extensive wildfire that burns large percentages of watersheds. When large parts of watersheds are burned, flooding occurs in downstream areas (USFS 2010).

Alternative B (Proposed Action)

This alternative proposes to treat vegetation by creating large openings, both permanent and temporary, in 20 to 50 percent of the project area, dependent on site conditions. Remaining groups of trees would be thinned as described in the vegetation report. Removal of trees would occur using mechanized equipment including masticators and by hand.

The direct effects to water resource features would be prevented and mitigated through the use of design features and BMPs as described in appendix B of the soil and water specialist report. Stream channels in the project area would not be used as pathways for motorized vehicles. Areas with riparian characteristics, including Ojo Terreo Spring, would be protected by buffer zones where trees would be retained and motorized vehicles would be excluded. Many stream channels contain stringers of ponderosa pine as described in the vegetation report. These areas would be retained as groups of trees. Openings would not be created where stream channels are present or on concave slopes. These practices are described in appendix B of the soil and water specialist report.

The areas where impacts to ephemeral and intermittent stream channels are those within areas open to personal use firewood permits. These areas are on satisfactory soils with less than 40 percent slopes, 1,710 acres of ponderosa pine and 1,450 acres of piñon-juniper woodlands. Personal firewood collecting can lead to a high degree of surface disturbance, including to streambanks and channels, directly through motorized cross-country travel and indirectly by mobilizing sediment. The effect is greatest in the piñon-juniper vegetation type.

The reduced susceptibility to crown fire and increased control opportunities provided by this alternative could decrease the potential for uncharacteristic wildfire to burn water resource features and their watersheds. This protects these features from high intensity effects related to wildfires of this type.

There would be little direct or indirect effects on surface water quality from alternative B. There may be some increased sedimentation during runoff events from soil disturbance and road use within the project area. Since storm runoff waters often include sediment, it is not likely to be detectable in these flows. The creation of permanent and temporary openings across up to 60 percent of the project area would increase water reaching the surface, leading to more runoff. Snowmelt waters, however, are not naturally turbid, and increased sediment loads in these waters during early spring are likely if project activities occur during this time. In addition, watersheds 8, 9, and 10 are upstream of the perennial portions of Tajique Creek. Tajique Creek is already impacted by elevated sediment levels related to roads and dispersed recreation. The areas around springs and designated riparian areas would not be treated; these buffer zones would prevent sediment from entering these areas, thereby protecting their water quality.

Changes in runoff rates and water yield from area disturbance and vegetation removal in the project area and near stream channel bottoms could occur in some watersheds. The average percent of basal area removed within each project watershed was calculated to determine the potential effect on water balance, including annual water yield and peak flows. As shown in table 20, more than 15 percent of the basal area is proposed for removal under the proposed alternative in watersheds 2, 6, 8, 9, and 12. In these watersheds, projects would occur at least a year apart due to migratory bird phasing. If less than 15 percent of each watershed is treated every 3 to 5 years, it is unlikely that peak flows would be measurably changed during runoff events as long as roads are maintained and motorized cross-country travel for personal firewood removal is mitigated.

Table 20. Average percent basal area reduction from each project watershed

Project Watershed Number	Watershed Acres	Acres of Projects			Average Basal Area Removed Alternative B	Average Basal Area Removed Alternative C
		USFS	Isleta	Chilili		
1	4,757	13	847	0	10.0%	8.2%
2	2,620	1,803	184	0	58.2%	40.9%
3	5,168	188	341	0	6.5%	5.0%
4	5,722	20	520	12	5.4%	4.4%
5	412	0	3	82	11.3%	9.3%
6	2,976	1,221	1	519	42.3%	30.4%
7	859	75	0	0	5.7%	4.6%
8	4,010	3,518	0	0	63.2%	47.1%
9	757	227	0	0	21.1%	16.0%
10	4,116	137	0	0	2.7%	1.8%
11	381	59	0	0	11.9%	8.4%
12	586	249	0	0	27.7%	22.3%

Note: These numbers may vary slightly from totals found elsewhere due to GIS data. Shaded watersheds are above 15 percent.

Alternative C

This alternative proposes to treat vegetation by creating temporary openings in 10 percent of the project area, dependent on site conditions. Remaining trees would be thinned as described in the

vegetation report. Removal of trees would occur using mechanized equipment including masticators and by hand.

The direct effects to water resource features would be prevented and mitigated through the use of design features and BMPs as described in appendix B of the soil and water specialist report. Stream channels in the project area would not be used as pathways for motorized vehicles. Areas with riparian characteristics, including Ojo Terreo Spring, would be protected by buffer zones where trees would be retained and motorized vehicles would be excluded. These areas have some opportunities for site improvement as described in the wildlife report, which could include removal of nonnative plants and selected trees to promote desired species. These practices are described in appendix B of the soil and water specialist report.

The areas where impacts to ephemeral and intermittent stream channels are those within areas open to personal use firewood permits. These areas are on satisfactory soils with less than 40 percent slope, 1,710 acres of ponderosa pine and 1,450 acres of piñon-juniper woodlands. Personal firewood collecting can lead to a high degree of surface disturbance, including to streambanks and channels, directly through motorized cross-country travel and indirectly by mobilizing sediment. The effect is greatest in the piñon-juniper vegetation type.

The reduced susceptibility to crown fire and increased control opportunities provided by this alternative could decrease the potential for uncharacteristic wildfire to burn water resource features and their watersheds. This protects these features from high intensity effects related to wildfires of this type.

There would be little direct or indirect effects on surface water quality from alternative C. There may be some increased sedimentation during runoff events from soil disturbance and road use within the project area. Since storm runoff waters often include sediment, it is not likely to be detectable in these flows. The creation of temporary openings on 10 percent of the project area would increase water reaching the surface, leading to more runoff. Snowmelt waters, however, are not naturally turbid, and increased sediment loads in these waters during early spring are likely if project activities occur during this time. In addition, watersheds 8, 9, and 10 are upstream of the perennial portions of Tajique Creek. Tajique Creek is already impacted by elevated sediment levels related to roads and dispersed recreation. The areas around springs and designated riparian areas would not be treated; these buffer zones would prevent sediment from entering these areas, thereby protecting their water quality.

Changes in runoff rates and water yield from area disturbance and vegetation removal in the project area and near stream channel bottoms could occur in some watersheds. As shown in Table 20, more than 15 percent of the basal area is proposed for removal under the proposed alternative in watersheds 2, 6, 8, 9, and 12. In these watersheds, projects would occur at least a year apart due to migratory bird phasing. If less than 15 percent of each watershed is treated every 3 to 5 years, it is unlikely that peak flows would be measurably changed during runoff events as long as roads are maintained and motorized cross-country travel for personal firewood removal is mitigated.

Alternative Summary and Comparison

Table 21 provides a summary of water resource measures.

Table 21. Summary of water resource measures

Alternative	Measure for Sediment Yield			Measure for Impact to Water Resource Feature		
	Potential Acres of Disturbance	Miles of Road to be Used for Project Purposes	Miles of Unauthorized Roads to be Obliterated Post Project	[1]Transition Ratio		
				P-J	PP	MC
A	0	0	0	1.60	2.13	0.61
B	5,147	32.7	11	0.04	0.13	.04
C	3,538	32.7	11	0.04	0.13	0.04

[1] Transition ratio = risk of crown fire likely if >1 under severe weather conditions.
P-J = piñon-juniper; PP = ponderosa pine; MC = mixed conifer; Oak = oak woodlands.

Cumulative Effects

Actions occurring within the Cibola NF&Gs that could potentially combine with the effects of the proposed action and result in significant environmental impacts include vegetation treatment, thinning, prescribed fires, and grazing and wildlife habitat improvements. Past actions in the area have included recreation and livestock grazing. A list of activities is listed in the EA. The areas surrounding the project area were settled nearly 200 years ago.

The cumulative effects boundary for watershed condition is the sixth code watersheds. This is the scale used by the Water Resource Sector Strategy (2011) to determine watershed condition. The no action alternative has the most potential for changing watershed condition, due to the susceptibility for large wildfires. A large wildfire has the potential to change watershed condition to impaired on any of the sixth code watersheds in the project area. Implementing one of the action alternatives could provide control opportunities, thereby reducing the size and severity of potential wildfires. This could prevent watershed condition moving to impaired.

Vegetation

Pueblo and Chilili Affected Environment

Much like temperature and precipitation, vegetation is heavily influenced by the area's elevation and topography. The project area consists of a total of 2,620 acres with an elevation range of 6,000 to 8,000 feet. Vegetation communities within the project area consist of piñon-juniper woodlands at lower elevations and south-facing aspects, ponderosa pine forest and oak shrubland at middle elevations and north-facing aspects, and a small area of mixed conifer woodland at higher elevations. Varying age classes, densities, and health are present throughout the project area. Some small meadows are also present. Mixed conifer woodlands are transitional, with ponderosa pine becoming codominant with Douglas-fir as elevation increases. The full biological evaluation for Pueblo and Chilili lands (appendix B) includes a list of plant species identified during the field surveys.

Existing Conditions

Piñon-Juniper Woodland

Approximately 57 acres of the analysis area consists of piñon-juniper woodland. The canopy is dominated by piñon pine and one-seed juniper. The understory associated with this land cover type is variable and may be dominated by shrubs and grasses, or may be absent. Common mid-story shrubs in this ecosystem include sagebrush (*Artemisia* sp.), mountain mahogany, and Gambel oak. Common understory herbaceous species are blue grama and Arizona fescue (*Festuca arizonica*), as well as banana yucca (*Yucca baccata*) and prickly pear cactus (*Opuntia polyacantha*). Much of the piñon-juniper woodland in the project area exhibits dense closed canopy with a minimal understory of sparse grasses. Vegetation vigor is generally low with evidence of competition and high levels of mortality; individual trees have become susceptible to insect and mistletoe (Family: Viscaceae) infestation.

Ponderosa Pine Forest Type

Approximately 1,895 acres of the analysis area consists of ponderosa pine forest type. This forest type occurs at the ecotone between grasslands and shrublands and more mesic coniferous forests and ranges in elevation from 6,000 to 8,000 feet. Ponderosa pine is the dominant overstory species, transitioning to piñon pine, and one-seed and alligator juniper on the xeric end of its range, to Douglas-fir and Gambel oak in drainages and north-facing slopes. Understory shrubs are somewhat limited due to the ever increasing canopy cover and consist of mountain mahogany, Gambel oak, gray oak (*Quercus grisea*), western snowberry (*Symphoricarpos occidentalis*), Woods' rose (*Rosa woodsii*), New Mexico locust (*Robinia neomexicana*), and kinnikinnick (*Arctostaphylos uva-ursi*). Common herbaceous understory components include needle and thread grass (*Hesperostipa comata*), fescue (*Festuca* sp.), muhly (*Muhlenbergia capillaries*), and grama (*Bouteloua* sp.) species. Understory vegetation in ponderosa stands tend to be sparse, primarily consisting of bladder pod (*Lesqueralla* sp.), woolly loco (*Astragalus mollissimus*), New Mexico groundsel (*Senecio neomexicanus*), perky sue (*Tetraneuris argentea*), dwarf lousewort (*Pedicularis centranthera*), slim-leaf mustard (*Schoenocrambe linearifola*), Fendler's penstemon (*Penstemon fendleri*), spreading fleabane (*Erigeron divergens*), and creeping mahonia (*Berberis repens*). Trees in this ecosystem type tend to have a heavy parasitic plant load. Ponderosa, piñon, and juniper alike are heavily infested with mistletoe, while pinesap (*Monotropa hypopithys*) and squawroot (*Conopholis alpina* var. *mexicana*) attack pine and oak roots.

Mixed Conifer Forest Type

Approximately 40 acres of the analysis area consists of the mixed conifer forest type with elevations ranging from 7,500 to 10,500 feet. Because this habitat type occurs over such a wide elevation range, this ecological association is highly variable, depending especially on temperature and moisture relationships. At the lower end of the elevation range, the mixed conifer forest and woodland is found on steep, cool, north-facing slopes, while in the upper elevations it occurs on both north- and south-facing slopes and in drainages. Douglas-fir, white fir (*Abies concolor*), and ponderosa pine are the most common canopy dominants. Many cold tolerant deciduous shrub species are common in the understory, including kinnikinnick, creeping mahonia, western snowberry, Gambel oak, and common juniper (*Juniperus communis*). Herbaceous species included Arizona fescue, sedges (*Carex* sp.), and meadow rue (*Thalictrum* sp.). Understory vegetation changed as the elevation increases, with plants in the Family

Fabaceae becoming dominant, for example, Wright's deervetch (*Lotus wrightii*) and purple locoweed (*Oxytropis lambertii*).

Meadow Grasslands

Montane and subalpine grassland habitats are scattered throughout the project area on south-facing slopes and plateau areas. These areas make up approximately 72 acres of the analysis area and are found primarily in the Pueblo and Chilili portions of the project. Soils in these areas resemble prairie soils, in that they are well drained and relatively high in organic matter, with a dark brown A-horizon. These areas typically support two to three dominant bunch grasses, including Arizona fescue, timber oat-grass (*Danthonia intermedia*), mountain muhly (*Muhlenbergia montana*), blue grama, and bluebunch wheatgrass (*Pseudogoegneria spicata*). Other herbaceous plants included Indian paintbrush (*Castilleja minata*), purple three-awn (*Aristida purpurea*), and squirreltail (*Elymus longifolus*). Many of the open meadows are becoming encroached upon by the piñon-juniper woodland type, reducing wildlife habitat and increasing fire risk and potential for crown fire spread.

Riparian Forest Type

Riparian forest does occur in the project area (characterized by wetland vegetation, such as boxelder (*Acer negundo*), New Mexico locust, Virgin's bower (*Clematis ligusticifolia*), and narrowleaf cottonwood (*Populus angustifolia*)) but in very limited amounts and localized settings. Scattered ephemeral drainages are found throughout the project area, with understory vegetation composed of wild strawberry (*Fragaria vesca* var. *americana*), wild rose (*Rosa* sp.), wild bergamot (*Monarda fistulosa*), yarrow (*Achillea millefolium* var. *lanulosa*), mountain parsley (*Pseudocymopterus montanus*), and solitary sunflower (*Helianthus pauciflorus*).

Old Growth

Fuel reduction treatments, while targeting a change in forest structure to reduce the potential for crown fire, can also seek to retain large diameter trees and old growth. These older trees provide habitat for wildlife, perpetuate genetic diversity, and provide a record of disturbance events and past climates (Swetnam and Brown 1992). Because of their thick bark and higher crown base heights, old trees are better able to withstand wildfire and so would be protected from any damage that may result from a prescribed burn. Unlike dense stands of small diameter trees, large diameter trees do not pose a fire hazard so their retention does not undermine hazardous fuel reduction objectives. In this project area all trees over 16 inches in diameter would be retained.

Invasive Species

Guided by the New Mexico State-listed Noxious Weeds List (2009), no noxious weeds, or invasive plants species, were immediately identified in a SWCA biological field survey of Pueblo and Chilili lands conducted in May 2010 and USFS surveys conducted in 2010-2011.

Although no invasive species were identified, noxious weeds such as spotted knapweed (*Centaurea maculosa*), Canadian thistle (*Cirsium arvense*), saltcedar (*Tamarix* sp.), and cheatgrass (*Bromus tectorum*) (all known to occur within the adjacent Sandia RD to the north of the proposed project, see USFS 2010) may increase and spread through human-induced activities (vehicles, grazing, etc.).

Cibola NF&Gs Affected Environment

Existing Conditions

Overall (all forest types), trees larger than 16 inches in diameter (at either d.b.h. or d.r.c.) are deficient.

Piñon-Juniper Woodland

Approximately 2,600 acres of the analysis area consists of the piñon-juniper woodland forest type. This forest type is typically a mix of piñon pine and one-seed/Rocky Mountain juniper with scattered ponderosa pine, alligator juniper, wavyleaf oak, and Gambel oak. At the “wetter” end of this forest type, piñon-juniper and ponderosa pine are more evenly balanced resulting in an “ecotone” between the two forest types. The grass/forb/shrub component is lacking in both diversity and abundance. The dominant habitat type is piñon pine/blue grama.

Basal areas per acre range from 21 to 246. Vegetative structural stages are weighted heavily to the VSS 4 and VSS 5 (>5–11 inches d.r.c.) classes and underrepresented in the VSS 1–3 classes.

The percent of maximum stand diversity index (SDI) values tell the comprehensive story. While individual site SDI values range from 39 to 407, the weighted average value for percent of maximum SDI for this forest type is 63 percent of maximum SDI, indicating that tree growth has reached a “plateau” where tree-to-tree competition is severe. Overall vegetation vigor and health are at a low point making the vegetation susceptible to replacement through insect/disease activity and/or wildfire. Mortality is occurring, and susceptibility to bark beetle attack is high.

Easterly/southeasterly drainages support localized ponderosa pine “stringers,” which provide additional species and structural diversity to the piñon-juniper woodlands.

Dwarf mistletoe infections are generally light (less than 20 percent of the trees infected) and localized across most of the project area but are more continuous and severe in the Dog Head portion of the Mountainair RD.

Oak Woodland

Approximately 1,100 acres of the analysis area consists of the oak woodland forest type. This forest type is typically dominated by oak with scattered ponderosa pine and alligator/Rocky Mountain juniper.

Basal areas per acre range from 17 to 240. Vegetative structural stages are heavily weighted (81 percent) in the VSS 1 and 2 structural stages.

The percent of maximum SDI values tell the comprehensive story. While individual site SDI values range from 44 to 529, the weighted average for this forest type is 34 percent of maximum SDI, indicating less than full site occupancy and relatively vigorous growing conditions for this forest type.

Ponderosa Pine Forest

Approximately 3,900 acres of the analysis area consists of the ponderosa pine forest type. Typically this is the “dry” end of the ponderosa pine type and has scattered piñon pine and one-seed/alligator juniper, as well as Gambel/wavyleaf oak. In moist sites (drainages, etc.) oaks tend

to be large and long lived. Also in the drainages and/or north slopes, Douglas-fir and white fir may be intermixed with ponderosa pine and may be actually increasing due to lack of fire in the pine ecosystem For the same reason, “ladder fuels” are more common, which can facilitate ground fires moving into the tree crowns.

Basal areas per acre range from 18 to >300 square feet per acre. While vegetative structural stages are relatively balanced, most of the stocking occurs in the VSS 3 (5–11.9 inch diameter) class. The grass/forb/shrub component lacks diversity, abundance, and vigor. The dominant habitat type is ponderosa pine/Gambel oak.

Again, percent of maximum SDI values tell the comprehensive story. While individual site SDI values range from 39 to >500, the weighted average for this forest type is 72 percent of maximum SDI, indicating that the forest type also has reached a “plateau” where tree-to-tree competition is extremely intense. Mortality is occurring and overall vegetation vigor and health are at a low point making the vegetation susceptible to replacement through insect/disease activity and/or wildfire.

There is much within-stand species diversity that is not addressed within the overall forest type classification. Piñon-juniper, alligator/Rocky Mountain juniper, and Douglas-fir are commonly scattered, though at low densities, throughout the ponderosa pine forest type.

Easterly/southeasterly drainages support localized, more concentrated Douglas-fir “stringers,” which provide additional species and structural diversity to the ponderosa pine forest type.

Mixed Conifer Forest

Approximately 131 acres of the analysis area consists of the mixed conifer forest type (at least 40 percent composition of Douglas-fir and white fir).

Basal area per acre ranges from 77 to 237. The vegetative structural stages are grouped into the VSS 3 (5–11.9 inches d.b.h.) and VSS 5 (18–23.9 inches d.b.h.) classes. Multistoried conditions, plus live branches near the ground, provide a ready avenue for ground fires to move into the tree crown. The dominant habitat type is white fir/Gambel oak.

While individual site SDI values range from 147 to 421, the weighted percent of maximum SDI value is 61 percent of maximum SDI indicating that the stand also has reached that “plateau” where tree-to-tree competition is extremely intense. Mortality is occurring and overall vegetation vigor and health is declining making the vegetation susceptible to replacement through insect/disease activity and/or wildfire. Dwarf mistletoe infection is generally light (less than 20 percent of the trees infected) and localized.

Old Growth

Fully developed old growth structural conditions, as defined on pages 65-66 of the forest plan (1985), do not exist in the project area.

Old growth resources were analyzed at multiple scales, the first being the midscale Manzanita/Manzano Ecosystem Management Area, which includes NFS lands in the Manzanita and Manzano Mountains outside Manzano Mountain Wilderness; one scale above, which includes

the Manzanita/Manzano Ecosystem Management Area plus Manzano Mountain Wilderness; and at one scale below, at the Isleta CFRP project level.

Midscale – The 90,549-acre (NFS lands) Manzanita/Manzano Ecosystem Management Area is characterized by historical harvest activities and grazing over the last 300 to 400 years. Fire activity, especially over the last 150 years, has been minimal.

Allocation of at least 20 percent, by the forested Manzanita/Manzano Ecosystem Management Area, of old growth has been completed (forest plan, page 65). Table 22 shows the gross acreage and allocated areas for old growth management for each included forest type. Included are "de facto" old growth areas (forest plan, page 55) such as northern goshawk nesting areas.

Table 22. Old growth allocation within the Manzanita/Manzano Ecosystem Management Area

Forest Type	Gross Acres	Old Growth Allocation (acres)
Piñon-juniper woodland	49,056	13,703 (28%)
Ponderosa pine	22,912	4,911 (21%)
Mixed conifer	2,727	545 (20%)

One scale above – The Manzano Mountain Wilderness supplements the Manzanita/Manzano Ecosystem Management Area described above to comprise a scale above the midscale area approximately 127,631 acres in size. Historic disturbance within the Manzano Mountain Wilderness is more limited than in the Manzanita/Manzano Ecosystem Management Area due to the lack of access, legislative withdrawal of the area as a wilderness, and lack of historic fire activity.

All forested areas within the Manzano Mountain Wilderness are considered "de facto" old growth (forest plan (1985), page 65).

Table 23 displays the **combined** forest type and allocated old growth acres for both the Manzanita/Manzano Ecosystem Management Area and Manzano Mountain Wilderness.

Table 23. Old growth allocation within the combined Manzanita/Manzano Ecosystem Management Area and Manzano Mountain Wilderness

Forest Type	Gross Acres	Old Growth Allocation (acres)
Piñon-juniper woodland	56,670	21,317 (37%)
Ponderosa pine	27,795	9,794 (35%)
Mixed conifer	10,406	8,224 (79%)

One scale below – The Isleta CFRP project area comprises the scale below the initially described Manzanita/Manzano Ecosystem Management Area. This approximate 7,687-acre project area represents an area that was typically very accessible for wood harvest and grazing, resulting in disturbance related changes to stand structure over time. At least 20 percent (forest plan (1985), page 65) of each forest type representing those stands most closely meeting the minimum criteria for old growth structural attributes, has been set aside for management designed to achieve old growth status. Table 24 shows those selected areas by forest type.

Sites with the most potential to reach old growth status have been allocated for each representative forest type in the project area.

Table 24. Old growth allocation within the Isleta CFRP

Forest Type	Gross Acres	Old Growth Allocation (acres)
Piñon-juniper woodland[1]	2,582	860 (33%)
Ponderosa pine[2]	3,852	780 (20%)
Mixed conifer[3]	131	83 (63%)

[1] Selected locations/sites allocated toward old growth in the piñon-juniper woodland include: 004004/17; 004005/2; 004074/19; 004076/15; 004084/1,6,7; and 500001/3, 8, 16, 20, 22, 24, 25, 32, 34, 36, 40, and 44–46.
[2] Selected locations/sites allocated toward old growth in the ponderosa pine include: 004001/1, 8, and 16; 004002/1; 004004/24 and 27; 004073/7, 10, 14, and 16; 004074/2; 004076/7; and 500001/15 and 28.
[3] Selected locations/sites allocated toward old growth in mixed conifer include: 4073/2.

Northern Goshawk Habitat Structures

Distribution of habitat structures (forest plan, 1985 as amended) for the northern goshawk are analyzed at the Manzanita/Manzano Ecosystem Management Area scale, the Isleta CFRP project scale, and site (stand) scale.

- VSS Classes
  - Manzanita/Manzano Ecosystem Management Area Scale – Distribution by forest type and VSS class is shown in table 25. VSS classes 1 and 2 are more prevalent across this broad landscape due to recent severe wildfire activity and subsequent natural and artificial reforestation.
  - Isleta CFRP project scale – Distribution by forest type and VSS class is shown in table 26.
  - Site (stand) scale – Stand density index distribution by VSS diameter groups is an indicator of within-stand variation and is shown in table 27.

Table 25. Distribution by VSS class and forest type (percentage) for forested areas within the Manzanita/Manzano Ecosystem Management Area

Forest Type	VSS 1	VSS 2	VSS 3	VSS 4	VSS 5	VSS 6
Piñon-juniper woodland	0%	<1%	1%	35%	63%	–
Oak woodland	31%	28%	8%	22%	11%	–
Ponderosa pine	9%	3%	55%	22%	11%	<1%
Mixed conifer	25%	3%	46%	15%	11%	0%

Table 26. Distribution by VSS class and forest type (percentage) for forested areas within the Isleta CFRP Project area

Forest Type	VSS 1	VSS 2	VSS 3	VSS 4	VSS 5	VSS 6
Piñon-juniper woodland	3%	3%	6%	43%	45%	–
Oak woodland	38%	43%	3%	3%	13%	–
Ponderosa pine	12%	3%	48%	17%	18%	2%
Mixed conifer	0%	0%	37%	0%	63%	0%

Table 27. Distribution by VSS diameter groups (by site) at the site level

Forest Type	VSS 1/2	VSS 3	VSS 4	VSS 5	VSS 6
Piñon-juniper woodland	78%	11%	2%	9%	–
Oak woodland	99%	1%	0%	0%	–
Ponderosa pine	73%	20%	4%	3%	0%
Mixed conifer	74%	10%	5%	5%	6%

- Tree Densities
  - Average tree densities (trees per acre) by forest type at the different scales are shown in table 28. Relatively high and consistent tree densities, at all scales, reflect the lack of disturbance over time, either naturally or through management.
- Snags (standing dead trees)
  - Snag deficits in the piñon-juniper and ponderosa pine forest types at the site and Isleta CFRP analysis area levels reflect historical use and limited management (prescribed fire, etc.) due to better accessibility (table 29). Higher snag levels, at the Manzanita/Manzano Ecosystem Management Area level, are a result of recent wildfire activity across the landscape.
- Downed Logs
  - Relatively low downed log levels in the piñon-juniper and ponderosa pine forest types at the site and Isleta CFRP project area levels reflect accessibility and harvest activity. Downed logs at these scales are typically at higher stages of decay.
  - Higher quantities of downed logs at the Manzanita/Manzano Ecosystem Management Area are reflective of fire damaged snags from recent wildfire activity deteriorating and falling to the ground.
  - Table 30 displays downed log distribution at all scales.

Table 28. Average tree densities (trees per acre) by forest type at the different scales

Forest Type	Manzanita/Manzano Ecosystem Management Area	Isleta CFRP Project Area	Site Level
Piñon-juniper woodland	683	674	108–6,600
Oak woodland	5,115	1,265	797–6,780
Ponderosa pine	710	573	90–4,988
Mixed conifer	3,201	1,799	311–4,201

Table 29. Average number of snags (standing dead trees) per acre at the different scales

Forest Type	Manzanita/Manzano Ecosystem Mgt Area	Isleta CFRP Project Area	Site Level
Piñon-juniper woodland	9–12	<2	<2
Oak woodland	4–6	<2	<2
Ponderosa pine	14–20	<2	<2
Mixed conifer	6–8	<2	<2

Note: Piñon-juniper snags are at least 12 inches d.r.c./10 feet high; ponderosa pine snags are at least 9 inches d.b.h./15 feet high.

Table 30. Average number of downed logs larger than 12 inches in midpoint diameter per acre at the different scales

Forest Type	Manzanita/Manzano Ecosystem Management Area	Isleta CFRP Project Area	Site Level
Piñon-juniper woodland	10–15	<2	<2
Oak woodland	1–3	<2	<2
Ponderosa pine	10–15	<2	<2
Mixed conifer	4–6	<2	<2

Note: Tentatively, a “dispersed” northern goshawk PFA area is planned for the portion of the project on the Mountainair RD.

- Climate Change and the Forested Environment

  The forested landscape of the Isleta project plays a role in carbon sequestration. Carbon stored in live biomass, dead plant material, and soil represents the balance between CO_2 absorbed from the atmosphere and its release through respiration, decomposition, and burning. Live tree vigor, both as individuals and on a landscape scale, is a factor in how efficiently carbon is sequestered. Based on current projections, the primary regional level effects of climate change include projected increases in the frequency of extreme weather events; wildfire risks; outbreaks of insects, diseases, and nonnative invasive species; demand for decreasing upland water supplies; and national forest socioeconomic uses and demands (USDA, 2010)

Pueblo and Chilili Environmental Consequences

General Plant Communities

Alternative A (No Action)

Under alternative A, there would be no change to the current forest structure and plant community composition in the project area. The current unhealthy forest condition would be perpetuated over time and become more susceptible to disturbance by fire, drought, insects, and disease. The current homogenous stand age structure would be unchanged and habitat diversity would remain limited. Understory plant vigor would remain low continuing to perpetuate limited species diversity.

Alternative B (Proposed Action)

Under alternative B, the proposed treatments would reduce vegetation density and create more varied structure in a manner that would restore the forest to a more sustainable condition. Forest

health is expected to be improved with resultant increases in individual tree vigor and resilience to drought, disease, and insect infestation. The herbaceous plant community would benefit from increased sunlight and reduced competition from the overstory vegetation. Studies of similar treatments in the Southwest have found herbaceous biomass to increase significantly following thinning treatments compared to control plots (Covington et al. 1997; Griffis et al. 2001).

Prescribed fire would have both immediate and long-term impacts on the general plant community. Removal of surface fuels due to wildfire would prepare the forest floor and seedbed promoting increased seed germination. Based on studies of similar treatments, herbaceous plant biomass and diversity of native species are expected to increase (Griffis et al. 2001). Prescribed fire would also remove ladder fuels and reduce the density of small diameter trees raising the average c.b.h. in a stand and making the residual trees more resilient in the event of an uncharacteristic crown fire. Many species are also dependent on fire for regeneration, including ponderosa pine (Biswell 1973). Because ponderosa pine is shade intolerant, regeneration is limited by continuous canopy cover; prescribed fire that opens up the canopy and increases sunlight to the ground surface can invigorate regeneration and recruitment of the species, and strategic and long-term management of regenerating seedlings and saplings can help create a more varied age structure.

Old Growth

Alternative A (No Action)

Under alternative A, there would be no change to old growth habitat. Old growth could be impacted, however, in the event of an uncharacteristic wildfire due to the higher severity fire behavior predicted given the current stand condition.

Alternative B (Proposed Action)

Under alternative B, existing old growth would be protected from any canopy removal treatment unless it would compromise the effectiveness of a firebreak or pose a safety hazard to the public or firefighters. Old growth recruitment and enhancement would be expected to increase due to a reduction in tree densities and resultant improvement in vigor and growth. In the event of an uncharacteristic wildfire, treatments proposed in alternative B would reduce fire behavior intensity and protect old growth species from crown fire damage by removing ladder fuels and reducing the intensity of bole and basal charring and soil heating that could cause postfire mortality.

Invasive Species

Alternative A (No Action)

Under alternative A, there would be no change to the current distribution of noxious weeds. However, in the event of an uncharacteristic wildfire, disturbed areas may become prone to weed infestations as native species are consumed by fire in the project area. Wildfire destruction of forest canopy and ground fuels has been significantly correlated with decreases in native species and increases in nonnative species, at least in the first year post fire (Omi and Martinson 2007).

Alternative B (Proposed Action)

Fuel treatments proposed under alternative B may give rise to an increase in nonnative species by thinning out the forest canopy and leaving more bare ground for establishment; however, the treatments reduce the risk of high-severity wildfire associated with higher risks of nonnative plant establishment (Omi and Martinson 2007). Measures will be implemented to reduce the spread of invasive species, including cleaning equipment before and after entering the site, periodic and thorough inspection of all apparatus and equipment, and minimization of soil disturbance through following BMPs.

Cibola NF&Gs Environmental Consequences

Alternative A (No Action)

The no action alternative would result in no treatment of the existing unhealthy forest vegetation conditions. The forest ecosystem would remain susceptible to the adverse effects of uncharacteristic wildfire and insect/disease outbreaks. Both standing and downed fuel conditions would remain contiguous and susceptible to active and intense crown fire.

Forest vegetation would continue to grow but at reduced rates due to high tree densities, overcrowding, and competition for limited nutrients, water, and sunlight. Trees, both on an individual and landscape basis, would continue to be stressed and more susceptible to drought and insect and disease attack. Higher rates of mortality resulting from these causes could be expected. The dramatic increases in stand density and basal area over the last 80 to 90 years represent an increased susceptibility for bark beetle epidemics and stand-replacing wildfire (Moore et al. 2004).

Stand structure (the horizontal and vertical distribution of forest components including the height, diameter, crown layers, and stems of trees, shrubs, snags, and downed woody debris) would remain homogeneous or uniform.

Current conditions regarding the relatively low vegetation vigor and growth would continue. These poor health and vigor conditions would contribute to long-term adverse forest health conditions across the broader landscape. Recruitment and enhancement of old growth at all scales would continue to occur, although at the current, slower pace. In addition, such areas would be susceptible to uncharacteristic wildfire and/or insect/disease outbreaks.

Snag and downed log recruitment would continue to occur at current rates. Current inventories and future recruitment would be adversely affected by uncharacteristic wildfire.

Perceptible changes in distribution of vegetation components including structural stages, tree densities, snag and downed log distribution, and canopy cover would occur, at all scales, at slow rates in the near term unless affected by natural events (wildfire, insect/disease infestation, etc.). Invasive plant species would continue to be identified and mapped through random surveys in the area. Appropriate treatment strategies would continue to be developed based on these random findings.

Current poor vegetation productivity, as well as the potential for uncharacteristic wildfire and insect/disease outbreaks, will continue to adversely affect the resiliency and ability of the forested ecosystems in responding to projected climate change.

Alternative B (Proposed Action)

The proposed action effectively treats vegetation density, composition, and horizontal and vertical structure in the project area and in a manner that restores the forest types to a more sustainable condition (reduced tree densities, improved vertical and horizontal structure, and desired species composition). From a larger scale, this alternative treats only a minor portion of the total landscape in need of treatment.

Both standing and downed fuel conditions would be less contiguous and lessen the probability of sustained active and intense crown fire. Forest vigor within the project area is improved by reducing tree densities.

Desired structural conditions within the northern goshawk nesting, PFA, and foraging areas would not be completely achieved in this one entry, but would be placed on a trajectory toward meeting those conditions in the future.

The Gambel oak component can be highly affected by fire. Gambel oak can resprout prolifically (USFS 1997). Maintenance of the area would be critical to continue meeting treatment objectives. Project objectives can be met by retaining all coniferous tree species that are larger than 16 inches d.b.h./d.r.c..

Tree densities within the piñon-juniper and ponderosa pine forest types would be reduced to 30 to 70 square feet basal area per acre (approximately 55–138 trees per acre). Percent of maximum SDI levels would be decreased to 15–25 percent, providing for more open forest conditions, increased tree growth/vigor, and recruitment of understory grasses, forbs, and shrubs. Desired VSS class distribution would be enhanced through the recruitment of VSS classes 1 and 2 over approximately 10 percent of the forest type and further development of the mature and old forest classes through reduced competition and increased tree vigor. The potential for insect/disease outbreaks would be reduced. Stand structure would move toward uneven-aged management. Retaining a mix of native species would further strengthen forest health. Canopy cover would be reduced across the analysis area as a whole; however, canopy cover would be maintained within groups. Outside the analysis area, canopy cover levels would remain at current levels and increase over time.

Snag recruitment would continue to occur at current rates. Downed log recruitment could be expedited by the retention of logs onsite after treatment.

Percentage of canopy cover would be retained or would more quickly grow into the 45–60 percent level within the multiple tree groups spread across the project area in the piñon-juniper and ponderosa pine forest types. Within the mixed conifer forest type, canopy cover would remain unchanged unless affected by wildfire or insect/disease outbreaks.

Deficit vegetative structural stages would be recruited and horizontal/vertical diversity structure would be improved.

Old growth recruitment at the project scale would be enhanced through reduction of tree densities and resultant improvement in tree vigor and growth as well as retention of the larger trees in each of the included forest types. Old growth recruitment at the two higher scales would occur at a slower rate.

The proposal to burn natural and activity created woody material, either through prescribed or pile burning, within the project area would directly release carbon dioxide (CO_2) during burning operations. This would contribute to increasing the atmospheric greenhouse gas (GHG) concentration. However, restoration (or maintenance) of the desired conditions would result in a lower risk of uncharacteristically severe wildfire for those treated acres. This reduced risk has a twofold effect on GHG emissions or the carbon cycle:

1. There is a direct beneficial effect on climate change of decreased GHG emissions from these acres because the risk of acres being burned by uncharacteristically severe wildfires would be reduced; and
2. There is an indirect beneficial effect by treating these acres because live stands of trees would retain higher capacity to sequester carbon dioxide compared to stands killed by uncharacteristically severe wildfires, especially if not immediately reforested.

It would be difficult to determine the significance of effects of one project on GHGs directly and, therefore, climate change indirectly, as there are currently no Federal statutes, regulatory standards, or policy direction on the significance of such effects. Until meaningful, accepted thresholds are adopted against which to weigh any project related GHG emissions, it would not be possible to determine whether a specific project would have a significant effect under this factor.

Mechanized reentry to maintain desired conditions would occur at an estimated interval of 25 to 30 years.

Alternative C

The environmental consequences of implementing alternative C are similar to those discussed for alternative B (proposed action) with the following differences:

- In the forested areas between the 10 percent of the area to be placed in temporary openings, stand structure would be more uniform and homogeneous.
- Reentry to maintain desired conditions would occur at more frequent intervals (estimated 15–20 years) as tree crowns close upon one another and tree densities increase.
- Attainment of desired conditions, specifically managing for uneven-age stand conditions for live trees to include tree groups and openings, would occur at a slower rate as groups would be recruited on only 10 percent of the area in each entry.

Cumulative Effects

Pueblo and Chilili

Past Activities

The Pueblo and Chilili project areas have undergone very little management in the past century, with forest activities limited mainly to firewood collection, hunting, recreation, and grazing. In the last 2 decades, there has been increased forest management in both jurisdictions related to hazardous fuels reduction. This includes:

- Isleta Fuel Break Project – Fuel break construction beginning June through October 2008 using tribally owned mastication equipment to reduce the threat of uncharacteristic wildfire moving onto tribal lands from adjacent Federal, private, and state lands, and also to reduce the threat of wildfires originating on tribal lands to move outside reservation boundaries. The area treated was approximately 255 acres along TR 210 beginning at the Albuquerque Trail drainage and the Pueblo southern boundary fence extending eastward following the fence to the southeast corner, then northward to the junction of Nustar Petroleum Pipeline and NFS Road 321. The width of the fuel break varies from 2 chains up to 5 chains depending on terrain. Some parts of this area were initially cleared by the BIA in the mid 1990s.
- Tower Road Fuel Break – Originally initiated by the BIA in the late 1990s to create defensible space along TR 210 and the Isleta Lookout Tower road northward to the junction of TR 207 in Largo Canyon. The treatment consisted of hand crews using chain saws to reduce ladder fuels, densities of less than 4 inches d.b.h. and d.r.c. material up to 1 chain along TR 210. Material was then piled for burning at a later date, which never occurred due to funding issues. Vegetation has since grown back, causing the treatment to be ineffective at this time.
- North Fuel Break – Initiated by the BIA in the late 1980s or early 1990s to create defensible space along the Pueblo's north boundary beginning at David Canyon extending east along the boundary fence to the northeast corner of the reservation boundary. Treatment consisted of hand crews using chain saws to reduce ladder fuels and densities of small diameter vegetation in the hopes of reducing the threat of uncharacteristic wildfire coming onto or moving off Pueblo lands. The treatment area was approximately 200 acres.
- Northeast Fuel Break – Created by the BIA in the mid to late 1990s from the northeast corner of the Pueblo extending south to the junction of TR 207 at Gotera Canyon. Treatment was done using hand crews with chain saws ahead of BIA mastication equipment to reduce the densities of small diameter vegetation 1 to 2 chains wide along the reservation boundary. Total acreage is estimated to be about 40 to 70 acres in size. Some material was piled to be burned at a later time, but due to funding and personnel turnover this was never accomplished.
- Chilili 2008 CFRP Project – Hand thinning of 269 acres of ponderosa pine stands for fuels reduction purposes. Material was removed from the site for firewood. This action was located adjacent to the 2008 project area in order to benefit from landscape-level effects.
- Jimmy Shack Project – From July to November 2011, hand thinning in established Douglas-fir stands to reduce competition, ladder fuels, overtopping, and the threat of wildfire establishing in the crowns resulting in stand-replacing fire. Material being thinned would be piled and burned at a later time when conditions permit. The size of the area is approximately 111 acres beginning at the westernmost junction of TR 210 and the Nustar Petroleum Pipeline extending east along TR 210 three chains wide at a distance of 1 mile.

All past and current projects on Pueblo and Chilili lands are designed to reduce uncharacteristic wildfire and provide benefit for forest health and other resources, including wildlife habitat, soils,

and water quality. No adverse cumulative effects on vegetation resources would be sustained from past, present, or reasonably foreseeable future actions in combination with the effects of the proposed action. The proposed action in conjunction with previous and current projects would provide cumulative benefits to the area by creating landscape-level hazardous fuels reduction.

U.S. Forest Service (USFS)

Current vegetation conditions (the affected environment) in the 90,549-acre Manzanita/Manzano Ecosystem Management Area are a reflection of past and present treatments.

Past Activities

The area has a long (since the 1500s) history of European influence, which includes intensive grazing and harvest of wood products. This, as well as several decades of fire suppression, has altered the natural fire regime (USFS 1999).

Much of the active forest management has occurred in the last 10 years under the Thunderbird Ecosystem Management Area Project, approved in 2004 and ongoing. This management includes the following:

- Approximately 1,400 acres of wildlife habitat improvement. Activities include meadow restoration, rehabilitation of openings, and other structural/nonstructural habitat improvement.
- Approximately 8,400 acres of thinning and selection harvests. Most of these treatments have involved implementation of the northern goshawk management guidelines as a result of the 1996 amendment to the forest plan.
- Management of fuels (prescribed burning, burning of piles, rearrangement of fuels, etc.) has occurred on an estimated 10,000 acres.

Wildfire activity during the last 10 years has affected approximately 16,700 acres within the Thunderbird Ecosystem Management Area. The recent (2007–2008) destructive wildfires in the Manzano Mountains alone eliminated existing forest cover on an estimated 7,000 acres. Approximately 1,500 acres, most conducive to planting, have been restored through reforestation activities. Oak has restored vegetation cover to all areas and natural regeneration of tree species is slowly occurring.

Current Activities

Approximately 600 acres of the Thunderbird Ecosystem Management Area remained to be implemented in 2011 and 2012. These activities would primarily involve thinning and group selection treatments favoring habitat improvement for the northern goshawk.

Foreseeable Activities

Projects currently in the NEPA analysis process within the Thunderbird Ecosystem Management Area include:

- The Espinoso Barranco Wildlife Habitat Improvement Project (approximately 2,500 acres). This project was implemented in February 2012. This project involved thinning/group selection for northern goshawk habitat improvement.
- The Cedro Fuels Reduction Project (approximately 13,500 acres) which is anticipated to be implemented in 2012/2013. While the emphasis is on fuels management within the WUI, northern goshawk management guidelines would guide the treatments.
- The Red Canyon Fuels Reduction Project (approximately 540 acres) anticipated to be implemented in 2012. Treatments here would be similar to the Cedro Fuels Project previously described.

Global climate change may affect human health. There is uncertainty and unknown risks associated with global climate change, and the ultimate effects on climate change are indeed the results of incremental cumulative effects of many actions, most of which are outside the USFS's control. The USFS cannot discern significant climate change effects of the Isleta CFRP project, given the context of projects and plans and the lack of effects that can be meaningfully evaluated under current science, modeling, and policies.

In summary, all projects are designed to improve habitat for both the northern goshawk and MSO but are also designed/implemented to improve other resources, such as soils and water quality, and include management mitigations to protect such resources from uncharacteristic wildfire and insect/disease outbreaks. No adverse cumulative effects on vegetation resources would be sustained from past, present, or reasonably foreseeable future actions in combination with the effects of the proposed action.

Wildlife

Reduction of natural processes such as low fire intervals in the piñon-juniper type have resulted in a tightly closed woodland canopy and a reduced grass, shrub, and forb understory. Wildlife species dependent on diverse habitat within the woodland system are limited due to lack of understory vegetation. Piñon-juniper woodlands are important to wildlife because they provide piñon nuts and juniper berries that are readily available forage for many wildlife species. Other habitat features include critical winter range for game mammals and birds, travel corridors, human created water sources, thermal cover, dead and downed woody materials used for nesting and resting, and snags used by cavity-nesting species.

Ponderosa pine forests provide forage and cover for many species of wildlife. Habitat features common in ponderosa pine forest include roost and nest trees, snags and large downed logs, abundant needle litter, thermal cover, travel corridors, grassy forest openings, fawning areas for deer, and natural and human created water sources. Large areas of this habitat type within the project boundary are vegetated by even-aged stands. These ponderosa pine stands lack the understory vegetation necessary for wildlife species diversity. There are very few older age class ponderosa pine stands with large diameter trees, snags, and large downed logs. Management of habitat for the northern goshawk is an important consideration in this habitat type.

The oak woodland or mountain shrub forest type is dominated by oak with scattered coniferous trees. Oak woodlands provide important habitat for many wildlife species, with understory vegetation providing browse species and mast crops, and thermal variation from surrounding

conifer forests. In general, areas of mountain shrub have decreased due to tree encroachment, largely resulting from fire suppression.

In the mixed conifer forest, much of the habitat in the project area is in steep terrain, so trees have not been logged in recent years. Old growth trees with associated downed logs and woody debris are important habitat features. Springs, seeps, and other water sources are more common in the mixed conifer habitat type, as are rock outcrops and snags. Management of habitat for the MSO is an important consideration in this habitat type.

Wildlife use riparian habitat types disproportionately more than the availability of these areas across the landscape. These areas provide essential components such as water and forage for many wildlife species. Some riparian areas have been degraded due to nonnative plant species invasion and conifer encroachment, as well as shading and crowding out of riparian vegetation, as a result of past management practices such as overgrazing and the exclusion of fire. In these areas there is little shrub or herbaceous understory, and bank stability has been reduced allowing accelerated channel degradation and increases in sediment. Riparian areas are located near Ojo Terreo and Troncon Negro where springs and seeps support sedges, rushes (*Juncus* sp.), and a few willow (*Salix* sp.) trees. Other springs and/or seeps occur on the Chilili and Isleta portions of this project.

Due to fire suppression, a gradual yet continual buildup of coniferous trees has increased tree density of all species in the project area, resulting in high potential for ladder fuels (smaller, dense stands of trees that allow wildfires to reach the canopy) to accumulate. This dense accumulation also shades the understory, reducing grass/forb and shrub components essential as wildlife forage and cover.

The proposed action was developed in conjunction with the National Wild Turkey Federation. Wild turkeys (*Meleagris gallopavo*) are prevalent throughout the entire project area and, as such, the treatment was designed to benefit the species. Impacts to wild turkey are assessed below.

Pueblo and Chilili Affected Environment

Habitat in the Pueblo and Chilili project areas include 572.6 acres of piñon-juniper woodland, 1,895 acres of ponderosa pine forest, 36.2 of mixed conifer forest, and 72 acres of meadow grasslands. Riparian habitat is minimal with some ephemeral drainages scattered throughout the project area and some marginal wetland areas existing along roads just outside the project area, likely due to runoff.

Existing Conditions

General Wildlife

The most common small mammals are red squirrel (*Tamiasciurus hudsonicus*), Abert's squirrel, ring-tail (*Bassariscus astutus*), striped skunk (*Mephitis mephitis*), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), and several rat (*Neotoma* sp.) and mouse (*Peremyscus* sp.) species. Larger mammal species include mule deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), northern raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), kit fox (*Vulpes macrotis*), coyote (*Canis latrans*), puma (*Puma concolor*), and bobcat (*Lynx rufus*).

Common reptile species include western diamondback rattlesnake (*Crotalus atrox*), found in lower elevation piñon-juniper woodlands; bullsnake (*Pituophis melanoleucus*), found in piñon-juniper woodland and ponderosa pine-Gambel oak dominated forests; and prairie lizard (*Sceloporus undulatus*) and short-horned lizard (*Phrynosoma douglasii*), both found in a range of habitats present in the project area.

Migratory Birds

The Federal Migratory Bird Treaty Act (MBTA) of 1918 (as amended) prohibits the taking, hunting, killing, selling, purchasing, etc., of migratory birds, parts of migratory birds, or their eggs and nests. Most native bird species of North America are covered by the MBTA. In addition, the Bald and Golden Eagle Protection Act of 1940 prohibits the taking of bald (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), including their parts, nests, and eggs.

Bird species observed during the biological survey include the turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), wild turkey, broad-tailed hummingbird (*Selasphorus platycercus*), hairy woodpecker (*Picoides villosus*), Steller's jay (*Cyanocitta stelleri*), mountain chickadee (*Parus gambeli*), white-breasted nuthatch (*Sitta carolinensis*), dark-eyed junco (*Junco hyemalis*), western bluebird (*Sialia mexicana*), northern flicker (*Colaptes auratus*), chipping sparrow (*Spizella passerine*), and American robin (*Turdus migratorius*).

Many bird species use habitats found in the project area for shelter, nesting, and foraging. The mesic piñon-juniper woodland and dry mixed conifer community provides habitat for numerous species of birds, which may occur either as residents or as migrants/transients. In addition to the birds already mentioned, other birds protected by the MBTA that may occur in the project vicinity include piñon jay (*Gymnorhinus cyanocephalus*), Virginia's warbler (*Vermivora virginiae*), and black-throated gray warbler (*Dendroica nigrescens*) in the piñon-juniper vegetation classification; flammulated owl (*Otus flammeolus*) and Grace's warbler (*Dendroica graciae*) in the ponderosa pine vegetation classification; and broad-tailed hummingbird (*Selasphorus platycercus*) in the mixed conifer vegetation classification.

Golden eagles are protected under the Bald and Golden Eagle Protection Act (USFWS 2010b) and the MBTA. In New Mexico the species nests in large trees, on rock ledges, or cliffs at elevations ranging from 4,000 to 10,000 feet and is typically found in mountainous regions of open country, prairies, arctic and alpine tundra, open wooded areas, and barren areas. Golden eagles are carnivores that forage in flight or on perch, feeding mainly on small mammals as well as invertebrates, carrion, and other wildlife (Biota Information System of New Mexico (BISON-M) 2010). Activities in the project area are not expected to impact the population of golden eagles, and none were observed during field reconnaissance within the project area.

Threatened and Endangered Species

The New Mexico Rare Plant Technical Council (2010) Web site was reviewed for plant species. The BISON-M database was also consulted to determine which wildlife species are likely to occur within the project area. BISON-M provides information from the New Mexico Department of Game and Fish (NMDGF), the USFWS, and the USFS.

Three of the 17 species listed by the USFWS and 2 of the 11 species listed by the State of New Mexico for Bernalillo and Torrance Counties have the potential to occur in the project area. For the rest of the listed species, the project area is either clearly beyond the known geographic or

elevational range of these species or it does not contain vegetation or landscape features known to support these species, or both. Habitat requirements, potential for occurrence and possible effects on these species are summarized in the biological evaluation in appendix B.

MSO, northern goshawk, Baird's sparrow (*Ammodramus bairdii*), spotted bat (*Euderma maculatum*), and Townsend's big-eared bat (*Corynorhinus townsendii*) have the potential to occur in the project area and are discussed further below.

Mexican Spotted Owl (*Strix occidentalis lucida*)

Habitat and Range Requirements

The MSO is a USFWS listed threatened species in Bernalillo and Torrance Counties. The MSO occurs in mountainous regions of Arizona, New Mexico, and parts of Utah, Colorado, and Texas, as well as into Mexico. Their habitat includes primarily mixed conifer forest types, but it also includes pine-oak woodlands and riparian woodlands. Their preferred habitat has a multilayered canopy with large overstory trees, a moderate to high canopy closure, and uneven-aged stands. They also require an abundance of large snags and downed woody debris within their habitat to attract prey species. They occur at elevations ranging from 2,700 to 10,000 feet, but generally are found between 5,000 and 9,000 feet. Other suitable habitat features include steep slopes, rocky outcrops, and riparian canyons with cool, humid environments.

Habitat Evaluation and Suitability

No MSO habitat was found within the proposed treatment areas on Pueblo lands. MSOs were not observed during field reconnaissance. Surveys were conducted for the species in 2009 and 2010, and none were detected on Pueblo land.

Northern Goshawk (*Accipiter gentilis*)

Habitat and Range Requirements

The northern goshawk is a USFWS species of concern in Bernalillo and Torrance Counties. Across the entire breeding range, goshawks nest in a broad range of vegetative communities. Within their home ranges, goshawks use a diverse array of habitats for foraging, both in terms of vegetation type and open space. Goshawks tend to select nesting habitat in the densest stands available, given the capability of the forest type, and prefer high canopy closure on north-facing slopes. The size of forest patches used for nest areas appears to be highly variable across the species' range (Woodbridge and Hargis 2006).

Habitat Evaluation and Suitability

There is marginal nesting habitat for northern goshawks in the ponderosa pine and mixed conifer forest types, in the areas of steep, north-facing hillsides. Suitable foraging habitat is available throughout the project area. No nests or northern goshawks were observed during the field survey. Surveys were conducted for the species in 2009 and 2010, and none were detected on Pueblo land.

Baird's Sparrow (*Ammodramus bairdii*)

Habitat and Range Requirements

The Baird's sparrow is a New Mexico threatened species in Bernalillo and Torrance Counties. In New Mexico this species has been found in a variety of habitats, ranging from desert grasslands in the south to prairies in the northeast and mountain meadows in the San Juan and Sangre de Cristo Mountains. They breed in shortgrass prairies.

Habitat Evaluation and Suitability

There is suitable nesting habitat in the shrubs and trees within the project area and suitable foraging habitat is present throughout the project area. Construction activities may negatively impact the breeding sites of the species if there is abundant tree and shrub removal during breeding months (April–August).

Spotted Bat (*Euderma maculatum*)

Habitat and Range Requirements

The spotted bat is a New Mexico threatened species in Bernalillo County. The species has been captured in ponderosa pine of montane forests, piñon-juniper woodlands, and open semidesert shrublands. Rocky cliffs are necessary to provide suitable cracks and crevices for roosting, as is access to water. The bat shows apparent seasonal change in habitat, occupying ponderosa pine woodlands in the reproductive season and lower elevations at other times of the year (BISON-M 2010).

Habitat Evaluation and Suitability

The project area contains piñon-juniper woodlands and rocky outcrops that may serve as potential roosting habitat for the species. Cattle ponds and meadow grasslands may provide foraging habitat for some individual species. Tree removal and burning activity may negatively impact the roosting sites of the species, especially if there is abundant tree removal. No bats were observed during the field survey.

Townsend's Big-eared Bat (Corynorhinus townsendii)

Habitat and Range Requirements

Townsend's big-eared bat is a USFWS species of concern in Bernalillo County. The bats are frequently associated with caves and abandoned mines for day roosts and hibernacula but would also use abandoned buildings and crevices on rock cliffs for refuge. Townsend's big-eared bats are relatively sedentary; they do not move long distances from hibernacula to summer roosts, nor do they move or forage far from their day roosts

Habitat Evaluation and Suitability

The piñon-juniper woodlands that occur in the project area may serve as roosting habitat for the species, as well as any abandoned buildings in the project vicinity. Cattle ponds and meadow grasslands may provide foraging habitat for some individual species. Tree removal and burning activity may negatively impact the roosting sites of the species, especially if there is abundant tree removal. No bats were observed during the field survey.

Cibola NF&Gs Affected Environment

Refer to the "Wildlife" section for a discussion on the vegetation types and wildlife habitat.

All wood generated from this project would be removed on existing NFS roads or on existing Non-NFS roads and trails (unauthorized roads and trails created by users). No new roads or temporary roads would be constructed. These existing motorized roads and trails are currently affecting wildlife by causing direct habitat loss, habitat fragmentation, direct mortality, interruption of travel corridors, displacement due to disturbance, and potential for harassment and illegal harvest.

Existing Conditions

Threatened and Endangered Species

The USFWS list of threatened, endangered, and candidate species that may occur in Bernalillo and Torrance Counties (USFWS 2011) was reviewed to determine potential wildlife and plant species that may occur in the assessment area. The NMDGF's 2010 "Biennial Review of the List of Threatened and Endangered Species of New Mexico" was also consulted (NMDGF 2010). The New Mexico Rare Plant Technical Council Web site was reviewed, but there are no known populations of rare or endangered plants in the analysis area (New Mexico Rare Plant Technical Council 1999). Refer to the project level biological assessment report in the project record for a more detailed description of threatened, endangered, and candidate wildlife species and critical habitat occurring in the project area.

Threatened, endangered, or candidate wildlife species that may occur or have potential habitat in the project area include the MSO (table 31). No known protected activity centers or designated critical habitat occur within the project boundary; potential restricted habitat exists in the 131 acres of mixed conifer forest. Species whose habitats do not occur in the project area were not considered further.

Sensitive Species

The Regional Forester's Sensitive Species List for the Southwestern Region was reviewed to determine potential wildlife or plant species which may occur in the assessment area. The yellow-billed cuckoo (*Coccyzus americanus*) was analyzed as a candidate species above, as was the bald eagle. Refer to the project level biological assessment report in the project record for a more detailed description of sensitive species. The following USFS Regional Forester's sensitive species were considered but not evaluated due to the absence of suitable or potential habitat in the analysis area (table 32).

Table 31. Potential threatened and endangered species for Bernalillo and Torrance Counties (species highlighted in gray will be considered in more detail)

Common Name	Scientific Name	Group	Status	Habitat Type
Black-footed ferret	*Mustela nigripes*	Mammal	Endangered -extirpated	Plains grassland – Occurs only in association with prairie dog towns. There are no prairie dog towns in the project area.

Common Name	Scientific Name	Group	Status	Habitat Type
Rio Grande silvery minnow	*Hybognathus amarus*	Fish	Endangered	Aquatic – There is no link or association between the project area and the Rio Grande where the species occurs.
Southwestern willow flycatcher	*Empidonax traillii extimus*	Bird	Endangered	Riparian – Occurs in lower elevation boggy riparian areas with an overstory of cottonwood and willows. This habitat type does not occur within the analysis area.
Mexican spotted owl	*Strix occidentalis lucida*	Bird	Threatened	Mixed conifer – Occurs in mixed conifer and montane riparian habitat. There are 131 acres of mixed conifer (restricted habitat) in the analysis area. There are no known territories or designated critical habitat in the project area. This species will be considered further.
Mountain plover	*Charadrius montanus*	Bird	Proposed Threatened	Plains grassland – Occurs only in association with short-grass prairies. There is no habitat in the project area.
Yellow-billed cuckoo	*Coccyzus americanus*	Bird	Candidate, R3 Sensitive	Riparian – Occurs in lower elevation riparian habitat outside the analysis area.
Bald eagle	*Haliaeetus leucocephalus*	Bird	Delisted, R3 Sensitive	Occurs only itinerantly in the project area.

Source: NMDGF (2010); USFWS (2011).

Table 32. Sensitive species considered but not evaluated

Common Name	Status	Condition in Project Area
Rocky Mountain bighorn sheep	R3 Sensitive	Documented to occur on the Mountainair RD; habitat is unaffected.
Western burrowing owl	R3[1] Sensitive	Associated with prairie dog towns, which are not found in the project area.
Peregrine falcon	R3[1] Sensitive	No preferred nest sites affected; no direct link to prey.
Sandia alumroot	R3 Sensitive	Populations currently recorded from Sandia and Manzano Mountains crest areas, outside the project area.
Plains leopard frog	R3 Sensitive	Requires dense aquatic emergent vegetation for breeding, larger streams for overwintering; no habitat in the project area.
Gray-footed chipmunk	R3 Sensitive	Only occurs in the Gallinas Mountains of the Mountainair RD; does not occur in the project area.
Gunnison's prairie dog	R3 Sensitive	Found in montane grassland, juniper savanna habitat; occurs outside the project area.
Tall bitterweed	R3 Sensitive	Occurs in the southern portion of the Manzano Mountains, outside the project area.

[1]USFWS species of concern for planning purposes.

Sensitive wildlife species that may occur or have potential habitat in the project area include northern goshawk, loggerhead shrike (*Lanius ludovicianus*), gray vireo (*Vireo vicinior*), Merriam's shrew (*Sorex merriami leucogenys*), dwarf shrew (*S. nanus*), spotted bat (*Euderma maculatum*), and pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*) (table 33). Surveys were conducted to protocol in the project area for northern goshawk. A new territory was located in David Canyon in the southern portion of the Sandia RD adjacent to the U.S. Department of Defense Withdrawal Area. A PFA and associated nest areas were established within the project area.

Table 33. Potential sensitive species

Common Name	Scientific Name	Group	Habitat Type
Northern goshawk[1]	*Accipiter gentilis*	Bird	Found in ponderosa pine and oak habitat with open areas, and woody debris to support abundant prey. There is one known territory in the project area, and the ponderosa pine habitat is considered suitable for future occupancy. Surveys were conducted to protocol in the project area, but no other territories were located. "Management Recommendations for the Northern Goshawk in the Southwestern United States" (Reynolds 2006) outlines desired forest conditions for the 6,000-acre home range used by a breeding pair, including the viability of 14 important prey species.
Loggerhead shrike	*Lanius ludovicianus*	Bird	Suitable habitat for the loggerhead shrike is located in open, shrubby grasslands usually with a scattering of trees or savannah pine-oak woodlands. It could be found in the lower elevation piñon-juniper woodlands.
Gray vireo	*Vireo vicinior*	Bird	This species inhabits dry-shrub dominated landscapes mingled with networks of shallow arroyos. Elevations where it nests range from 5,000 to 6,500 feet. There is habitat available for this species in the project area.
Merriam's shrew	*Sorex merriami leucogenys*	Mammal	This species is generally associated with dry habitats, usually near water. No surveys have been conducted for this species in the project area, but potential habitat is present.
Dwarf shrew	*Sorex nanus*	Mammal	The preferred habitat is talus and other rocky areas primarily in mixed conifer forest. No surveys have been conducted for this species in the project area, but potential habitat is present.
Spotted bat	*Euderma maculatum*	Mammal	This species is a cliff dweller that roosts in cracks and crevices in rock in forested areas near open water. No surveys have been conducted for this species in the project area.
Pale Townsend's big-eared bat[1]	*Corynorhinus townsendii pallescens*	Mammal	Conifer forests strongly associated with the availability of caves or cave-like roosting habitat (mines, buildings, etc.) provide habitat for the Townsend's big-eared bat. No surveys have been conducted for this species in the project area.

[1]USFWS species of concern for planning purposes.

Management Indicator Species

The forest plan identified 13 forestwide management indicator species (MIS) to estimate the effects planned activities may have on wildlife forestwide and project level habitat and

populations. All 13 MIS were considered for this analysis, but only those species whose habitat occurs in the project area were considered further.

Based on the habitat types that exist in the analysis area, the following MIS were selected for analysis: elk, mule deer, juniper titmouse (*Baeolophus ridgwayi*), black bear, pygmy nuthatch (*Sitta pygmaea*), hairy woodpecker, wild turkey, and house wren (*Troglodytes aedon*). Only those MIS likely to occur in the project area were analyzed. Table 34 describes the habitat type, existing habitat trends, MIS, and existing MIS population trends. Refer to the forestwide MIS report in the project record for a more detailed description of MIS and their habitat associations, habitat trends, and population trends (USFS 2005).

Table 34. Habitat types, MIS, and existing forestwide habitat and population trends

Habitat Type	Acres in Project Area	Existing Forestwide Habitat Trend	Management Indicator Species	Existing Forestwide Population Trend
Piñon-juniper	2,582	Stable	Mule deer	Downward
			Juniper titmouse	Downward
Ponderosa pine	3,852	Stable	Pygmy nuthatch	Stable
			Wild turkey	Upward
Mixed conifer	131	Stable	Hairy woodpecker	Upward
			Black bear	Stable
			Elk	Upward
Oak woodland Mountain shrub	1,122	Downward	Mule deer	Downward
Riparian *	490	Upward	House wren	Stable

* Not all the acres identified as riparian can be considered true riparian habitat. Some of these acres include dry washes and ephemeral drainages.

MIS for piñon-juniper woodlands are mule deer and juniper titmouse. Mule deer can be found in the area yearlong. Mule deer numbers in general have decreased over the past decade, and mid-successional habitats used by deer are being reduced due to a lack of disturbance from fire or mechanical treatments. The juniper titmouse is a woodland species that nests in cavities. Older age class piñon and juniper trees in open canopy stands are the primary nesting habitat. Existing population trend for the species is downward statewide in New Mexico due to conversion of woodland habitat to rangeland, removal of mature and senescent trees in piñon-juniper habitat, and overall decline of this habitat due to drought and beetle infestation.

MIS for ponderosa pine forests are pygmy nuthatch and wild turkey. The pygmy nuthatch is a cavity nester and prefers old growth ponderosa pine. Wild turkey is a habitat generalist that occurs in ponderosa pine, pine-oak, and piñon-juniper woodlands. It was reestablished in the Manzano and Manzanita Mountains in the early 1990s and has continued to expand its range in the area.

MIS for mixed conifer are black bear, elk, and hairy woodpecker. Black bears are found throughout the project area where they require woodland cover and food producing shrubs and trees such as oak, piñon, current, sumac, cactus fruit, and bear corn, which are all abundant in the project area. Bear populations appear to cycle in relationship to mast (acorn and piñon nut) crops, which are dependent on precipitation and absence of late freezes. Hairy woodpeckers are a primary cavity excavator found in several habitat types with larger diameter snags. Elk is not

common in the Manzanita and Manzano Mountains but is occasionally found in the project area. Elk prefer open grassy meadows located less than 0.5 mile from water. Sedges are most often selected as forage. Many of the grassy openings on the analysis area are being encroached upon by conifer trees. Hiding cover for elk occurs in stands 30 to 60 acres in size with 70 percent canopy cover. Road density is also an important habitat consideration with optimum road spacing at less than 0.25 mile of primary road per section of land (640 acres).

MIS for oak woodland (mountain shrub) habitat is the mule deer. As discussed for piñon-juniper woodland, mule deer populations have been declining in the recent past. Oak woodland habitat would continue to show a downward trend unless there are large wildfires or prescribed burns implemented to improve the quality of habitat. The change in the amount of this habitat type is due primarily to fire suppression and the trend is expected to continue to decline.

MIS for riparian habitat is the house wren. The house wren feeds on insects in the understory of riparian vegetation primarily at elevations from approximately 7,500 to 8,500 feet. The species is a summer resident of the project area and a neotropical migrant. Limiting factors for house wrens appear to be suitable snags and cavities in proximity to riparian areas.

Migratory Birds

On January 10, 2001, Executive Order 13186 was signed placing emphasis on conservation of migratory birds. The Executive Order supplements the MBTA, which has been in effect since the early 1900s. Effects to migratory birds are analyzed in the following manner: (1) effects to highest priority birds listed by New Mexico Partners in Flight (2007), (2) effects to important bird areas (IBAs), and (3) effects to important overwintering areas.

On the Cibola NF&Gs, populations of birds are monitored through the use of breeding bird surveys (BBS) on geographic areas to detect populations and trends during the breeding period. There are two types of BBS surveys done on the Cibola NF&Gs: USGS monitoring routes, which are 24.5 miles in length, and Cibola NF&Gs BBS routes. These latter surveys are from 1 to 2 miles in length with either 6 to 11 points, respectively. Each point is surveyed for 10 minutes. The nearest Cibola NF&Gs BBS route on the Mountainair RD at Tajique Canyon is located just southwest of the southern boundary of the project. The Tajique Canyon route is in similar habitat and elevation (except it has much more riparian vegetation). The Fourth of July route is in similar proximity to the project area; it is also similar in elevation, but it has much more deciduous forest than is representative of the project area. The Perra BBS route is located just east of the southern portion of the project area in riparian habitat. On the Sandia RD, the Wilding Ridge BBS runs through the portion of the project area in David Canyon. Refer to the Cibola National Forest breeding bird report for 2010 and supplement for 2011 for additional details (USFS 2010).

Priority birds identified for the Southern Rockies/Colorado Plateau Conservation Region were reviewed for potential occurrence in the project area. Gray vireo and loggerhead shrike were considered as sensitive species. Year-round residents were excluded from the migratory bird analysis (juniper titmouse, scaled quail (*Callipepla squamata*), pinyon jay (*Gymnorhinus cyanocephalus*), and crissal thrasher (*Toxostoma crissale*)). Priority bird habitat in the project area is piñon-juniper, ponderosa pine, mixed conifer, oak woodland, and riparian. Troncon Negro Canyon and Chilili Canyon provide some riparian habitat. One other small spring, Ojo Terreo, contains some riparian vegetation as well. All drainages in the project area are ephemeral (flowing only in response to precipitation). Different vegetation types provide habitat for a variety

of migratory birds. There are no IBAs within the project area. The nearest IBA is located along Tajique Canyon on the southwest side of the project's southern boundary. The Perra Canyon IBA, also in the Manzano Mountains, is to the east. On the Sandia RD, the project borders the U.S. Department of Defense Withdrawal Area IBA. The Cedro and Otero Canyon IBAs are north of the project's northern boundary. There are no overwintering areas identified in the project area. Migratory bird species evaluated are summarized in table 35. Population trends were determined according to New Mexico Partners in Flight assessments (New Mexico Partners in Flight 2007).

Table 35. Migratory bird species evaluated in the analysis area

Habitat Type	Species	Population Trend	Comments
Piñon-juniper: 2,582 acres	Virginia's warbler	Stable	The species is common when Gambel oak understory is available from May through July and during dispersal and migration.
	Black-throated gray warbler	Downward	The location of this species is generally in elevations lower than the project area, but it may occur uncommonly from May to September in mesic woodlands with a high canopy cover interspersed with shrubs.
Ponderosa pine: 3,852 acres	Flammulated owl	Unknown	This cavity-nesting species occurs commonly from May to September where large, old ponderosa pine trees exist.
	Grace's warbler	Downward	The area contains suitable habitat where it nests in the upper canopy of contiguous ponderosa pine stands. It is relatively common from May to September.
Mixed conifer: 131 acres	Band-tailed pigeon	Downward	This species is probably not common within the project area, but occurs when there is an abundant mast crop from May to September.
	Broad-tailed hummingbird	Stable	There is suitable habitat that occurs from about 7,000 feet upward for this species where it occurs from May to September.
Oak woodland: 1,122 acres	Black-chinned sparrow	Unknown	This species nests in shrub and chaparral in arroyos from 5,500 to 8,000 feet from mid-April to late June.
Riparian: 490 acres	Red-naped sapsucker	Stable	This species feeds primarily in deciduous forest along riparian areas and requires hard snags for nesting cavities.

Pueblo and Chilili Environmental Consequences

Wildlife

Alternative A (No Action)

The no action alternative would not reduce the tree densities in the project area; density and canopy cover of all timber types would continue to increase throughout the project area. Existing small openings and forb/shrub/grassland areas would continue to decrease in size and woodland species would continue to encroach on open meadow grassland. Fuels buildup would continue, leading to a crown fire if wildfire occurs in the area.

Currently undesirable structural conditions within northern goshawk nesting, PFAs, and foraging areas would remain essentially unchanged and would change slowly for an extended period of time.

Alternative B (Proposed Action)

The proposed action would provide reduced potential of stand-replacing wildfire since fuels would be reduced throughout the area. Implementation of the proposed action would result in long-term benefits to wildlife species by providing essential habitat components such as diverse structural stages, snags, downed logs, and varied canopy cover. There would be no change in the population or habitat trends of species at the forest level. There may be some short-term displacement due to treatment activity, but in the long term forage condition and habitat availability would improve for all species.

Desired structural conditions within the northern goshawk nesting, PFA, and foraging areas would not be completely achieved in this one entry but would be placed on a trajectory toward meeting those conditions in the future.

Impacts Specific to Wild Turkey

The proposed action was developed in collaboration with the National Wild Turkey Federation; therefore, impacts to wild turkey are assessed here.

The proposed action would improve habitat for wild turkeys across the entire project area. The treatment reduces the potential for active crown fires and would, therefore, benefit wild turkey habitat for many years. The goals of altering forest conditions in ponderosa pine and piñon-juniper woodlands toward those consistent with the northern goshawk guidelines (Reynolds et al. 2006) would improve wild turkey habitat.

Oak woodland treatments should also improve wild turkey habitat where implemented. Oak mast is an important food item for wild turkeys. Oak treatments should improve the health of oak stands and, as such, improve wild turkey habitat. Prescribed fire has been demonstrated to improve wild turkey habitat by providing improved nesting and brooding habitat.

Meadow restoration treatments would be beneficial to wild turkeys within the project area. Meadows are important habitat components of our forests and provide important brooding areas for wild turkeys if not overused by livestock and elk. Treatment of oaks with herbicide applications does not pose a threat to wild turkey populations or habitat. Improvement of oak stands through this type of thinning should benefit wild turkey populations and habitat by providing additional nesting and brooding habitat.

Migratory Birds

Alternative A (No Action)

Under alternative A there would be no direct impact to migratory birds. Current forest structure would remain unchanged but densities would increase over time and make stands more susceptible to uncharacteristic wildfire. In the event of a severe crown fire, nesting and foraging habitat for migratory bird species would be compromised. Species that are dependent upon snags would potentially benefit from the passage of a severe wildfire in the project area.

Alternative B (Proposed Action)

Direct impacts to breeding birds would be minimal. Treatments proposed under alternative B would not be carried out during the nesting season (April 1–July 31). Treatments proposed to be conducted during the nesting season would require a biologist to conduct a nesting bird survey

prior to treatment. If no nesting birds are found, treatments could be conducted during the nesting season. Project activities could temporarily displace resident species due to equipment noise and human activity during thinning. Tree removal could create short-term impacts to species that nest and forage in trees due to changes in vertical and horizontal forest structure; most tree removal would be in the small diameter classes, however, that are rarely used by bird species for nesting substrates. The creation of clumps and openings in stands that are currently dense with continuous cover should encourage regeneration of the herbaceous layer and benefit species that prefer more open habitat and grassland areas. Treatments are designed to create a more diverse age structure, which would have an overall benefit of creating greater habitat diversity. By ensuring that treatment does not occur during the primary nesting season, there is limited chance of unintentional take of migratory birds. Implementation of the proposed action would not be expected to cause an overall decline of bird species populations.

Threatened and Endangered Species

Alternative A (No Action)

The no action alternative would not reduce the tree densities in the project area; density and canopy cover of all timber types would continue to increase throughout the project area. Existing small openings and forb/shrub/grassland areas would continue to decrease in size and woodland species would continue to encroach on open meadow grassland. Fuels buildup would continue, leading to a crown fire if wildfire occurs in the area.

Alternative B (Proposed Action)

The proposed action would provide reduced potential of stand-replacing wildfire since fuels would be reduced throughout the area. The proposed action incorporates northern goshawk guidelines and measures to lessen effects to threatened, endangered, and sensitive species. Short-term noise disturbance and human presence during treatment could temporarily disturb threatened and endangered species.

Implementation of the proposed action would result in long-term benefits to threatened and endangered species by providing essential habitat components such as diverse structural stages, snags, downed logs, and varied canopy cover necessary for potential occupancy of these species.

Mexican Spotted Owl (*Strix occidentalis lucida*)

Tree removal and forest burning activities would temporarily disturb the species if construction activities occur during breeding months (April–August). However, since the forest treatment includes thinning, burning, and creating an uneven-aged forest stand throughout the project area, this proposed project is likely to benefit the MSO, whether it is currently present or not, by creating or enhancing habitat elements known to be used by the species.

Baird’s Sparrow (*Ammodramus bairdii*)

This proposed project may impact individuals of Baird’s sparrow, but it is not likely to result in a trend toward Federal listing or loss of viability.

Spotted Bat (Euderma maculatum)

This proposed project may impact individuals of spotted bat, but it is not likely to result in a trend toward Federal listing or loss of viability.

Townsend's Big-eared Bat (*Corynorhinus townsendii*)

This proposed project may impact individuals of Townsend's big-eared bat, but it is not likely to result in a trend toward Federal listing or loss of viability.

Sensitive Species

Alternative A (No Action)

The no action alternative would not reduce the tree densities in the project area; density and canopy cover of all timber types would continue to increase throughout the project area. Existing small openings and forb/shrub/grassland areas would continue to decrease in size and woodland species would continue to encroach on open meadow grassland. Fuels buildup would continue, leading to a crown fire if wildfire occurs in the area.

Alternative B (Proposed Action)

The proposed action would provide reduced potential of stand-replacing wildfire since fuels would be reduced throughout the area. The proposed action incorporates northern goshawk guidelines and measures to lessen effects to sensitive species. Short-term noise disturbance and human presence during treatment could temporarily disturb sensitive species.

Implementation of the proposed action would result in long-term benefits to sensitive species by providing essential habitat components such as diverse structural stages, snags, downed logs, and varied canopy cover necessary for potential occupancy of these species.

Northern Goshawk (*Accipiter gentilis*)

Tree removal and forest burning activities would temporarily disturb the species if construction activities occur during breeding months (April–August). However, since the forest treatment includes thinning, burning, and creating an uneven-aged forest stand throughout the project area, this proposed project is likely to benefit the northern goshawk, whether it is currently present or not, by creating or enhancing habitat elements known to be used by the species.

Cibola NF&Gs Environmental Consequences

Threatened and Endangered Species

Alternative A

Alternative A would not reduce the tree densities in the Isleta CFRP Project area; density and canopy cover of all timber types would continue to increase throughout. Existing small openings and forb/shrub/grassland areas would continue to decrease in size so that forage remains limited for MSO prey species. Fuels buildup would continue, leading to increased potential for a uncharacteristic wildfire if wildfire occurs in the area. Species would continue to experience disturbance from existing roads and trails.

Alternative B

In general, alternative B provides reduced potential of uncharacteristic wildfire since fuels would be reduced throughout the area benefitting wildlife and habitat. Existing tree densities and canopy cover would be maintained in mixed conifer areas benefitting Mexican spotted owl and its prey species. Prescribed fire would be used exclusively in these areas to maintain fuel loading, and management activities would occur outside the Mexican spotted owl breeding season (March 1–August 31). Alternative B incorporates designs to lessen effects to threatened and endangered species. Implementation of alternative B would provide essential habitat components such as snags, downed logs, residual basal area, and canopy cover necessary for potential occupancy of threatened and endangered species. Disturbance from vehicle use of roads would increase in the short term due to project activities.

Alternative C

In general, alternative C provides reduced potential of uncharacteristic wildfire, but to a lesser degree than alternative B (see fire/fuels specialist report in the project record). Implementation in mixed conifer would be the same as alternative B. No tree cutting would occur in mixed conifer, and prescribed burns would occur outside the Mexican spotted owl breeding season (March 1–August 31). Alternative C incorporates designs to lessen effects to threatened and endangered species in the same manner as alternative B. Implementation of this alternative would provide essential habitat components such as snags, downed logs, residual basal area, and canopy cover necessary for potential occupancy of threatened and endangered species. Potential disturbance from vehicle use of roads would increase in the short term due to project activities. Table 36 provides a threatened and endangered species effects determination summary for all three alternatives.

Table 36. Summary of effects determinations on Mexican spotted owl

Species	Alternative A	Alternative B	Alternative C
MSO	Continuation of fuels buildup and small diameter (ladder) trees leading to a potential crown fire if wildfire occurs in the area. Important habitat features such as snags, and large downed logs could be burned. No effect in the short term. In the long term, disease, insects, and drought may create some natural variation in the mixed conifer habitat.	This alternative would reduce ladder fuels and maintain snags, downed logs, and residual basal area for potential MSO occupancy on 131 acres of mixed conifer habitat. No tree cutting would occur in mixed conifer, and prescribed burns would only occur outside the MSO breeding season (March 1–August 31). May affect species, not likely to adversely affect species or its habitat.	This alternative would reduce ladder fuels and maintain snags, downed logs, and residual basal area for potential MSO occupancy on 131 acres of mixed conifer habitat. No tree cutting would occur in mixed conifer, and prescribed burns would only occur outside the MSO breeding season (March 1–August 31). May affect species, not likely to adversely affect species or its habitat.

Sensitive Species

Alternative A

Alternative A would not reduce the tree densities in the Isleta CFRP Project area; density and canopy cover of all timber types would continue to increase throughout the project area. Existing small openings and forb/shrub/grassland areas would continue to decrease in size reducing habitat

quality for sensitive species or their prey. Fuels buildup would continue, leading to a crown fire if wildfire occurs in the area. Disturbance to wildlife species from vehicles on existing and unauthorized roads and trails would continue.

Alternative B

In general, alternative B provides reduced potential of uncharacteristic wildfire since fuels would be reduced throughout the area. Alternative B incorporates new designs to lessen effects to sensitive species (see Youtz et al. 2007). No adverse management activities would occur within the goshawk PFA from March 1 to September 30. Vehicle related disturbance would increase in the short term due to project activities; road decommissioning would be coordinated with the implementation phases and would decrease disturbance to wildlife from vehicle use of unauthorized roads in the long term.

See information and discussion pertaining to the northern goshawk below alternative C. Reynolds et al. (2006, 2008) describes desired conditions in southwestern ponderosa pine as mosaics of small, highly interspersed groups of different VSS classes, where “Grass, herb, shrub habitat was interspersed around the VSS groups and provided habitat for rabbits, ground squirrels, and birds.” Youtz et al. (2007) explains that these groups of trees interspaced within a grass/forb/shrub mosaic provide for an irregular and discontinuous forest canopy with variable tree densities and discontinuous arrangement of fuels, which minimizes the potential for crown fire and facilitates the use of low intensity prescribed fire. This surrounding root development zone, or primary rooting zone, between tree clumps are free of trees and provide nutrient uptake that allows trees within groups to develop (Pearson 1950).

The standards and guidelines in the forest plan, as amended with the northern goshawk recommendations in September 1996 (Amendment No. 7), are silent on the percentages of area within a stand that should be managed under tree cover and the percentages that should be managed as forest openings (grass/forb/shrub). If this alternative is selected, the forest plan would be amended to state the following: A range (20–60 percent of the area) of forest canopy gaps and openings would be maintained within each stand (excluding MSO restricted/threshold and northern goshawk nesting areas); the remainder of the stand would be managed for the forest structural stages (VSS classes) distribution of 10 percent, 10 percent, 20 percent, 20 percent, 20 percent, and 20 percent.

Assumptions of the SWGS included that goshawks are habitat generalists and that prey abundance is limiting (Reynolds et al. 1992). If these assumptions are valid, the proposed action should maximize prey abundance as well as availability, improving foraging opportunity while maintaining nesting area habitat, thus benefitting goshawk populations in the long term. Alternatively, if the goshawk is a habitat specialist and selects stands on the basis of forest structure rather than prey abundance, then prey abundance may not be equivalent to prey availability (Beier and Drennan 1997). Additionally, interspecific competition for nest sites and prey species, as well as direct predation, by red-tailed hawks and great horned owls, which are more abundant in open habitats such as meadows, edge, forest openings, and woodlands, likely varies as a function of the openness of forest types and extent of natural and anthropogenic fragmentation of a forest (Johnson 1992, USDI Fish and Wildlife Service 1988, Squires and Kennedy 2006). Negative effects on goshawk populations may increase with increasing forest fragmentation and loss of mature forest (Reynolds et al. 2006, La Sorte et al. 2004, Gatto et al. 2005). Great horned owls are most abundant in fragmented landscapes (Houston et al. 1998),

begin nesting earlier than goshawks and occasionally lay eggs in goshawk nests, forcing goshawks to construct or use alternative nest areas (Reynolds et al. 1994), and have been known to kill adult and nestling goshawks (Woodbridge and Detrich 1994, Reynolds et al. 2006). Boyce et al. (2006) observe the need for research, and stated that "Although it is believed that extensive habitat modifications are detrimental, it remains unclear exactly how goshawk populations are responding to habitat modification because of inadequate study of the effects across a gradient of tree-harvesting intensities." Management recommendations still remain as untested hypotheses, and a sound experimental design with control, replication, and sufficient sample sizes would be required, which would be potentially problematic, costly, and could take decades (Squires and Kennedy 2006, Reynolds et al. 2006).

Alternative C

In general, alternative C provides reduced potential of stand-replacing wildfire, but to a lesser degree than alternative B (refer to the fire/fuels specialist report). This alternative incorporates existing designs (Reynolds et al. 1992) to lessen effects to sensitive species. No adverse management activities would occur within the PFA from March 1 to September 30. Vehicle related disturbance would increase in the short term due to project activities; road decommissioning would be coordinated with the implementation phases and would decrease disturbance to wildlife from vehicle use of existing and unauthorized roads in the long term. Implementation of alternative B would provide essential habitat components such as snags, downed logs, residual basal area, and canopy cover necessary for potential occupancy of sensitive species.

Scientific information on northern goshawk biology remains limited. The northern goshawk conservation strategies (Reynolds et al. 1992) were developed in 1992 and subsequently incorporated as forest plan amendments (USFS 1996). In ponderosa pine forests, the sustainable distribution approximated 10 percent of the area occupied by grasses, forbs, or shrubs, 10 percent by seedling-saplings, 20 percent by young trees, 20 percent by mid-aged trees, 20 percent by mature trees, and 20 percent by older trees (Reynolds et al. 1992; Bassett et al. 1994). Some reviews (including those by the USFWS, State of Arizona Game and Fish Department, and NMDGF) of the northern goshawk management guidelines were critical, and were mainly concerned with the degree to which forest structure in goshawk foraging habitat would be opened and fragmented (Boyce et al. 2006; USFS 1992; Arizona Game and Fish Department 2004; NMDGF 2004, Greenwald et al. 2005). Others recognized that the guidelines include a landscape-scale mosaic of age and structural classes intended to provide habitats for a broad spectrum of wildlife species maintained under an uneven-aged silvicultural system intended to approximate the composition, structure, and patterns within the range of natural variability existing in presettlement conditions of southwestern ponderosa pine forests before fundamental changes in natural disturbance regimes and forest structure (Long and Smith 2000). Benefits identified included reduction of unnaturally high tree densities and the return of frequent, low intensity surface fires, as well as the ability to simultaneously recreate healthy forests, restore diversity, sustain ecological processes, and reduce fuel loads to avoid loss of life and property (Boyce et al. 2006).

Table 37 provides a sensitive species effects determination summary for all three alternatives.

Table 37. Summary of effects determinations to sensitive species by alternative

Species	Alternative A	Alternative B	Alternative C
Northern goshawk	This alternative would allow fuels to build up, leading to a potential crown fire if a wildfire occurs in the area. No impact to the species in the short term is expected. In the long term, habitat could become so densely stocked with trees that prey species habitat would be reduced. Continued inaction would not meet the forest plan guidelines.	Implementation of this alternative would improve habitat conditions for prey species and reduce potential for a crown fire if wildfire occurs in the area. Fragmentation could reach levels of decreasing prey availability and increasing interspecific competition, as well as direct predation. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	This alternative would treat the dense, overstocked stands of ponderosa pine in the project boundary to the standards set forth in the northern goshawk management recommendations and forest plan. Implementation of this alternative would improve habitat conditions for both the northern goshawk and its prey species. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.
Loggerhead shrike	Potential habitat would not be protected or maintained. Displacement of individuals would not occur.	Tree removal may have a minimal impact on the species during the breeding season, but a phased approach would reduce impacts. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	Tree removal may have a minimal impact on the species during the breeding season, but a phased approach would reduce impacts. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.
Gray vireo	Potential habitat would not be protected or maintained. Displacement of individuals would not occur.	Tree removal may have a minimal impact on the species during the breeding season, but a phased approach would reduce impacts. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	Tree removal may have a minimal impact on the species during the breeding season, but a phased approach would reduce impacts. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.
Spotted bat	This species is not likely to be affected through implementation of alternative A since individuals roost in rocky cliffs and outcrops rather than trees. Continuation of fuels buildup leading to a potential crown fire may improve prey species availability in the short term.	There would be slight direct impacts to the species, but large trees would remain except in permanent openings and riparian areas would be maintained. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	There would be slight direct impacts to the species, but large trees would remain and riparian areas would be maintained. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.
Pale Townsend's big-eared bat	Continuation of fuels buildup could lead to a potential crown fire if wildfire occurs in the area, thus increasing the species' prey population in the short term. Roost habitat would likely be lost in the event of a landscape-scale wildfire.	Snags and larger diameter trees would be retained except in permanent openings improving roosting habitat somewhat, but overall impacts (if any) are expected to be insignificant. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	Snags and larger diameter trees would be retained, improving roosting habitat somewhat, but overall impacts (if any) are expected to be insignificant. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.

Dwarf shrew	Continuation of fuels buildup could lead to a potential crown fire if wildfire occurs in the area, thus reducing hiding cover of the species and its prey. No impact on the species in the short term is expected.	The species has the potential to occur in the project area. The tree removal may have a minor impact to the species, as this activity would remove the tree understory cover of seedlings/saplings and pole-sized trees. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	The species has the potential to occur in the project area. Tree removal may have a minor impact to the species, as this activity would remove the tree understory cover of seedlings/saplings and pole-sized trees. Less project area would result in VSS class 1. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.
Merriam's shrew	Continuation of fuels buildup could lead to a potential crown fire if wildfire occurs in the area, thus reducing hiding cover of the species and its prey. No impact on the species in the short term is expected.	The species has the potential to occur in the area. Tree removal may have a minimal impact on the species. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	The species has the potential to occur in the area. Tree removal may have a minimal impact on the species but would be less than in alternative B. May impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability.

Management Indicator Species

Alternative A

Alternative A would not reduce the tree densities in the Isleta CFRP Project area; density and canopy cover of all timber types would continue to increase throughout the project area. Existing small openings and forb/shrub/grassland areas would continue to decrease in size. Wildlife would continue to be subject to disturbance due to existing motorized roads and trails. Table 38 provides an effects summary of alternative A on MIS.

Table 38. Summary of alternative A effects on MIS

MIS	Direct and Indirect Effects	Forestwide Population/Habitat Effects
Elk	Habitat would not be improved as stands would remain in an overstocked condition with a dense canopy that has reduced the availability of understory forage. In the event of an uncharacteristic stand-replacing wildfire, elk foraging habitat would be improved once the area recovers, but cover conditions would no longer be met. Project level populations of elk would remain stable. It is unlikely there would be any long- or short-term increase or decrease in elk populations unless habitat was lost due to wildfire.	N
Mule deer	There would be no change in the woodland canopy cover, thus there would be a continued lack of browse forage availability. Winter range cover would be retained and displacement due to human presence would not occur. Habitat loss and fragmentation due to roads would continue, but to a lesser degree in the short term than alternatives B and C. In the event of a stand-replacing wildfire, mule deer browse forage would increase once the area recovers, but cover requirements would not be met, making foraging areas generally unavailable except along unburned edges. This alternative would not affect mule deer populations in the project area.	N

MIS	Direct and Indirect Effects	Forestwide Population/Habitat Effects
Juniper titmouse	Habitat features such as old growth and snags would not be protected from wildfire under this alternative. The juniper titmouse would not be displaced given that no disturbance would occur. Project level populations of juniper titmouse are expected to continue to decline due to factors other than alternative A.	N
Black bear	There would be less mast and herbaceous forage available to black bear due to continued dense canopy growth, reducing understory forage. Cover requirements would continue to be met without the temporary displacement due to human presence and the use of temporary roads described in alternatives B and C. Project level populations of black bear are expected to remain stable.	N
Pygmy nuthatch	Ponderosa pine snags used for nesting would not be affected in the short term, but if landscape-scale wildfire occurred, snags could be created. There would be no nest abandonment or unintentional take associated with treatment activities. Project level populations of pygmy nuthatch are expected to remain stable. In the long term, not taking any action would not affect pygmy nuthatch unless local habitat was completely lost to landscape-scale fire.	N
Wild turkey	Habitat would not be improved since there would be no change to tree age and class structure, and the existing dense forest would not provide understory forage. Roost trees would not be protected from drought and fire effects. Roads would continue to cause habitat loss and displacement, but to a lesser degree in the short term than as described in alternatives B and C. Project level populations of wild turkey are expected to remain upward for reasons unrelated to implementation of this alternative. In the long term, not taking any action would not affect the forest level population or habitat trend of wild turkey unless cover and forage habitat were completely removed as a result of an uncharacteristic wildfire.	N
Hairy woodpecker	Habitat needs would continue to be met under this alternative unless there was a stand-replacing wildfire. There would be no displacement due to human presence during treatments. Project level populations of hairy woodpecker are expected to remain upward.	N
House wren	Habitat needs would continue to be met unless there was a stand-replacing wildfire. There would be no displacement due to human presence during treatments. Project level populations are expected to remain stable.	N

N = Negligible impact to population or habitat (forestwide) since the amount of untreated acres represent a very small percentage of the total habitat available on the Cibola NF&Gs.

Alternative B

In general, there would be no change in the population or habitat trend of MIS at the forest level. Implementation of alternative B would result in short-term displacement due to treatment activity (noise and human presence). Snags used by cavity nesting MIS birds would be retained. In the long term, forage condition and availability would improve for all species due to reduced canopy cover and retention of oaks and other shrubs. Other habitat features common in ponderosa pine forests such as roost and nest trees and downed logs would be retained except in permanent openings. The risk of stand-replacing wildfire would be reduced. Use of existing roads would result in increased displacement of elk, deer, and turkey from preferred habitat during treatment. Eventual road decommissioning would lessen the effect in the long term. Table 39 provides an effects summary of alternative B on MIS.

Table 39. Summary of alternative B effects on MIS

MIS (Habitat)	Short-term Project Level Species Direct Effects	Long-term Project Level Habitat Indirect Effects	Forestwide Population Effects
Elk (mixed conifer)	Short-term displacement due to human activity likely.	IC - Improves foraging habitat; may compromise security cover (patches ≥ 250 acres in size); no change in habitat quantity.	N
Mule deer (piñon-juniper and oak woodland)	Short-term displacement due to human activity likely.	IC - Improves browse forage availability and quality; no change in habitat quantity. Most patches would be too small for thermal cover requirements (2–5 acres).	N
Juniper titmouse (piñon-juniper)	Short-term displacement due to human activity likely affecting foraging habitat.	IC - Improves foraging habitat: treatment is implemented in stages so that not all piñon-juniper woodlands are treated within the same year. Treatment retains snags. There would be no change in habitat quantity.	N
Black bear (mixed conifer)	Short-term displacement due to human activity likely.	IC - Improves mast crop and forage availability and retains oaks; no change in habitat quantity.	N
Pygmy nuthatch (ponderosa pine)	Short-term displacement due to human activity likely affecting foraging habitat.	NC - Activity would occur outside the nesting season in the PFA and is implemented in stages so that not all the ponderosa pine forest habitat is treated within the same year. Snags and large diameter trees would be retained.	N
Wild turkey (ponderosa pine)	Short-term displacement due to human activity.	NC - Treatment activity occurs outside the nesting season in the PFA and is implemented in stages so that not all the ponderosa pine habitat would be treated within the same year. Openings would provide improved forage conditions for poults.	N
Hairy woodpecker (mixed conifer)	Short-term displacement due to human activity likely.	NC - Treatment activity is implemented in stages so that not all the mixed conifer habitat would be treated within the same year, and large snags would be retained.	N
House wren (riparian)	Short-term displacement due to human activity likely.	NC - Treatment activity is implemented in stages so that not all the riparian habitat is treated within the same year. Snags would be retained.	N

IC = improves habitat condition; DC = decreases habitat condition; NC = no change in habitat condition since the amount of treated acres represents a very small percentage of the total habitat available on the Cibola NF&Gs; N = no change in population trend at the forest level.

Alternative C

In general, there would be no change in the population or habitat trend of MIS at the forest level. Implementation of alternative C would result in short-term displacement due to treatment activity (noise and human presence). Snags used by cavity nesting MIS birds would be retained. In the long term, forage condition and availability would improve for all species due to reduced canopy cover and retention of oaks and other shrubs. Other habitat features common in ponderosa pine forests such as roost and nest trees and downed logs would be retained. The risk of stand-replacing wildfire would be reduced. Use of existing roads would result in increased displacement of elk, deer, black bear, and turkey from preferred habitat during treatment. Eventual road

decommissioning would lessen the effect in the long term. Table 40 provides an effects summary of alternative C on MIS.

Table 40. Summary of alternative C effects on MIS

MIS (habitat)	Short-term Project Level Species Direct Effects	Long-term Project Level Habitat Indirect Effects	Forestwide Population Effects
Elk (mixed conifer)	Short-term displacement due to human activity likely.	IC - Improves foraging habitat; no change in habitat quantity.	N
Mule deer (piñon-juniper and oak woodland)	Short-term displacement due to human activity likely.	IC - Improves browse forage availability and quality; no change in habitat quantity.	N
Juniper titmouse (piñon-juniper)	Short-term displacement due to human activity likely affecting foraging habitat.	IC - Improves foraging habitat: treatment is implemented in stages so that not all piñon-juniper woodland is treated within the same year. Treatment retains snags. There would be no change in habitat quantity.	N
Black bear (mixed conifer)	Short-term displacement due to human activity likely.	IC - Improves mast crop and forage availability and retains oaks; no change in habitat quantity.	N
Pygmy nuthatch (ponderosa pine)	Short-term displacement due to human activity likely affecting foraging habitat.	NC - Activity would occur outside the nesting season in the PFA and is implemented in stages so that not all the ponderosa pine forest habitat is treated within the same year. Snags and large diameter trees would be retained.	N
Wild turkey (ponderosa pine)	Short-term displacement due to human activity.	NC - Treatment activity occurs outside the nesting season in the PFA and is implemented in stages so that not all the ponderosa pine habitat would be treated within the same year. Openings would provide improved forage conditions for poults.	N
Hairy woodpecker (mixed conifer)	Short-term displacement due to human activity likely.	NC - Treatment activity is implemented in stages so that not all the mixed conifer habitat would be treated within the same year, and large snags would be retained.	N
House wren (riparian)	Short-term displacement due to human activity likely.	NC - Treatment activity is implemented in stages so that not all the riparian habitat is treated within the same year. Snags would be retained.	N

IC = improves habitat condition; DC = decreases habitat condition; NC = no change in habitat condition since the amount of treated acres represents a very small percentage of the total habitat available on the Cibola NF&Gs; N = no change in population trend at the forest level.

Migratory Birds

Alternative A

Under alternative A, fuels buildup would continue, leading to a uncharacteristic crown fire if a wildfire occurs in the area. This would substantially reduce nesting and foraging habitat. Woodpeckers can benefit in the short term from wildfire, as the dead and dying trees provide insect habitat; sapsuckers prefer live trees for their excavations. Disturbance due to vehicle use

and human activity related to existing and unauthorized motorized roads and trails would continue. Under alternative A, unintentional take of migratory birds due to tree cutting and prescribed fire would not occur.

Alternative B

Thinning activity would occur in phases so that fuel reduction activities and wood product removal can occur while providing mitigation for the unintentional take of migratory birds. The recommended Cibola NF&Gs migratory bird timing restriction is April 1 to July 31. This timing restriction would be implemented annually on two-thirds of the project area, while activity could occur throughout the year on the other third. In these activity areas it is recognized that unintentional take of migratory birds could occur.

Unintentional take results in direct mortality of migratory birds from cutting or burning of nest trees. Some incidental take can also result from nest abandonment due to human activity. In all project areas, habitat features important to high-priority migratory birds would be retained. Large trees would be retained and a more natural spacing (similar to what occurs in fire-adapted ecosystems where small trees and overly dense stands are usually removed by natural fire) would result. The short-term impacts would be a reduction in both vertical and horizontal diversity within stands. Since trees would be removed to create groups and openings and to reduce the “ladder fuels” (trees that allow a fire to easily reach the canopy or “crowns”), this would increase the lower understory layers and eventually result in increased diversity within the stands. Most bird species do not utilize these smaller diameter trees as nesting substrate; however, trees in the 9-inch and above class (particularly in piñon-juniper stands) may occasionally be used as nesting substrates. The vertical stand diversity (due to the removal of smaller, understory trees) would be the component most affected by alternative B. Horizontal tree diversity (looking at the stand from directly above) would be impacted as trees between groups would be removed except for one or two of the larger diameter trees that are retained between groups. For the most part, areas with extant small diameter trees (where a larger overstory does not occur) may be removed, thus creating openings in the canopy where none existed. Some slight impacts could be expected in the short term to nesting habitat, but as noted, these small trees are generally not the preferred nest substrates. Since trees would not be cut on two-thirds of the project area during any one year (during the primary breeding season), unintentional take of migratory birds is likely to occur in only a portion of the project area. In the short term, vehicle use and associated disturbance would increase in the project area. Populations of migratory birds dependent on piñon-juniper and oak woodlands, ponderosa pine, mixed conifer forests, and riparian areas would be maintained in the long term as a result of implementation of alternative B.

In the long term, after the thinning occurs and the stands retain a more natural spacing, populations of birds of conservation concern are expected to show slight to moderate increase, as opening the understory to increase light to the forest floor would allow for an increased shrub and forb component, potentially increasing species utilized as food by granivorous birds (seed and berry eaters), as well as creating a greater mix of understory plant species utilized by insects which are preyed upon by insectivorous bird species. Retaining the larger trees, as well as dead and dying trees with cavities present, would retain the important nesting substrates used by most of the species. Road decommissioning would be coordinated with the implementation phases, and in the long term would decrease disturbance due to vehicle use of unauthorized motorized roads and trails. Cavity trees may be reduced somewhat over time since removing the smaller trees would “release” larger trees (removing root competition allows the remaining trees to increase in

size); thus, trees that may have succumbed earlier due to the dense stocking rates would probably not be as prevalent.

Alternative C

Effects would be similar to alternative B. Risk of wildfire would be reduced to a lesser degree. Foraging opportunity would increase. Thinning activity would occur in phases so that fuel reduction activities and wood products removal can occur while providing mitigation for the incidental take of migratory birds. The recommended Cibola NF&Gs migratory bird timing restriction is April 1 to July 31. This timing restriction would be implemented annually on two-thirds of the project area, while activity could occur throughout the year on the other third. In these activity areas it is recognized that unintentional take of migratory birds could occur.

Table 41 summarizes the impacts (both short and long term) of the different alternatives.

Table 41. Summary of effects on migratory birds

Species	Alternative A	Alternative B	Alternative C
Band-tailed pigeon	NC – No change in habitat condition in the short term. DC – Decreases habitat condition in the long term due to loss of openings and berry producing shrubs.	DC – Decreases habitat condition in the short term due to disturbance. IC – Improves habitat condition in the long term due to increased foraging potential in mature pine/oak stands, maintenance of forest openings for berry-producing shrubs, maintenance of tall snags for roosting, decreased disturbance from vehicle use of roads, and decreased wildfire risk.	DC – Decreases habitat condition in the short term due to disturbance. IC – Improves habitat condition in the long term due to increased foraging potential in mature pine/oak stands, maintenance of forest openings for berry-producing shrubs, maintenance of tall snags for roosting, and decreased disturbance from vehicle use of roads.
Broad-tailed hummingbird	NC – No change in habitat condition in the short term. DC – Decreases habitat condition in the long term due to loss of openings, and deciduous shrubs as canopies continue to close.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance. IC – Improves habitat condition in the long term due to an increase in grassy areas and higher forb production associated especially with prescribed burns, and decreased disturbance due to road use.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance. IC – Improves habitat condition in the long term due to an increase in grassy areas and higher forb production associated especially with prescribed burns, and decreased disturbance due to road use.
Grace's warbler	NC – No change in habitat condition in the short term. DC – Decreases habitat condition in the long term due to continuing habitat loss associated with fire suppression and the potential of uncharacteristic fires. Also due to fire suppression or lack of mechanical	DC – Decreases habitat condition in the short term due to disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and decreased disturbance due to roads and wildfire risk.	DC – Decreases habitat condition in the short term due to disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and decreased disturbance due to roads and wildfire risk. Mechanical treatments would result in high quality older growth ponderosa pine forest with a relatively open understory. Taller, older trees in mature ponderosa pine habitat would be retained, benefitting

Species	Alternative A	Alternative B	Alternative C
	treatments, trees are smaller and form a more closed canopy than in the more park-like stands favored by this species.		this species.
Flammulated owl	NC – No change in habitat condition in the short term. DC – Decreases habitat condition in the long term because fire suppression and lack of vegetation treatments have created large areas of dense, “doghair” ponderosa pine stands unsuitable for nesting or foraging. Immediate threats include the loss of remaining areas of open, mature forest habitat to uncharacteristic fire.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and decreased vehicle disturbance and wildfire risk. Existing areas of mature or old growth forest would be protected and maintained.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and decreased vehicle disturbance. Forest thinning and controlled burning to restore more open, multistoried ponderosa pine and mixed conifer stands with fewer and larger trees, snags for nesting, a grassy understory and patch shrub cover should help reverse long-term habitat degradation to benefit this species. In addition to such restoration, existing areas of mature or old growth forest would be protected and maintained.
Red-naped sapsucker	NC – No change in habitat condition in the short term. DC – Decreases habitat condition in the long term due to fire suppression and loss of areas with deciduous trees like aspen.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and decreased road disturbance and wildfire risk. Medium sized to large diameter dead snags would be left intact.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and decreased road disturbance. Vegetation treatments would maintain taller trees in ponderosa and mixed conifer forest. Medium sized to large diameter dead snags would be left intact.
Virginia’s warbler	NC – No change in habitat condition in the short term. DC – Decreases habitat condition in the long term due to loss of open forests with shrub cover.	DC – Decreases habitat condition in the short term when prescribed fires are used, which removes suitable nests sites and foraging opportunities, as well as project related disturbance. IC – Improves habitat condition in the long term due to increased foraging potential, decreased disturbance and wildfire risk, and the reinstitution of a natural disturbance regime.	DC – Decreases habitat condition in the short term when prescribed fires are used, which removes suitable nests sites and foraging opportunities, as well as project related disturbance. IC – Improves habitat condition in the long term due to increased foraging potential, decreased disturbance, and the reinstitution of a natural disturbance regime.
Black-chinned sparrow	NC – No change in habitat condition in the short term. DC – Decreases habitat	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance.

Species	Alternative A	Alternative B	Alternative C
	condition in the long term.	IC – Improves habitat condition in the long term due to increased foraging potential, decreased disturbance due to roads from decommissioning, and decreased wildfire risk since this species prefers open canopy habitat and shrubs, which would increase following the proposed vegetation treatments.	IC – Improves habitat condition in the long term due to increased foraging potential and decreased disturbance due to roads from decommissioning.
Black-throated gray warbler	NC – No change in habitat condition in the short term. DC – Decreases habitat condition in the long term due to potential loss of large stands of mature piñon-juniper woodland due to insects, disease, and wildfire.	DC – Decreases habitat condition in the short term due to loss of structural diversity, increased habitat fragmentation in dense woodland habitat, and disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and an overall reduction in road density. Vegetation treatments would reduce the risk of stand-replacing wildfire.	DC – Decreases habitat condition in the short term due to loss of structural diversity and disturbance. IC – Improves habitat condition in the long term due to increased foraging potential and treatment mitigation that maintains large stands of mature piñon-juniper woodland and an overall reduction in road density.

IC = Improves habitat condition; DC = Decreases habitat condition; NC = No change in habitat condition

Important Bird Areas: There are no Audubon Society designated IBAs affected by the project. The nearest IBA is the Tajique Canyon site, directly south and west of the project boundary in the Manzano Mountains.

Overwintering Areas: Important overwintering areas have not yet been designated on the Cibola NF&Gs; thus, none would be impacted by project implementation.

Cumulative Effects Across Jurisdictions

The cumulative effect analysis area for wildlife includes habitat types similar to the project area (piñon-juniper woodlands, ponderosa pine forests, mixed conifer forests, oak woodlands, and riparian areas) along the wildland-urban interface on the east side of the Manzanita and Manzano Mountains. Past activities in the analysis area that have led to current conditions include livestock grazing in the early to middle 1900s, subsequent removal of livestock from the Cibola NF&Gs (Sandia Ranger District), exclusion of unplanned fires, human settlement, and recreational development and use of trails and trailheads. More recent activities considered as cumulative effects include USFS and private lands fuels reduction treatments in the vicinity of the Isleta Collaborative Landscape Analysis Project area and along the WUI zone. Some of those treatments have occurred in the past 30 years and trees are becoming reestablished, reducing the effectiveness of the treatments. New fuels reduction and forest health restoration projects on USFS managed lands are being proposed along the WUI north of the project area. Fuel hazard reduction treatments presently occurring on private lands are also likely to continue.

Cumulative effects under alternative A would result in a continuation of existing habitat conditions for wildlife in the WUI since much of this area has not yet been treated for fuels reduction. Wildlife species composition and populations on NFS lands would continue to be similar to what is there now except in the event of a stand-replacing wildfire. Fuel hazard reduction presently occurring on private lands is likely to continue and may result in heavier treatments with less emphasis on leaving untreated patches, snags, and downed woody debris and providing for stand diversity. Existing development and expansion of subdivisions along the WUI would continue to fragment and isolate woodland and forested habitats in this area reducing its habitat value for wildlife on USFS managed lands.

Cumulative effects related to alternatives B and C would result in the continued treatment of the WUI resulting in some reduction in the threat of stand-replacing wildfire. Without reducing the danger from wildfire by some combination of thinning and burning along the entire wildland-urban interface and beyond, fuels treatments in the Isleta Collaborative Landscape Analysis Project area are likely to reduce the fire severity only within or near the project boundaries. Past, present, and future treatments on USFS lands would provide for more sustainable conditions to maintain vegetation structural and compositional diversity. Expected improvement of forage habitat on NFS lands would tend to reduce wildlife use of housing areas in the WUI. The cumulative effects of past and future fuels reduction to wildlife species dependent on these woodland and forest habitats would be overall beneficial.

Air Resources

Affected Environment Across Jurisdictions

New Mexico has a mild, arid to semiarid, continental climate characterized by abundant sunshine, light total precipitation, low relative humidity, and relatively large annual and diurnal temperature ranges (New Mexico Climate Center 2010). The average hours of annual sunshine range from nearly 3,700 hours in the southwest portions of the state to 2,800 hours in the north-central portions. The freeze-free season ranges from more than 200 days in the southern valleys to less than 80 days in the northern mountains, where some high mountain valleys have freezes in the summer months.

A wide variation in annual precipitation totals is characteristic of arid and semiarid climates (Wilcox and Breshears 1994). Generally, July and August are the rainiest months of the year, with 30 to 40 percent of the state’s annual precipitation falling at this time. Summer rains fall almost entirely during brief, frequently intense thunderstorms. The moisture associated with these storms originates in the Gulf of Mexico. Spring and summer rains often encourage the growth of fine fuels such as grasses and forbs. Late in the season or the following year, these fine fuels can be very dry and actively carry a ground fire.

Winter is the driest season in New Mexico. During this season, precipitation is primarily a result of frontal activity associated with Pacific Ocean storms that move across the country from west to east. Much of this precipitation falls as snow in mountain areas. Snowpack provides water for tree growth and has broad reaching effects on overall forest health. In years with low snowpack, soil and fuels have more time to dry out before the fire season begins, which can result in more extreme fire behavior. In years with high snowpack, onset of the fire season may be delayed due to high soil and fuel moisture.

According to the Western Regional Climate Center (2010), the normal annual precipitation for Tajique, a close weather station to the project area, averaged 19.60 inches for the period of 1914 to 1970. Nearly two-thirds of the annual precipitation for the area occurs December through March, July, and August. The average maximum temperature for the area is 63.7 degrees Fahrenheit (°F), with an average minimum temperature of 33.3 °F (Western Regional Climate Center 2010).

In regard to air quality, the project area lies within both the Albuquerque-Mid Rio Grande Interstate Air Quality Control Region 152 and the Northeastern Plains Intrastate Air Quality Control Region 154 (NMED 2010). The closest Class I air quality areas are Bandelier National Monument and the adjacent Bandelier and Dome Wilderness areas, approximately 55 miles north of the project area. A Class I airshed, established by the Clean Air Act and administered by the EPA, applies to national parks over 6,000 acres and wilderness areas and memorial parks over 5,000 acres that require the highest level of aesthetic protection.

Additionally, the Clean Air Act and its amendments require the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment (Public Laws 88-206, 90-148, 91-604, 95-95, and 101-549). These criteria pollutants include lead (Pb), nitrogen oxide (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns in size (PM_{10}), particulate matter less than 2.5 microns in size ($PM_{2.5}$), and ozone (O_3). The Clean Air Act also allows states to adopt additional ambient air quality standards. The State of New Mexico's ambient air quality standards are more stringent for primary pollutants than the Federal NAAQS. Although the NMED AQB does not conduct any regional air quality monitoring, both Bernalillo and Torrance Counties have been classified by the EPA as an "attainment area," which means that ambient air quality meets the standards of the levels set in the NAAQS (NMED 2007).

Motorized vehicles, smoke and dust, and numerous industrial and commercial sources throughout the state likely account for a large portion of the pollutants within the project area.

Environmental Consequences Across Jurisdictions

Alternative A (No Action)

There are no direct effects expected under alternative A. The current land use and air quality is expected to remain the same. In the event of an uncharacteristic wildfire, there is potential for emissions that would exceed that of a prescribed fire depending on the size and severity of the fire.

Alternative B (Proposed Action)

Under alternative B, the primary direct effects to air quality come from prescribed fire and pile burning within the project area following thinning treatments. The major pollutant of concern in smoke is fine particulate matter, both PM_{10} and $PM_{2.5}$. Mitigation of these effects would be through obtaining burn permits from Bernalillo and Torrance Counties and ensuring that the burns are carried out within proposed prescription windows that mitigate smoke effects. The public would also be informed about burn days and times. Air quality effects related to prescribed fire on USFS lands are discussed in detail in the "Cibola NF&Gs Affected Environment" section.

Based on the location of this project and the westerly winds that prevail throughout most of New Mexico, prescribed burning is not likely to affect downwind Class I airsheds.

Climate Change

Affected Environment Across Jurisdictions

Globally, the Earth's surface temperature has increased by about 1.2 ºF to 1.4 ºF since 1900, with most of the warming occurring in recent decades. Anthropogenic gases, particularly CO_2, are enhancing the natural greenhouse effect, and likely contributing to an increase in these global average temperatures and related climate changes (EPA 2010). CO_2 and other pollutants enter the atmosphere through burning of the fossils fuels (oil, natural gas, and coal) that we depend on to meet our daily energy needs.

The potential effects of climate change on the environment would vary spatially. A study done by the Agency Technical Work Group (2005), in accordance with Executive Order 05-033, projects major environmental implications for the State of New Mexico from a changing climate. The agency has predicted some of the following environmental consequences in New Mexico if temperatures continue to rise at the current, "business-as-usual" rate:

- Average air temperature substantially warmer by 6–12 °F
- Greater warming for winter, nighttime minimum temperatures, and higher elevations
- More episodes of extreme heat
- Fewer episodes of extreme cold
- Longer frost-free period
- Changes in average precipitation are uncertain, precipitation could increase or decrease
- More extreme events (torrential rain, severe droughts)
- Continuation of historical patterns of wet and dry cycles, including likely recurrence of multiyear drought
- Winter rain instead of snow at all but highest elevations

Impact of Climate Change on Fire Frequency and Severity

Climate change has played an extensive role in altering fire occurrence and severity by influencing the vegetative cover and available burnable fuel across the western landscape. In the past few years, fires have grown to record sizes, are burning earlier and longer, and are burning hotter and more intensely than they have in the past (Westerling et al. 2006). According to the National Interagency Fire Center, occurrence of uncharacteristic wildfires greatly increased over the last 20 years. Westerling et al. (2006) claim that a study of large (>1,000 acres) wildfires throughout the western United States from 1970 to 2003 saw a pronounced increase in frequency of fire since the mid 1980s. Fires from 1987 to 2003 were four times more frequent than the 1970–1986 average. After 1987, the length of the fire season was also observed to increase by 78 days.

Changes in relative humidity have been blamed for much of the changes as increased drying over much of the Southwest has lead to an increase in days with high fire danger (Brown et al. 2004).

Advanced computer models are now making national scale simulations of ecosystems providing predictions of how fire regimes would change in the 20th century (Neilson 2004). Predictions are that western grasslands would undergo increased expansion of woodier vegetation such as piñon-juniper associated with increased precipitation occurring during typical wet seasons. Summer months are predicted to be hotter and longer, which would also contribute to increased fire risk (Neilson 2004). Under greater climatic extremes widely predicted throughout the U.S., fire behavior is expected to become more erratic, with longer flame lengths, increased torching and crowning, and more rapid runs and blowups associated with extremely dry conditions (Brown et al. 2004).

In a General Accounting Office report on climate change and Federal lands, natural resource experts from numerous Federal and state agencies and leading academic experts predict that climate change would cause forest fires to grow in size and severity (General Accounting Office 2007). This, in turn, would impact the safety of communities located not just in the WUIs but in even larger areas as a result of impaired air quality resulting from vast smoke production. The cost of fire suppression and the expense of fire preparedness is likely to increase in parallel with increasingly larger fires. Experts warn that Southwest fire and fuels management strategies and policies need to address these risks now in order to prepare for these changing regimes, while also accommodating complex changing ecosystems subject to growing human stresses (Brown et al. 2004).

Since Southwest forest environments and ecological processes are influenced by climate, we need to be prepared to learn and understand changes in climate and ecosystem processes and function, and to employ adaptive management strategies to accommodate such changes over time. Although fire suppression is still aggressively practiced, fire management techniques are continually adapting and improving. Due to scattered human developments and values throughout the WUI, suppression would always have to be a priority in those areas. However, combining prescribed fire with effective fuels management and restoration techniques would help reestablish natural fire regimes and reduce the potential for uncharacteristic wildfires associated with our changing climate.

Environmental Consequences Across Jurisdictions

Alternative A (No Action)

Under alternative A, there would be no direct effects on carbon sequestration and greenhouse gas emissions and, therefore, no indirect effects on global climate change. However, in the event of an uncharacteristic wildfire, there could be a significant pulse of greenhouse gas emissions into the atmosphere that may impact climate change.

Alternative B (Proposed Action)

Under alternative B, there may be some short-term impacts to climate change, though on a project level the impacts on global climate change are difficult to quantify. Thinning treatments that reduce canopy cover would impact the global carbon cycle by removing trees that sequester CO_2; however, the treatment would avoid large greenhouse gas emission pulses and effects to the carbon cycle by decreasing the potential for large-scale wildfire. Prescribed burning would also emit greenhouse gases into the atmosphere. However, the greenhouse gas emissions associated with a prescribed burn are expected to be significantly less than the emissions associated with an uncharacteristic crown fire, which has the potential to spread beyond the project area.

Scenic Resources

Pueblo and Chilili Affected Environment

The proposed project area offers great scenic resources to those near and far. Since access for the general public is restricted, the main users of the area are tribal members and members of the Chilili Land Grant.

The Sandia Mountains are highly valued for their scenic quality and current users enjoy many scenic vistas and varied landscapes. The mountains are located in the Mexican Highland section of the Basin and Range physiographic province (USFS 1999). Landscapes range from lower elevation grasslands to piñon-juniper woodlands and ponderosa pine forests at higher elevations. Mixed conifer forests are also found scattered throughout the project area. The current forest structure in the project area is dense and uniform in terms of age structure, which may impede upon natural vistas.

Due to a lack of formal vegetation management, the landscape is predominantly natural appearing, with few road or infrastructural developments. Native flora and fauna dominate, and there are numerous opportunities for wildlife viewing.

Cibola NF&Gs Affected Environment

Forest Plan – Visual Quality Objectives

The forest plan utilized the USFS Visual Management System (VMS) to determine visual quality objectives for all NFS lands within the Cibola NF&Gs (USFS 1974). Visual quality objectives (VQOs) are designed to integrate the public's concern for scenic quality (sensitivity levels) with the diversity and scenic attractiveness of the natural features (variety classes.) These objectives describe the degree of acceptable alteration of the natural landscape based on the importance of aesthetics. (USFS 1974)

VQOs are used to describe the degree of alteration that may occur to the visual resource on lands within the Cibola NF&Gs' management areas:

- **Retention** – This VQO provides for management activities that are not visually evident. Under retention, activities may only repeat form, line, color, and texture that are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc., should not be evident (approximately 500 acres in the analysis area).
- **Partial Retention** – Management activities must remain visually subordinate to the characteristic landscape. Associated visual impacts in form, line, color, and texture must be reduced as soon after project completion as possible but within the first year (approximately 7,200 acres in the analysis area).

The Isleta CFRP analysis area is located in Management Areas 2, 11, and 15 as specified in the forest plan (1985). The current visual management direction was developed using the VMS. These management areas provide for a range of VQOs across the landscape within the project area. The VQOs range from partial retention to retention within the project area, where partial retention is 93.5 percent of the project area.

The following VQOs were assigned to Management Area 2 (which includes all of the nonwilderness acres on the Sandia RD):

- 11,996 acres retention
- 28,623 acres partial retention
- 2,666 acres modification

The following VQOs were assigned to Management Area 11:

- 3,214 acres retention
- 39,469 acres partial retention
- 59,747 acres modification

The following VQOs were assigned to Management Area 15:

- 2,105 acres retention
- 23,199 acres partial retention
- 25,318 acres modification

Cumulative Effects Area

The cumulative effects area for scenic resources includes views from the Tranquillo Pines residents that border the Cibola NF&Gs. The project area can be viewed from these locations. Viewers in these locations often have high concern for scenic quality. Because of the high concentration of residents adjacent to the project area, the visual resources of the project area are important to their experience and perceptions.

Pueblo and Chilili Environmental Consequences

Alternative A (No Action)

Under alternative A, there would be no perceived change to scenic resources, though the current dense structure of the forest may continue to impinge upon natural vistas. In the event of an uncharacteristic wildfire in the project area, the burn scar associated with the fire may be perceived negatively by some users.

Alternative B (Proposed Action)

Under alternative B, there would be some temporary and more long-term changes to scenic resources. Since scenic beauty is a subjective parameter, the perceived impact would vary by user. The fuel break area proposed around the Pueblo and Chilili would be thinned to a basal area of 50 square feet per acre with a removal of both understory and overstory canopy equating to approximately 50 percent reduction in tree density. This would result in a much more open forest structure and greater visibility on both sides of the Pueblo boundary, impacting Pueblo users and adjacent private landowners. Treatment of meadow encroachment would create equally open areas with significant changes in visibility and scenic resources, but with accompanying increases in herbaceous species diversity and landscape character.

Treatment areas would be characterized, at least on a temporary basis, by thinning slash, cut-stumps, and disturbed ground resembling a managed landscape in contrast to the unaltered landscape currently exhibited. For some this altered appearance may be perceived as diminished scenic beauty. Following treatment, however, slash cleanup and regeneration of the understory vegetation layer would mask some of the initial disturbance and improve landscape variability, character, and visibility.

Prescribed burns have been found to negatively impact scenic beauty on a temporary basis due to charring of flora and soils; within 5 years scenic resources are expected to be enhanced as a result of regeneration and increased species diversity and varied structure (Rosenberger and Smith 1998). Prescribed fires are likely to impact scenic resources to a lesser extent than more uncharacteristic wildfire that would have longer lasting impacts. Pile burning would be limited to isolated areas and is likely to only minimally impact scenic resources.

Cibola NF&Gs Environmental Consequences

The following discussion describes expected visual changes to the landscape in the short term (1 to 5 years) and in the long term (more than 6 years). Visual impacts of treatments are determined by the type and magnitude of treatments being implemented. The primary goal is reducing density and removing ladder fuels. The impact is most evident in the immediate foreground, where details such as stumps and slash are discernible. In distant foreground and middle ground views, the change is most evident during winter months, when the contrast with snow makes the density reduction more apparent. Treatments would maintain greater irregularity in canopy levels, maintaining textural variety in the short and long term, especially as viewed from Tranquillo Pines.

When total basal area is reduced to below 80 square feet per acre, the disturbance becomes visually dominant in the immediate foreground and foreground views, opening the stand to more light, longer views, and less sense of enclosure. In immediate foreground views, stumps are evident, ground disturbance is increased, and slash begins to dominate the view. In foreground to middle ground views, openings created are apparent but do not dominate the view.

Slash has been shown to have a high negative impact on visual quality (Rosenberger and Smith 1998). During harvest operations, where slash debris and ground disturbance is evident, visitors would likely feel that visual quality has been reduced.

Viewers may perceive loss of scenic beauty in middle ground views. The angle that the harvested area is viewed and the amount removed correlates with the perception of reduction of scenic quality. Orland et al. (1993) found that the foreground and middle ground views of treatments were preferred to the no action alternative because of the accelerated forest recovery when decreasing density.

Firewood Removal

Where vehicles would be used to access the harvested trees for firewood, there may be some ground disturbance. In the immediate foreground this appears as disrupted forest litter (fallen needles, leaves, and other natural debris) and exposed soil, which is often lighter in appearance to the surrounding area. During the period where trees are being cut and removed, residual slash would be visible. This would give a coarse textural quality to the ground, until ground cover has

been established. It is anticipated that within 5 years, the color contrast created by the ground disturbance would be reduced as normal forest litter is deposited and ground cover has been established.

Alternative A (No Action)

The no action alternative would result in little perceived change. Uncharacteristic wildfire is a greater risk in the no action alternative. If a large fire or series of fires occur, views of a fire altered landscape may begin to dominate.

Alternative B (Proposed Action)

The openings created by reducing the vegetation density would be visible from area subdivisions and trails. The line created in the forest canopy cover by treating to the project boundary would likely be visible from Tranquillo Pines, since greater than 50 percent of the stand would be removed. This would provide a linear contrast from the adjacent forest cover in the U.S. Department of Defense Withdrawal Area and residential areas.

In the piñon-juniper forested areas in the northern Manzano project area, total tree densities (trees greater than 5 inches d.r.c.) range from 25 to 888 trees per acre. In addition, stands have an average of 1,890 trees per acre less than 5 inches d.b.h.. In the David Canyon project area, total tree densities (trees greater than 5 inches d.r.c.) range from 62 to 537 trees per acre. In addition, stands have an average of 2,294 trees per acre less than 5 inches d.b.h.. There would be an approximately 45 to 87 percent reduction in the tree cover per acre. This would result in a much more open forest appearance, especially since clumps would be maintained. The clumpy nature of the treatment would be more natural, but would leave large open areas between clumps. Most people who are familiar with the area from the residential areas or area trails would perceive a substantial change from the continuous canopy in the existing condition.

In the ponderosa forest areas in the northern Manzano project area, total tree densities (trees greater than 5 inches d.b.h.) range from 34 to 1,288 trees per acre. In addition, stands have an average of 1,758 trees per acre less than 5 inches d.b.h.. In the David Canyon project area, total tree densities (trees greater than 5 inches d.b.h.) range from 109 to 451 trees per acre. In addition, stands have an average of 3,082 trees per acre less than 5 inches d.b.h.. There would be an approximately a 47 to 82 percent reduction in the tree cover per acre. As with the piñon-juniper forested area, this would result in a much more open appearance with open expanses between the clumps.

Stumps, slash, and ground disturbance would dominate the view in the immediate foreground of area trails where they cross through treatment areas. This proposed action would change the undeveloped character until stumps have aged and slash has been treated or has diminished over time. A decrease in the sense of solitude and diminished scenic quality would likely occur while traveling area trails. Viewers may perceive diminished scenic quality in this area until slash has been removed or decomposed, and the ground cover has reestablished in the treatment area. Mitigation would not be applied to the non-NFS trails. Since many of these are frequently used by local residents, they are likely to perceive diminished quality. These trails may not be usable upon completion of the project. For anyone who uses these trails frequently, this is likely to displace the users of these trails.

The existing landscape character is predominantly natural appearing to natural evolving away from residential and recreation developments. Near residential areas, the landscape is influenced by the rural development character within view of the homes. The landscape character would change from natural evolving and natural appearing to an altered landscape with a managed appearance, at least in the short term for up to 10 years. For people who prefer the appearance of an unmanaged landscape, this would decrease the scenic quality.

Trail users in this area would likely see the treatment activities and the visual impacts during and after completion. Mitigations would be applied along system trails within the project boundary. Viewing thinned areas, including slash and downed trees, burned slash piles, and hearing chain saws during activities would likely reduce their sense of solitude.

Prescribed burns have been found to negatively impact scenic beauty in the short term, but with ground vegetation recovery, can enhance scenic beauty within 5 years (Rosenberger and Smith 1998). Prescribed fire causes short- and long-term visual impacts, and may begin to dominate the view as the size of the area burned increases. Where prescribed fire is limited to slash reduction, there are isolated areas of burned piles evident. Once these piles have been scattered, there may be some short-term evidence of darkened litter and soil that would be reduced within 5 years and generally only be noticeable within the immediate foreground. Where broadcast burning is used to reduce slash, visual impacts include charred bark of standing trees and downed logs, and a blackened appearance to the ground plane and burned understory plants. The visual impacts would be reduced within 2 years, with regeneration of ground cover plants and deposition of forest litter over the burned sites. Charred bark, limbs, and other features may be visible for many years.

Fire effects are seen as a natural phenomenon by most visitors, expressing strong support for prescribed natural fire policies. While fire was considered to have diminished scenic values, the presence of fire did not adversely affect visitor satisfaction (Love and Watson 1992). Light prescribed fires are perceived to enhance scenic quality for up to 5 years (Taylor and Daniel 1983).

The VQOs are expected to be met upon completion of the project.

Alternative C

The direct and indirect effects for alternative C would be the same as described for alternative B, except in that the residual stand structure for alternative C would not create large open areas between clumps.

Cumulative Effects Across Jurisdictions

No Action

The impacts to the cumulative effects area are similar to the direct effects from the project. No action would result in little perceived change. Uncharacteristic wildfire is a greater risk in the no action alternative. If a large fire or series of fires occur, views of a fire altered landscape may begin to dominate.

Proposed Action

The proposed action may lead to a perceived diminished scenic quality for residents and travelers who are familiar with the area. The casual observer would likely not notice the changes as viewed from a distance.

Alternative C

Alternative C may lead to a diminished scenic quality for residents and travelers who are familiar with the area. However, the proposed action under alternative C would be a thinning from below while favoring trees with the healthiest crowns so the residual stand structure would appear less unchanged than alternative B, which would create large openings between clumps of trees. The casual observer would likely not notice the changes as viewed from a distance.

Mitigation

To meet visual quality objectives within the immediate foreground areas (up to 300 feet) adjacent to area trails and residential areas, slash treatments would be as follows:

- Stumps would be cut to a 6-inch height throughout the project area. Within the immediate foreground areas (up to 300 feet) of trails, the face cut of stumps would be directed away from the trail, where possible.
- Piles created in the immediate foreground would be burned to achieve 95 percent or more consumption, and following burning, unconsumed slash would be scattered and the ground would be seeded with the approved seed mixture for this area. The burning of piles created within the immediate foreground between June and September of any year should be burned in September to November of that same year unless fuel or weather conditions are not conducive to attainment of the 95 percent consumption objective. These piles would be burned the following spring as soon as conditions permit. Piles created during a winter harvest operation would not be burned until the following September to November period.
- For alternative B, slash would be scattered within the foreground of area trails and residences to reduce visual impacts.

Transportation

Cibola NF&Gs Affected Environment

The transportation system within the analysis area is composed primarily of Forest Service maintenance level 2 and 3 NFS roads for alternatives B and C. Tables 42 and 43 list the roads to be used for this project. There is no difference in the transportation system between alternatives B and C for this project. The David Canyon and North Manzano project areas are included in alternatives B and C.

A maintenance level 3 NFS road is open and maintained for travel by prudent drivers in standard passenger cars. User comfort and convenience are low priorities. NFS roads in this maintenance level are typically low speed, single lane with turnouts, and spot surfacing. A maintenance level 2 NFS road is open for use by high-clearance, four-wheel drive vehicles. In addition, there are a number of NFS roads that are considered maintenance level 1. These roads are not open to vehicle traffic and have been blocked from entry by either a gate or some other barricade.

Roads within the project area are defined as either NFS roads or unauthorized roads. There are approximately 34 miles of NFS roads within the David Canyon and North Manzano project area. A NFS road is wholly or partly within, or adjacent to, and serving the National Forest System which is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources. NFS roads have a maintenance level assigned to them in order to set scheduled maintenance treatments.

An unauthorized road is a road or trail that is not a NFS road or trail or a temporary road or trail and is not included in a forest transportation atlas. There are 11 miles of unauthorized road within the North Manzano project area. Unauthorized roads exist in varying levels of use based on surface condition and types of use.

David Canyon Existing Conditions

Raven Road from New Mexico Highway 337 is a county maintained road that gives access to the north part of the project area and is a double lane, paved road for 1.62 miles until you approach Mars Court Trailhead. There are no outlying issues using the Raven Road for access.

NFS Road 530 coinicident with Trail No. 05530 is a single lane, native surfaced maintenance level 2 road that leads into the project area from Raven Road and is 2.32 miles. NFS Road 530 is only open to motorcycles per the “Sandia Ranger District Motor Vehicle Use Map.”

NFS Road 335 coincident with Trail No. 05335 (3.75 miles) and NFS Road 106 (3.36 miles) from NFS Road 530 lead to focused areas of the project. The north section of NFS Road 106 coinicident with Trail No. 05106 (1.4 miles) is only open to motorcycles per the “Sandia Ranger District Motor Vehicle Use Map.”

NFS Roads 335, 530, and 106 have not been maintained recently and are narrow in some areas with a roadway average of 12 feet. It has some roadside ditches but not the entire length of the road. There is no noticeable surfacing and minimal turnouts. Roadside and overhead brushing is needed for the entire length of the roadway. Sections of this roadway need to be reconditioned for the use of log trucks, including proper turnouts, drainage features, ditches, culverts, and road base course in certain areas. High-clearance, four-wheel drive vehicles using these access routes have no problems during dry conditions, but are not recommended during wet conditions to prevent resource damage.

North Manzano Division Existing Conditions

Maintenance level 3 NFS roads within this project area are a portion of NFS Road 55 (2 miles) from New Mexico Highway 55 to NFS Road 321. NFS Road 55 from New Mexico Highway 55 is a processed material surfaced single lane road that intersects NFS Road 321. There are no outlying issues using FR 55 for commercial vehicle access.

NFS maintenance level 2 roads within this project area are NFS Road 321 from New Mexico Highway 55, NFS Roads 55, 321C, 321D1, 321D1A, 321D2, 321D2A, 321D3, and 321E from NFS Road 321; NFS Road 260 from NFS Road 321; and 260A, 260A1 from NFS Road 260.

NFS Road 321 has several drainage features installed on the southeast portion of this road from NFS Road 260 to New Mexico Highway 55, making it only passable for high-clearance vehicles. NFS Roads 321C, 321D1, 321D1A, 321D2, 321D2A, 321D3, and 321E from NFS Road 321,

NFS Road 260 from NFS Road 321, and 260A, 260A1 from NFS Road 260 share similar characteristics of NFS Road 321 and are only recommended for high-clearance, four-wheel drive vehicles. These roadways have not been maintained recently, are narrow in some areas, and have tight curve radii with a roadway average of 12 feet. It has some roadside ditches but not the entire length of the road. It does not have any noticeable surfacing and minimal turnouts. Roadside and overhead brushing is needed for the entire length of the roadway. Sections of NFS Road 321 from NFS Road 55 to NFS Road 260 need to be reconditioned for the use of log trucks including proper turnouts, drainage features, ditches, culverts, and road base course in certain areas. High-clearance, four-wheel drive vehicles have no issues using these access routes during dry conditions, but are not recommended during wet conditions to prevent resource damage.

There are 11 miles of unauthorized roads to be used from NFS Road 321 and NFS Road 260 within this project. At the conclusion of this project, these roads and other mechanized travel ways within the project area will be maintained, closed, decommissioned, or obliterated.

Product Removal Route Information

Surface types for removal routes identified for timber removal for the action alternatives consist of asphalt pavement, crushed aggregate, and improved native (unprocessed pit run surfacing) and native material (table 42 and table 43).

Table 42. David Canyon haul route summary (miles)

Haul Route	Asphalt Pavement	Aggregate	Improved Native	Native	Maintenance Level	Total Haul Miles
FR 530 Coincident w/Trail No. 05530	-	-	2.3	-	-	2.3
FR 335 Coincident w/Trail No. 05335	-	-	-	3.75	-	3.75
NFS Road 106	-	-	-	2	-	2
FR 106 Coincident w/Trail No. 05106	-	-	-	1.4	-	1.4
Total Miles						9

Table 43. North Manzano Division haul route summary (miles)

Haul Route	Asphalt Pavement	Aggregate	Improved Native	Native	Maintenance Level	Total Haul Miles
NFS Road 55		2				2
NFS Road 321			8			8
NFS Road 260			3			3
NFS Road 321D3				1		1
NFS Road 321D1A				2		2
NFS Road 321D1				2		2
NFS Road 321E				2		2
NFS Road 321D2				1		1
NFS Road 321D2A				1		1

Haul Route	Asphalt Pavement	Aggregate	Improved Native	Native	Maintenance Level	Total Haul Miles
NFS Road 321E				0.2		0.2
NFS Road 260A				1		1
NFS Road 260A1				0.5		0.5
Unauthorized				11		11
Total Miles						34.7

Maintenance

All removal routes would require maintenance work. All removal routes have been assigned a level of maintenance needs, described below, to have the road to its designated maintenance level.

- **Low:** Work may consist of brushing roadside vegetation, falling danger trees, grading the roadbed, cleaning ditches and culvert inlets and outlets, and removing slough and slide material. These standard maintenance activities occur on all roads when commercial activity occurs or on a rotating basis determined by use and need.
- **Moderate:** Includes work described above with the addition of placing aggregate surfacing, installing turnouts, and replacing culverts.
- **High:** All the above mentioned work items could be included with the addition of repairing major road failures in riparian areas and road realignments.

Table 44 displays a summary of miles of maintenance needs for alternatives B and C.

Table 44. Maintenance summary (miles)

Haul Routes	Low	Moderate	High
David Canyon			
Raven Road	–	–	–
Trail No. 05530 coincident with NFS Road 530	2.0	–	–
NFS Road 335	4.0	–	–
NFS Road 106	2.0	–	–
Trail No. 05106 coincident with NFS Road 106	1.0		
North Manzano			
NFS Road 55	2	–	–
NFS Road 321	–	8	–
NFS Road 260	–	3	–
NFS Road 321D3	–	1	–
NFS Road 321D1A	–	2	–
NFS Road 321D1	–	2	–
NFS Road 321E	–	2	–
NFS Road 321D2	–	1	–
NFS Road 321D2A	–	1	–

Haul Routes	Low	Moderate	High
NFS Road 321E	–	.2	–
NFS Road 260A	–	1	–
NFS Road 260A1	–	0.5	–
Unauthorized	–	–	11
Total	**11**	**21.7**	**11**

There are approximately 44 miles of existing road within the project area. In total, 11 miles of road would require low maintenance and 21.7 miles would need to be upgraded to a moderate standard. Unauthorized roads would require high maintenance before used to access timber stands for thinning.

Costs for Roadwork

Table 45 below is a summary of transportation costs for all road maintenance. The cost for low maintenance is estimated at $1,000 per mile, moderate at $3,000 per mile, and $5,000 per mile for high maintenance.

Table 45. Transportation cost summary

Maintenance/Reconstruction Levels	Total Miles	Maintenance Costs per Mile	Total Amount
Low	11	$1,000	$ 11,000
Moderate	21.7	$3,000	$ 65,100
High	11	$5,000	$ 55,000
Total			**$131,100**

Summary

Haul route access to David Canyon has shown to be only appropriate for firewood and not commercial vehicles because of existing road conditions on NFS Roads 530, 335, and 106. These routes would need to be upgraded to a low reconstruction level to accommodate commercial vehicles providing safety to all users of the roads. Present conditions are only suitable for high-clearance, four-wheel drive vehicles during dry conditions. Access roads have to be closed during wet conditions to prevent further damage to the existing road structure and or resource damage.

North Manzano haul route access has shown to be only appropriate for firewood and not commercial vehicles because of existing road conditions on NFS Roads 321 and 260. NFS Road 321 from NFS Road 55 to NFS Road 260 has presently shown to be passable by high-clearance, four-wheel drive vehicles, but possible to commercial vehicles once the road has been upgraded to a moderate standard, including turnouts for this section of road to accommodate all users. Existing conditions would not allow for both logging trucks and public traffic due to poor sight distances, inadequate surfacing, failing drainage features, and improper turnouts.

NFS Road 321 from NFS Road 260 to New Mexico Highway 55 is not recommended for commercial vehicles but rather high-clearance, four-wheel drive vehicles due to the severity of the existing road conditions and numerous grade dips in place to prevent resource damage on this section of roadway. NFS Road 260 from NFS Road 321 to the north area of the project site is

only suitable for high-clearance, four-wheel drive vehicles with a native surface and a moderate standard required for road maintenance/reconstruction. NFS Roads 260 and 321 may have to be closed during wet conditions to prevent further damage to the existing road structure and/or resource damage.

At the conclusion of this project, all unauthorized roads and other mechanized travel ways within the Northern Manzano Division to be used for haul routes will be maintained, closed, decommissioned, or obliterated.

Transportation Environmental Consequences

Alternative A

Alternate A is the "no action alternative." Under this alternative, this project would not be implemented. There would be no changes in the use or maintenance of the transportation system. The opportunity to use commercial activities to accomplish road maintenance and decommissioning of unauthorized routes would be foregone.

Alternatives B and C

The transportation system used for this project would include NFS roads, trails, and unauthorized roads. There would be no new construction of roads, temporary roads, or any reconstruction under these alternatives. The following are potential environmental consequences for the transportation system.

- Overhead brushing will occur where needed.
- Roads will be closed during wet conditions to prevent damage to the existing road structure and to prevent erosion or sediment displacement.
- All routes will require standard Forest Service road maintenance to prevent further resource damage and to ensure safety for users and the public.

Approximately 11 miles of unauthorized roads located between NFS Road 321 and NFS Road 260 would be maintained, closed, decommissioned, or obliterated. Where forest products are removed using commercial methods, the contracts or permits would provide a means to fund all or a portion of the needed road maintenance and treatment of unauthorized roads.

Socioeconomic Resources

Pueblo and Chilili Affected Environment

Limited data are available to describe the Pueblo's and Chilili's social and economic characteristics; hence, Federal data collection efforts are presented here, most importantly, the decennial census and the American Community Survey (ACS). The ACS now includes 607 American Indian areas, Alaska Native areas, and Hawaiian homelands. The Pueblo is one of the select areas included in the ACS. The 2005–2009 multiyear estimates upon which the descriptive statistics that appear here are based were collected over a 60-month period.

The permanent population of the Pueblo, as estimated by the U.S. Census Bureau (2000), is 3,166 with a median age of the residents at 31.1 years. The Pueblo's median household income in the past 12 months (in 2009 inflation adjusted dollars) was estimated to be $40,242. While estimates

of the unemployment rate are not available for people who reside in the Pueblo, 75.9 percent of households in the Pueblo had income from salaries or wages, 12.7 percent had self-employment income, 24.3 percent had Social Security income, 5.9 percent had Supplemental Security Income, 18.7 percent had retirement income, 9.7 percent had income from interest, dividends, or net rental, and 15.3 percent had some other type of income. The median value of owner occupied residences is $81,200, which is lower than the New Mexico median of $108,100. Most of the Pueblo's population is of one race alone; 87.8 percent are American Indian or Alaska Native and 8 percent are white. The remainder of the population is some race other than American Indian/Alaska Native or white or of two or more races. Of the population 25 years and over, 38 percent are high school graduates or have completed the General Educational Development (GED) Program or alternative, 23.7 percent have completed some college (no degree), 9.4 percent have an associate's degree, 11 percent have a bachelor's degree, 4.2 percent have a master's degree, and 1.7 percent have a professional school degree.

The permanent population of Chilili is 133 and the median age is 27.8 (U.S. Census Bureau 2000). The median household income in 1999 was $43,571, which is greater than the New Mexico median of $41,509. Approximately 29 percent of Chilili residents live below the poverty level (U.S. Census Bureau 2000).

Any differences in data presented reflect different sources of information used by the separate agencies.

Cibola NF&Gs Affected Environment

Environmental Justice

Executive Order 12898 (Office of the President 1994) directs Federal agencies to focus attention on the human health and environmental conditions in minority[1] and low income communities[2]. The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects[3] on minority and low income populations.

Environmental justice means that, to the extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment.

---

[1] Minority means a person who is a member of the following population groups: American Indian or Alaska Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (USDA DR5600-002, 1997).

[2] Low income population means any readily identifiable group of low income persons who live in geographic proximity to, and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities. Low income populations may be identified using data collected, maintained, and analyzed by an agency or from analytical tools such as the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty (USDA DR5600-002, 1997).

[3] Human health and/or environmental effects as used in this Departmental Regulation include interrelated social and economic effects (USDA DR5600-002, 1997).

Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agency decision makers to identify impacts that are disproportionately high and adverse with respect to minority and low income populations[4] and identify alternatives that would avoid or mitigate those impacts.

The emphasis of environmental justice is on health effects and/or the benefits of a healthy environment. The Council on Environmental Quality (CEQ) has interpreted health effects with a broad definition: "Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low income communities or Indian Tribes…when those impacts are interrelated to impacts on the natural or physical environment" (CEQ 1997).

Table 46 reports the ethnic distributions within Bernalillo and Torrance Counties, the State of New Mexico, and the United States. Both counties have a higher proportion of Hispanic and American Indian residents than the United States. Due to the high proportion of Hispanic and American Indian residents in the study area, it has been determined that these ethnic groups meet the environmental justice requirements of a minority population meaningfully greater than the general population (the general population referenced is the population of the Nation). Therefore, decision makers should pay careful attention to potential impacts of management actions on those ethnic groups.

Table 46. Ethnicity by county, state, and nation, 2010

Area	Total Population	White	Black	American Indian/ Alaska Native	Asian	Hawaiian/ Other Pacific Islander	Two or More Races	Hispanic or Latino	White, not Hispanic
Bernalillo County	662,564	69.4%	3.0%	4.8%	2.3%	0.1%	4.4%	47.9%	40.5%
Torrance County	16,383	76.1%	1.3%	2.3%	0.4%	0.0%	4.3%	39.1%	56.0%
New Mexico	2,059,179	68.4%	2.1%	9.4%	1.4%	0.1%	4.3%	46.3%	40.5%
United States	308,745,538	72.4%	12.6%	0.9%	4.8%	0.2%	2.9%	16.3%	63.7%

Source: U.S. Census Bureau, State and County Quick Facts, 2010 accessed 10/20/2011

Table 47 reports the number of individuals below the poverty level and poverty rates in 2000 and 2009. Poverty rates in Bernalillo and Torrance Counties, the State, and the Nation increased from 2000 to 2009. In 2009, Torrance County had the highest poverty rate at 24.5 percent and Bernalillo County was lower at 15.6 percent. Both counties and the State had poverty rates higher than the national average. Such rates suggest that a substantial proportion of the existing population should be considered as a low income group. Therefore, decisions regarding future management actions on the Cibola NF&Gs should carefully assess the effects on low income populations.

[4] Minority populations/communities means any readily identifiable group of minority persons who live in geographic proximity to and, if circumstances warrant, migrant farm workers and other geographically dispersed/transient persons who will be similarly affected by USDA programs or activities (USDA DR5600-002, 1997).

Table 47. Poverty status by county, state, and nation, 2000 and 2009

Area	2000		2009	
	Number	Percent	Number	Percent
Bernalillo County	71,582	13.0%	98,583	15.6%
Torrance County	3,639	22.5%	3,889	24.5%
New Mexico	309,103	17.3%	359,030	18.2%
United States	31,581,086	11.3%	42,868,163	14.3%

Source: U.S. Census Bureau, Small Area Income and Poverty Estimates 2009, accessed 10/20/2011

In cases where management decisions are expected to create jobs and income in the local economy, it is unlikely that there would be a disproportionate adverse effect on minority and low income populations. Individuals in those populations may benefit from any increase in jobs and income in the area. Alternatively, future management decisions that may negatively affect local employment and income conditions should carefully assess the distribution of effects across population demographics, paying careful attention to Hispanic, American Indian, and low income populations.

Demographic Conditions and Trends

It is useful to understand the components of population change because it offers insight into the causes of growth or decline. For example, if a large portion of population growth is from in-migration, it would be helpful to understand the drivers behind the trend, whether people are moving into the area for jobs, quality of life, or both. If a large portion of population decline is from out-migration, it is similarly important to understand the reasons, including the loss of employment in specific industries, or youth leaving for education or employment opportunities. Table 48 shows the population change from 2000 to 2009 for the aggregated reporting area (Bernalillo and Torrance Counties).

Bernalillo County is highly urbanized and contains the city of Albuquerque. Torrance County, although immediately adjacent, has a more rural character and low population. It is useful to consider the counties individually and compare them with Albuquerque and the State (table 49).

Table 48. Components of population change for the aggregated reporting area, 2000–2009

Metric	2000	2009	Change 2000–2009	Percent Change
Population	574,097	659,002	84,905	15%
Natural Change	–	–	42,500	72%
Net Migration	–	–	47,200	28%

Source: Headwaters Economic Profile System, accessed 10/22/2011

Table 49. Population change, Bernalillo and Torrance Counties and the State, 2000–2010

Area	2000	2010	Change 2000–2010	Percent Change
Bernalillo County	556,678	662,564	105,886	19.0%
Torrance County	16,911	16,383	-528	-3.1%
City of Albuquerque	448,607	545,852	95,245	21.7%
New Mexico	1,819,046	2,059,179	240,133	13.2%

Source: U.S. Census Bureau, State and County Quick Facts, accessed 10/20/2011

Within Torrance County, the affected area includes the small Spanish land grant communities of Manzano, Torreon, and Tajique. The town of Chilili, also a Spanish land grant community is situated within Bernalillo County, and Isleta Pueblo (land grant) and Indian Reservation falls within both counties. Seemingly remote, these communities are located east of the Manzano and Manzanita Mountains but are immediately adjacent to the Albuquerque metro area. Mean travel time to work indicates that many of these residents are commuting to Albuquerque for work. Demographic statistics for small communities are frequently incomplete or unavailable. Population statistics for 2010 are not yet available for Manzano, Torreon, Tajique, or Chilili, nor is the commute time for Isleta Pueblo. Table 50 shows the population trends for these communities.

Table 50. Population trends for land grant communities

Area	2000	2005–2009 (estimate)*	2010	Mean Travel Time to Work (minutes)
Manzano	54	17	–	35
Torreon	244	269	–	50
Tajique	148	142	–	91
Chilili	113	147	–	44
Isleta Pueblo	2,201	2,789	2,489	–

Source: U.S. Census Bureau, American Fact Finder, accessed 10/20/2011
* 2005–2009 American Community Survey 5-Year Estimates.

Economic Conditions and Trends

Torrance and Bernalillo Counties have experienced a 39.2 percent increase in nonlabor income between 2000 and 2009. An aging population, stock market and investment growth, and a highly mobile population are some of the reasons behind rapid growth in nonlabor income. The growth in nonlabor income can be an indication that a place is an attractive place to live and retire. The in-migration of people who bring investment and retirement income with them is associated with a high quality of life, good health care facilities, and affordable housing. Because of these factors and the good climate, many U.S. Air Force personnel return and retire in the area.

Public land resources are one of the reasons the area is able to attract and retain nonlabor sources of income and are important to local economic well-being by contributing to economic growth and per capita income.

Table 51. Components of personal income change, 2000–2009 for the aggregated counties (Bernalillo and Torrance)

Component	2000	2009	Change 2000–2009	Percent Change 2000–2009
Total personal income	19,963,389	24,532,932	4,569,544	22.0%
Labor earnings	13,719,505	2,119,192	2,119,192	15.4%
Nonlabor income	6,243,884	8,694,235	2,450,351	39.2%
Dividends, interest, and rent	3,762,619	4,161,310	398,692	10.6%
Transfer payments	2,481,265	4,532,924	2,051,660	82.7%

Source: Headwaters Economic Profile System, accessed 10/22/2011
Values are in 2010 U.S. dollars.

Table 52 below lists the total number of jobs in the aggregated study area by industry. Government supports the largest percentage of jobs in the two counties and consists of Federal, military, State, and local government employment and government enterprise with a 12.3 percent increase in employment between 2001 and 2009.

The second largest industry is health care and social assistance, followed by retail trade; both of these are service related industries. Forestry, fishing, and related activities are a nonservice related industry with relatively low total employment, 353 jobs in 2009. However, this industry experienced a 50.2 percent increase in total employment during the reporting period.

Table 52. Employment by industry 2001–2009 for the aggregated counties (Bernalillo and Torrance)

Industry	2001	2009	Change 2001–2009	Percent Change 2001–2009
Total employment (number of jobs)	397,487	427,743	30,256	7.6
Nonservice related	**50,027**	**46,159**	**-3,868**	**-7.7**
Farm	1,575	1,248	-327	-20.8
Forestry, fishing, and related activities	235	353	118	50.2
Mining (including fossil fuels)	756	1,842	1,086	143.6
Construction	26,577	27,638	1,061	4.0
Manufacturing	20,884	15,078	-5,806	-27.8
Services related	**280,162**	**305,996**	**25,834**	**9.2**
Utilities	740	800	60	8.1
Wholesale trade	15,027	13,224	-1,803	-12.0
Retail trade	44,922	44,072	-850	-1.9
Transportation and warehousing	9,742	8,891	-851	-8.7
Information	11,287	9,972	-1,315	-11.7
Finance and insurance	17,158	17,941	783	4.6
Real estate and rental and leasing	13,213	19,083	5,870	44.4
Professional and technical services	35,688	41,951	6,264	17.6
Management of companies and enterprises	4,561	3,387	-1,174	-25.7
Administrative and waste services	30,890	31,108	219	0.7
Educational services	5,542	8,190	2,648	47.8
Healthcare and social assistance	36,499	47,679	11,180	30.6
Arts, entertainment, and recreation	7,058	8,913	1,855	26.3
Accommodation and food services	30,220	31,190	970	3.2
Other services, except public administration	17,615	19,594	1,979	11.2
Government	**67,045**	**75,302**	**8,257**	**12.3**

Source: Headwaters Economic Profile System, accessed 10/22/2011

Methodology

TREAT is a modeling tool used to assist in the development of economic impacts. It uses a Microsoft Excel workbook as the interface between user inputs and data from existing IMPLAN models. The individual worksheets contain the formulas that drive the model. TREAT was designed to streamline data entry and preparation for the generation of economic impact tables to be used in CFRP proposals. The goal for this tool is to assist teams in estimating the economic impacts of restoration activities while providing a standard approach at the proposal stage.

Economic impact analysis investigates the effects of restoration activities on employment and income levels. The relative size of the economy plays an important role in the estimate of impacts on jobs and income. The reported impacts would occur within the specified region. Economic models were built using IMPLAN software. IMPLAN is an input-output model that tracks the activity within an economy. A change in economic stimulus ripples through the economy and can affect employment and income levels in a variety of sectors. For example, an increase in the level of timber harvesting allowed in a region will likely require logging companies to hire more labor to perform the additional work associated with the increased extraction levels. Such impacts to industries occurring from a change in local production are referred to as **direct effects**. In other words, these are the impacts (i.e. change in employment) resulting from the changes in expenditures and/or production values caused by a policy to increase the timber harvested in the region.

In addition to hiring more labor, industries must meet technical requirements by purchasing more equipment, supplies, and other inputs to production. Some of these purchases will be made from other local industries; for example, additional fuel purchased by the logging companies at local gas stations increases the output in the oil and gas industry. Such impacts are called the **indirect effects**. Thus, the indirect effects are the changes in inter-industry purchases as they respond to the new demands of the directly affected industries. Another type of indirect effect is referred to as **induced effects**. Induced effects reflect changes in spending habits from individual households as income increases or decreases due to changes in production. For example, an increase in employment in the agriculture, forestry, fishing, and hunting sector will be filled by unemployed individuals in the region and/or the in-migration of new households. The increased income to those individuals will stimulate an increase in their demand for goods and services within the local area, which in turn could cause local companies to respond by increasing employment and output.

The jobs and labor income are average annual effects and are assumed to last the life of the project. The Isleta CFRP would create 18 total jobs and generate $628,067 over the life of the project, contingent of CFRP funding.

Table 53. TREAT summary table, average annual impacts

Impacts	Employment (Number of Part and Full-time Jobs)	Labor Income
Commercial forest projects	12.1	$476,636
Other project activities	2.1	$68,640
USFS implementation and monitoring	3.7	$82,790
Total project impacts	17.9	$628,067

Source: TREAT, Cibola Forestry, October, 2011.
Note: Employment includes full, part-time, and temporary jobs.
Labor Income is the value of wages and benefits plus proprietor's income.
Other Project Activities: Ecosystem restoration, etc., are labor intensive and will produce higher employment impacts relative to commercial harvest activities, which are highly mechanized and are not as labor intensive.
Values are in 2010 U.S. dollars.

Environmental Consequences

Alternative A (No Action)

The no action alternative would result in no change to the socioeconomic conditions of the local communities, including the Pueblo and Chilili. Tribal members and Chilili residents would not have access to temporary seasonal jobs associated with the forestry project. They would also not be provided with firewood to heat their homes. For the Cibola NF&Gs, the no action alternative would result in no change to the affected environment as described above.

Alternative B (Proposed Action) and Alternative C

Implementation of the forest landscape treatments would contribute to the Pueblo's economic well-being by creating jobs and meeting tribal member demand for forest products such as firewood. Full-time employment for the tribe's 10-person fire/fuels crew and part-time employment for up to 10 seasonal crew members is projected in the completion of landscape treatments on reservation lands and in contracting these crew resources to complete treatments on the Cibola NF&Gs and on Chilili land. The fire/fuels crew is trained and able to work in a broad range of forest management activities, including timber falling, wildfire suppression, pile burning, lopping and scattering, forest stand exams, and forest equipment operation. Full-time employment is also created for a fleet manager and heavy equipment operator to maintain and repair vehicles, machinery, chain saws, hand tools, etc., and to operate heavy equipment used in forest treatments.

The Pueblo relies on its trust relationship with the BIA for specialized forest management services including forest inventories and surveys, prescribed burning, and forest insect and disease detection/treatments. The Pueblo depends on its own public works department for road maintenance and assistance with erosion control.

The proposed action would result in short-term beneficial impacts to the socioeconomics of Chilili residents by meeting land grant member demand for forest products such as firewood. In addition, the proposed project would be eligible to compete for CFRP grant funds. If awarded, both the Pueblo and Chilili would receive up to $360,000 to implement the proposed action. With these funds, both entities would be able to build internal capacity for future forest restoration projects. This capacity building would result in long-term socioeconomic benefits.

For the Cibola NF&Gs, the proposed action would not result in demographic changes, such as displacement of minorities, geographic changes in land use, or economic hardship such as an increase in taxes. The proposed action would provide a short-term employment opportunity for both tribal and land grant members. Wood product permits on USFS lands would be offered without prejudice toward any particular group, under Federal laws, regulations, and policies.

Cultural Resources

Federal regulations require that the Pueblo, Chilili, and USFS, in compliance with Section 106 of the National Historic Preservation Act, consider the effects of the proposed project on historic properties that are included in, or are eligible for inclusion in, the National Register of Historic Properties (NRHP).

Pueblo and Chilili Affected Environment

SWCA completed a pedestrian survey of 49-foot transects within the proposed project area between May 17 and June 23, 2010.

Over the course of this extensive archaeological survey, 13 previously unidentified prehistoric and historic period archaeological sites were discovered, 3 previously identified archaeological sites were reexamined, and 184 isolated occurrences were encountered. Seven of the newly recorded sites contained prehistoric assemblages, three sites contained both prehistoric and historic assemblages, two sites contained historic assemblages, and one site contained an assemblage of unknown origin. Of these sites, five are recommended eligible for the NRHP, and eight are recommended not eligible. All three previously recorded sites are recommended not eligible to the NRHP.

In the case of all five sites recommended eligible to the NRHP, it is recommended that the Pueblo establish a 656-foot buffer around each of the site boundaries to avoid direct contact or indirect damage from the prescribed burning activities. The direct effects from the fire would directly damage the historic and archaeological integrity of the site area and the archaeological contents found within. The indirect effects from the burning activities may also severely damage the future potential for archaeological chromomeric dating and/or increase or further bury in-situ artifacts by topographic erosion. If these sites cannot be avoided, then it is recommended that archaeologists perform additional surface and subsurface testing to further investigate the scope and breadth of cultural properties present within the site boundaries. If previously unknown archaeological resources are uncovered during construction, it is recommended that work in that area should be halted and the New Mexico Historic Preservation Division should be notified.

Cibola NF&Gs Affected Environment

A detailed report of cultural resources can be found in appendix C. The archaeological resources located in the area are diverse and reflect the long-term use of the Manzano and Manzanita Mountains from prehistoric times to the early 19th century. The prehistoric sites reflect the lifeways of Archaic and Pueblo peoples, while the historic sites exhibit the periodic and long-term occupation of the region by mobile native groups (Athabascan), homesteaders, miners, loggers, and ranchers. These cultural resources include surface artifact scatters, intact features, and subsurface (potential or identified) cultural deposits that require management during the proposed project.

Environmental Consequences

Alternative A (No Action) – All Jurisdictions

There would be no effect to cultural resources as a result of the no action alternative.

Alternative B (Proposed Action) – All Jurisdictions

Project activities include thinning and/or burning of trees in specific project areas. Thinning activities include mastication, firewood collection, and commercial thinning, while burning activities include pile and broadcast burning. All sites located in all project areas have been flagged and would be avoided during project activities. In the case of broadcast burning, sites would be flagged and fire control lines would be cut on the outside of site perimeters. If pile burning is selected, the material would be piled away from sites.

Alternative C (Cibola NF&Gs Lands)

Project activities include thinning and/or burning of trees in specific project areas. Thinning activities include mastication, firewood collection, and commercial thinning, while burning activities include pile and broadcast burning.

There are a total of 16 eligible and/or not determined sites (13 previously recorded, 3 newly recorded) in the project area. All 16 sites located in all project areas would be flagged and avoided during project activities. In the case of broadcast burning, sites would be flagged and fire control lines would be cut on the outside of site perimeters. If pile burning is selected, the material would be piled away from sites.

Findings

There would be no effect to cultural resources as a result of implementing alternative B or alternative C.

Recreation Resources

Pueblo and Chilili Affected Environment

Recreational opportunities throughout the project area vary by jurisdiction. The Pueblo portion of the project area is open to all tribal members for recreational and traditional activities, including hunting and wood gathering, but is closed to the public. The Chilili portion of the project area is open to land grant members only. All areas are accessible by road but there are minimal formal trails. All jurisdictions wish to keep access to users limited to protect the natural resources in the project area; therefore, road enhancements would be minimal.

Cibola NF&Gs Affected Environment

David Canyon Division

The trail system within the David Canyon analysis area is composed primarily of Forest Service class III trails in addition to Forest Service roads (discussed in the transportation report) that are utilized by trail users and, in some cases, are coincidentally designated as motorized trails (motorcycle) on the district motor vehicle use map. The trails within the project area are defined as either NFS trails or unauthorized trails.

There are approximately 6.12 miles of NFS trails, 7.45 miles of NFS roads with coincident motorized (motorcycle) designation, and 3.5 miles of unauthorized trails within David Canyon.

Recreational use of trails and roads within David Canyon ranges from low to medium use depending on season and day of the week (based on personal observation). Primary use occurs from April to early November primarily on weekday afternoons/evenings and weekend days. Users include hikers, mountain bikers, OHV users (motorcycle), and equestrians.

Trails 05048, 05049, 05161, 05162, and 05238 are regularly maintained, are in good condition, and incorporate many design features to minimize or eliminate erosion problems. Features include maximum average grade, undulation and proper treadway clearing, and brush removal.

Coincident motorized routes with NFS roads, their condition and maintenance are covered in the transportation report.

The West Boundary Trail (unauthorized trail) is not regularly maintained but often traveled by a variety of users. It is anticipated that inclusion into the district trail system will occur during or following completion of this project.

Other unauthorized trails may exist within the project area but are not documented.

Northern Manzano Division

Because of this area's distance from Albuquerque and amenities such as restaurants, hotels, and shopping, most of those who recreate in this area are local residents.

The interior of the project area is accessed by level 2 maintenance roads (2-track, native material) and unauthorized and decommissioned roads. There are no developed trails for hiking, horseback riding, or OHV use, and there are no campgrounds, picnic areas, or other developed recreation sites. The majority of recreation use includes hunting, OHV use, horseback riding, and dispersed camping (usually in conjunction with hunting and OHV use). Driving for pleasure is a year-round activity (road conditions permitting) on NFSR 55 along its loop between Torreon and Tajique, especially when the Rocky Mountain maples change to their fall colors for a few weeks in late September and early October. During this time, hundreds of vehicles per day drive between Tajique and 4th of July Campground to view the leaves.

The southern boundary of the project area is National Forest System Road (NFSR) 55 in Cañon de Tajique (4th of July Canyon). Along the full length of this road are developed recreation sites, trailheads for hiking and horseback riding, a private camp facility, and private residences. The road is used for traffic to these improvements.

Pueblo and Chilili Environmental Consequences

Alternative A (No Action)

Under alternative A, there would be little perceived change to current recreational use. In the event of an uncharacteristic wildfire, there is potential that current users may be displaced due to damage to natural and scenic resources. Existing roads may need to be closed for resource protection and game species may be temporarily displaced, impacting those pursuing hunting opportunities.

Alternative B (Proposed Action)

Under alternative B, there could be some short-term impact to recreational users. Roads and trails may need to be closed to ensure public safety during periods of mechanized thinning and prescribed burning, and some areas may be temporarily closed for resource protection following treatment. Users on adjacent areas may be impacted by the sound of chain saws and other equipment during the extent of the project. Following project completion, recreational use is expected to return to normal. Hunting activities may be enhanced by the proposed treatment as understory forage utilized by game species is increased and areas are opened up, improving wildlife viewing from roads and trails.

Cibola NF&Gs Environmental Consequences

Alternative A (No Action) – Combined for David Canyon and North Manzano Divisions

No action will result in little perceived change. No immediate impact on recreational visitors would be noticed. Catastrophic wildfire is a greater risk in the no action alternative. A wildland fire in the area would displace users, possibly for many years.

Alternatives B and C

David Canyon Division

Temporary closures of roads or trails (system and user/nonsystem) to recreation use are planned, displacing individuals for the duration of the closure. Some recreation visitors will shift their use to trail and recreation site locations outside the project boundary. It is anticipated that users will begin using the trails again once closures have ended.

Once reopened, the reduction in vegetative cover may result in increased tread width and establishment of additional user trails.

Residents on adjacent lands are likely to hear chain saws and may observe noise, dust, and smoke during project treatments. This could be a concern to area residences.

Direct effects include: Temporary closure of roads or trails to recreation use. Elimination of unofficial trails from resulting slash debris.

Indirect effects include displacement of recreational visitors because of noise, dust, slash, and other harvest related effects in the vicinity of recreation sites and trails. Short-term reduction in visitation may also result from publicity through local and regional media about project area issues and actions. Some recreational visitors will shift their use to trail and recreation site locations outside the project boundary. Increased tread width and additional user trails are possible.

Northern Manzano Division

Most of these effects would be sporadic or short lived, such as traffic, smoke, and noise. Other effects such as thinned and cleared areas would be maintained over time to retain the desired characteristics of the stands.

Effects **in the interior** of the project area would include:

- Sounds of vehicles and equipment operating in specific areas under treatment.
- Possible increase in OHV traffic and user conflicts while project area roads are improved and opened.
- Possible difficulty in passing when vehicles meet on 2-track roads.
- Sights of the operation, including skid trails, machinery, and slash.
- Smoke from prescribed fires.
- Some roads would be closed temporarily to public use during operations for safety.
- Open viewsheds which could enhance visual enjoyment and hunting success.

Effects **along NFSR 55** would include:

- Those accessing Tajique Campground and private residences could encounter traffic from this project along NFSR 55 between Tajique and their respective turnoffs.
- Those driving further west and south of the project area along NFSR 55 to access Fourth of July Campground, the Albuquerque, Cerro Blanco, and Bosque trailhead parking areas, and Inlow Baptist Camp and Convention Center (private) could encounter traffic from this project along NFSR 55 between Tajique and NFSR 321.
- Those driving the road for pleasure could encounter traffic entering and exiting the project area via NFSR 55.
- There would be an increase in noise and dust from the increased traffic.

Cumulative effects include continued relatively low levels of persons hunting, driving for pleasure, camping, and horseback riding due to the decreasing populations of the communities between Chilili Land Grant and the town of Mountainair, as well as the distance to the Albuquerque Metro area.

The use of OHV vehicles can be expected to increase slightly due to their increasing popularity.

With implementation of the Travel Management Rule, roads and routes used for this project in the Northern Manzano Mountain Division would be designated for motorized use or restricted to administrative use only. OHV opportunities would decrease in sensitive areas and cross country, but use could increase overall in designated areas as opportunities are made known.

Cibola NF&Gs Cumulative Effects

David Canyon Division

Cumulative effects include a change in the overall experience for trail users within the project area. For some it will be positive, for some it will be negative. The biggest challenge is likely to be holding the trail width to design standard(s) and holding back user created trails.

Northern Manzano Division

No foreseeable changes in the amount of driving for pleasure, hunting, and horseback riding would occur through implementation of this project.

Indian Trust Assets

Indian Trust Assets (ITAs) are legal interests in property held in trust by the United States for Indian tribes or individuals. The Secretary of the Interior, acting as the trustee, holds many assets in trust. Examples of objects that may be trust assets are lands, minerals, hunting and fishing rights, and water rights. The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or individuals by treaties, statutes, and Executive Orders. These are sometimes further interpreted through court decisions and regulations.

Affected Environment

Because the proposed project analyzed in this EA is located on Pueblo reservation land, the resources within the project area are considered ITAs.

Environmental Consequences

Alternative A (No Action)

The no action alternative would not result in adverse impacts to ITAs. The fire threat within the project area would continue to increase due to reduced tree densities in the proposed project area. Density and canopy cover of all timber types would continue to increase throughout the project area. Existing small openings and forb/shrub/grassland areas would continue to decrease in size and woodland species would continue to encroach on open meadow grassland. In addition, traditional hunting areas could be adversely impacted because big game habitat, such as open meadows and clumpy forested areas, would be reduced.

Alternative B (Proposed Action)

The proposed action would result in beneficial impacts to ITAs. The forest conditions would improve as a result of the proposed forest treatments. Variables that tend to increase the risk of wildfire, such as tree density and interlocking tree canopies, would be reduced. In addition, the treatments would allow understory vegetation to become established, providing improved wildlife and big game habitat.

Chapter 4. Consultation and Coordination

The Pueblo, Chilili, and Cibola NF&Gs consulted the following individuals and Federal, State, and local agencies and tribes during development of this EA.

Federal, State, and Local Agencies

- Bureau of Indian Affairs - Southern Pueblo Agency
- Claunch-Pinto Soil and Water Conservation District
- Edgewood Soil and Water Conservation District
- Ciudad Soil and Water Conservation District
- New Mexico Wild Turkey Federation
- U.S. Department of Defense - Kirtland Air Force Base
- U.S. Department of Energy - Sandia National Labs
- New Mexico State Forestry Division

USFS Interdisciplinary Team Members

- Cid Morgan - Sandia District Ranger
- Karen Lessard - Mountainair District Ranger
- Paul Tidwell - Vegetation
- Matt Rau/Sunbear Vierra - Fire and Fuels Management
- Beverly deGruyter/Ramon Borrego/Zack Parsons - Wildlife
- Cynthia Benedict - Tribal Consultation and Cultural Resources
- Lucas C. Kellett/Christina Sinkovec/Cliff Nicoll - Heritage Resources
- Livia Crowley - Soil and Water Resources
- Tyler Albers - Scenic Resources
- Henry Martinez - Transportation
- Ian Fox - Forestry Program Manager

Tribes and Pueblos

- The Pueblos of Acoma, Zuni, Isleta, Sandia, Santo Domingo, Santa Ana, San Felipe, San Ildefonso, Cochiti, Zia, and Jemez
- Mescalero Apache Tribe
- Navajo Nation
- Jicarilla Apache Nation
- To’hajilee Navajo Chapter

Others

- Chilili Land Grant members
- New Mexico State University
- Sandia Mountain Natural History Center

List of Preparers

Brian J. Bader, Project Manager
SWCA Environmental Consultants
5647 Jefferson St. NE
Albuquerque, NM 87109
(505) 254-1115
bbader@swca.com

Coleman Burnett, Natural Resources Planner
SWCA Environmental Consultants
5647 Jefferson St. NE
Albuquerque, NM 87109
(505) 254-1115
cburnett@swca.com

Victoria Amato, Natural Resources Planner
SWCA Environmental Consultants
5647 Jefferson St. NE
Albuquerque, NM 87109
(505) 254-1115
vamato@swca.com

Matt Gagnon, Natural Resources Planner
SWCA Environmental Consultants
5647 Jefferson St. NE
Albuquerque, NM 87109
(505) 254-1115
mgagon@swca.com

Melani Oakley-Spangler, NEPA Specialist
SWCA Environmental Consultants
5647 Jefferson St. NE
Albuquerque, NM 87109
(505) 254-1115
spangler@swca.com

Literature Cited

Abella, Scott R., Charles W. Denton, David G. Brewer, Wayne A. Robbie, Rory W. Steinke, and W. Wallace Covington. 2010. *Using a Terrestrial Ecosystem Survey to Estimate the Historical Density of Ponderosa Pine Trees in Arizona.* Ecological Restoration Institute, Northern Arizona University, Flagstaff, AZ.

Abella, Scott R. 2008. *Managing Gambel Oak in southwestern Ponderosa Pine Forests: The Status of Our Knowledge.* USDA Forest Service, RMRS-GTR-218.

Agee, J. K. 1998. The landscape ecology of western forest fire regimes. *Northwest Science* 72:24–34.

Agee, J. K. 2003. Monitoring postfire tree mortality in mixed conifer forests of Crater Lake. Oregon. *Natural Areas Journal* 23:114–120.

Agency Technical Work Group. 2005. Potential Effects if Climate Change on New Mexico. Agency Technical Work Group, State of New Mexico. December 30, 2005.

Allen, C. D., M. Savage, D. Falk, K. F. Suckling, T. W. Swetnam, T. Schulke, P. B. Stacey, P. Morgan, M. Hoffman, and J. Klingel. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: a broad perspective. Ecological applications 12:1418-1433.

Arnold, J. F., D. A. Jameson, and E. H. Reid. 1964. The piñon-juniper type in Arizona. In *Effects of Grazing, Fire and Tree Control*. Washington, DC: U.S. Forest Service Production Research Report. 84 pp.

Arizona Game and Fish Department. 2004. Response to draft supplement to the final environmental impact statement for amendment of forest plans in Arizona and New Mexico. Phoenix, AZ, USA.

Baisan, C. H., Swetnam, T. W. 1997. Interaction of fire regimes and land use in the central Rio Grande valley. Research Paper RM-RP-330. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 20 pp.

Baisan, C. H., and T. W. Swetnam. 1995. Historical fire occurrence in remote mountains of southwestern New Mexico and northern Mexico. In: Brown, J. K., compiler. Proceedings: Symposium on fire in wilderness and park management. USDA Forest Service, General Technical Report INT-GTR-320. Ogden, UT: USDA, Forest Service, Intermountain Research Station: 153-156.

Baker, W. L., and D. J. Shinneman. 2004. Fire and restoration of piñon-juniper woodlands in the Western United States: a Review. Forest Ecology and Management. 189:1-21.

Bassett, R. L., D. A. Boyce, M. H. Reiser, R. T. Graham, and R. T. Reynolds. 1994. Influence of site quality and stand density on goshawks habitat in southwestern forests. Studies in Avian Biology 16: 41-45.

Beier, P., and J. E. Drennan. 1997. Forest structure and prey abundance in foraging areas of northern goshawks. Ecological Applications 7:564-571.

Biota Information System of New Mexico (BISON-M). 2010. BISON-M home page. Available at: http://www.bison-m.org. Accessed 29 April 2010.

Biswell, H. H. 1973. Fire ecology in ponderosa pine grassland. Proceeding of the Tall Timbers Fire Ecology Conference 12: 69-96.

Boerner, R. E., T. A. Waldrop and V. B. Shelburne. 2006. Wildfire mitigation strategies affect soil enzyme activity and soil carbon in loblolly pine (*Pinus taeda*) forests. Canadian Journal of Forest Research. Volume 36, Number 12.

Bosch, J. M., and J. D. Hewlett. 1982. *A Review of Catchment Experiments to Determine the Effect of Vegetation changes on Water Yield and Evapotranspiration.* Journal of Hydrology 55:3–23.

Boyce, D. A., R. T. Reynolds, and R. T. Graham. 2006. Goshawk status and management: what do we know, what have we done, and where are we going? Studies in Avian Biology No. 31:312–325.

Brockway, D. G., R. G. Gatewood and R. B. Paris. 2002. Restoring grassland savannas from degraded piñon-juniper woodlands: effects of mechanical overstory reduction and slash treatment alternatives. Journal of Environmental Management. 64. 179–197.

Brown, J. K. 1995. Fire regimes and their relevance to ecosystem management. Pages 171–178 In Proceedings of Society of American Foresters National Convention, Sept. 18–22, 1994, Anchorage, Alaska. Society of American Foresters, Washington, DC.

Brown, T. J., B. L. Hall and A. J. Westerling. 2004. The impact of twenty-first century climate change on wildland fire danger in the Western United States: An application perspective. Climatic Change 62:365-388.

Burgess, T. L. 1995. Desert grassland, mixed shrub savanna, shrub steppe, or semi-desert scrub? The dilemma of coexisting growth forms. In: The Desert Grassland. The University of Arizona Press, Tucson, AZ. pp. 31–67.

Cooper, C. F. 1960. Changes in vegetation, structure and growth of southwestern pine forests since white settlement. Ecological Monographs 30: 129–164.

Council on Environmental Quality. 1997. Environmental Justice, Guidance under the National Environmental Policy Act. 23 pp.

Costello, C. M; D. E. Jones; K. A. Green Hammond; R. M. Inman; K. H. Inman; B. C. Thompson; R. A. Deitner, and H. B. Quigley. 2001. A Study of Black Bear Ecology in New Mexico, with Models for Population Dynamics and Habitat Suitability. New Mexico Dept. of Game and Fish, Hornocker Wildlife Institute, Ecosystem Modeling, and New Mexico Cooperative Fish and Wildlife Research Unit. Federal Aid in Wildlife Restoration Project W-131-R. Available at: http://www.wildlife.state.nm.us/publications/documents/NMBearStudy.pdf

Covington, W. W. and M. M. Moore. 1994. Southwestern ponderosa forest structure: changes since Euro-American settlement. Journal of Forestry 92: (1) 39–47.

Covington, W. W., Fulé, P. Z., Moore, M. M., Hart, S. C., Kolb, T. E., Mast, J. N., Sackett, S. S. and Wagner, M. R. 1997. Restoring ecosystem health in ponderosa pine forests of the southwest. Journal of Forestry. 95. 23–29.

Cram, D., Baker, T., Boren, J. (2006) Wildland fire effects in silviculturally treated vs. untreated stands of New Mexico and Arizona. USDA Forest Service, Rocky Mountain Research Station, Research Paper RMRS-RP-55 (Fort Collins, CO).

Dietrich, J. H. & T. W. Swetnam, 1984. Dendrochronology of a fire-scarred ponderosa pine. Forest Science, 30: 238–247.

Dore, S., T. E. Kolb, M. Montes-Helu, S. E. Eckert, B. W. Sullivan, B. A. Hungate, J. P. Kaye, S. C. Hart, G. W. Koch, and A. Finkral. 2010. *Carbon and water fluxes from ponderosa pine forest disturbed by wildfire and thinning.* Ecological Applications, 20(3), pp. 663–683.

Famweb, 2010. Accessed November 26th 2010. http://fam.nwcg.gov/fam-web/weatherfirecd/new_mexico.htm#Fire%20Occurrence%20Files

Findley, James S. 1987. The Natural History of New Mexican Mammals. University of New Mexico Press. Albuquerque, NM. 164 pp.

Finney, M. A. (2001a) Design of regular landscape fuel treatment patterns for modifying fire growth and behavior. Forest Science 47, 219–228.

Fulé, P. Z., Crouse, J. E., Heinlein, T. A., Moore, M. M., Covington, W. W., Verkamp, G., 2003. Mixed-severity fire regime in a high-elevation forest: Grand Canyon, Arizona. Landscape Ecology 18, 465–486.

Elliot, W. J, and Audin, L. J. (editors). 2007, last update. DRAFT Cumulative Watershed Effects of Fuels Management in the Western United States. Available online: http//forest.moscosfsl.wsu.edu/engr/cwe/ accessed October 1, 2009.

Environmental Protection Association. 2010. Available online: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/resource.cfm. Accessed March 3rd 2010.

Ernest, Krintina A., Earl F. Aldon, and Esteban Muldavin. 1993. *Woody Debris in Undisturbed Pinon-Juniper Woodlands of New Mexico*. In: Managing Piñon-Juniper Ecosystems for Sustainability and Social Needs, proceedings of the symposium 1993 April 26-30; Santa Fe, New Mexico. USDA GTR-RM-236, pp 117–123.

Ffolliott, Peter F., Cody L.Stropki, Hui chen, and Daniel G. Neary. 2011. *The 2002 Rodeo-Chediski Wildfire's impacts on southwestern ponderosa pine ecosystem, hydrology, and fuels.* USDA Forest Service, RMRS-RP-85, Fort Collins, Rocky Mountain Research Station, 36 pp.

Gatto, A. E., T. G. Grubb, and C. L. Chambers. 2005. Red-tailed hawk dietary overlap with northern goshawks on the Kaibab Plateau, Arizona. Journal of Raptor Research 39(4): 439–444.

General Accounting Office. 2007. Climate Change – Agencies should develop guidance for addressing the effects on federal lands and water resources. Report to Congressional Requesters. GAO-07-863.

Gottfried, G. 2004. Silvics and silviculture in the southwestern piñon-juniper woodlands. In: Silviculture in Special Places: Proceedings of the 2003 National Silviculture Workshop. W. D. Sheppard and L. G. Eskew (Eds.). U.S. Forest Service Proceedings RMRS-P-34. 64–79.

Gottfried, G. J. and S. T. Overby. 2009. Overstory, fuel loading, and soil nitrogen changes following mechanical mastication or thinning pinyon-juniper stands in southwestern Colorado. Association for Fire Ecology Congress: Savannah, GA. December.

Grant, Gordon E., Lewis, Sarah L., Swanson, Frederick J., Cissel, John H., McDonnell, Jeffrey J. 2008. *Effects of forest practices on peak flows and consequent channel response: a state-of-science report for western Oregon and Washington.* Gen. Tech. Rep. PNW-GTR-760. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 76 pp.

Greenwald, D. N., D. C. Crocker-Bedford, L. Broberg, K. F. Suckling, and T. Tibbitts. 2005. A review of northern goshawk habitat selection in the home range and implications for forest management in the western United States. Wildlife Society Bulletin 33(1):120-129.

Griffis, K. L., Crawford, J. A., Wagner, M. R., and Moir, W. H. 2001. Understory response to management treatments in northern Arizona ponderosa pine forests. Forest Ecology and Management. 146. 239-245.

Hann, W. J. Bunnell, D. L. 2001. Fire and Land Management Planning and Implementation across Multiple Scales. International Journal of Wildland Fire. 10 (4): 389-403.

Hann, W., D. Havline, A. Shlisky. 2003. Interagency Fire Regime and Condition Class Guidebook, Version 1.2. 2005. The Fire Regime Condition Class Web site. U.S. Forest Service, U.S. Department of the Interior, The Nature Conservancy, and Systems for Environmental Management. Available online at http://frames.nbii.gov/frcc/documents/1.2.2.2./Complete_Guidebook_V1.2.pdf. Accessed December 2010.

Hardy, C. C., Schmidt, K. M., Menakis, J. P. 2001. Spatial data for National Fire Planning and fuel management. International Journal of Wildland Fire. 10: 353-372.

Harvey, M. J., J. S. Altenbach, and T. L. Best. 1999. Bats of the United States. Arkansas Game and Fish Commission and Asheville Field Office (NC), U.S. Fish and Wildlife Service. 64 pp.

Headwaters Economic Profile System (2011). http://headwaterseconomics.org/headwaters/economic-profile-system/ accessed 10/22/2011.

Hunter, M. E., W. D. Shepperd, J. E. Lentile, J. E. Lundquist, M. G. Andreu, J. L. Butler, and F. W. Smith. 2007. A comprehensive guide to fuels treatment practices for ponderosa pine in the Black Hills, Colorado Front Range and Southwest. Gen. Tech. Rep. RMRS-GTR-198. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 93 pp.

Idaho Department of Fish and Game (IDFG). 1995. Habitat conservation assessment and conservation strategy for the Townsend's big-eared bat. Idaho State Conservation Effort (ISCE). Draft unpubl. Rep. No. 1; Idaho Dept. of Fish and Game, Boise, Idaho. 63 pp.

Kaye, Jason P. and Stephen C. Hart. 1998. *Ecological Restoration Alters Nitrogen Transformations in a Ponderosa Pine-Bunchgrass Ecosystem.* Ecological Applications, 8 (4), pp. 1052–1060.

Kaye, M. W. and T. W. Swetnam. 1999. An assessment of fire, climate and Apache history in the Sacramento Mountains, New Mexico. Physical Geography 20: (4) 305–330.

La Sorte, F. A., R. W. Mannan, R. T. Reynolds, and T. G. Grubb. 2004. Habitat associations of sympatric red-tailed hawks and northern goshawks on the Kaibab Plateau. Journal of Wildlife Management 68:307-317.

Leopold, A. 1924. Grass, brush, timber and fire in southern Arizona. Journal of Forestry. 22: 1-10.

Long, J. N., Smith, F. W., 2000. Restructuring the forest: goshawks and the restoration of southwestern ponderosa pine. Journal of Forestry 98, pp. 25–30.

Love, Timothy G. and Alan E. Watson. 1992. Effects of the Gates Park Fire on Recreation Choices. Research Note, INT-402. USDA Forest Service, Intermountain Research Station. Ogden, UT.

McMillan, N. J., McLemore, V. T., and Ervin, S. D., 2000, Cambrian tectonics of New Mexico and Colorado, in, Lawton, T. F., McMillan, N. J., and McLemore, V. T., 2000, Southwest Passage: A Trip through the Phanerozoic: New Mexico Geological Society Guidebook 51, pp. 37–39.

McPherson, G. R. 1995. The role of fire in desert grasslands. In: The Desert Grassland. The University of Arizona Press, Tucson, AZ. 130–151.

National Wildfire Coordinating Group. 1998. Fireline Handbook. NWCG Handbook 3. PMS 410-1. NFES 0065. National Interagency Fire Center, Boise, ID.

Neary, D. G., K. C. Ryan and L. F. Debano. 2005. Wildland Fire in Ecosystems- Effects of Fire on Soils and Water - Chapter 12 Summary and Research Needs. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-42-vol.4. pp. 207–212.

Neilson, R. 2004. Western Forests, Fire Risk and Climate Change. Science Update. USDA Forest Service, Pacific Northwest Research Station. Issue 6. 13 pp.

New Mexico Administrative Code. 1995. Natural Resources and Wildlife – Endangered Plants. New Mexico Administrative Code 19.21.2.

New Mexico Climate Center (NMCC). 2006. Climate of New Mexico. New Mexico State University, Las Cruces. Available online at http://weather.nmsu.edu/News/climate-in-NM.html

New Mexico Energy, Minerals and Natural Resources Department (2007). New Mexico Communities at Risk Assessment Plan. 46 pp.

New Mexico Environment Department (NMED). 2004. Water Quality Survey Summary for the Middle Rio Grande (From Angostura Diversion near Algodones to Isleta Diversion near Isleta Pueblo) 1999.

———. 2009. Water Quality Monitoring of the Middle Rio Grande. Annual Baseline Condition and Trends of Key Water Quality Parameters. October 2006–July 2008. Final Report. Surface Water Quality Bureau.

———. 2010. EPA Air Quality Nonattainment Areas in New Mexico. Available at: http://www.nmenv.state.nm.us/aqb/ modeling/na_map.html. Accessed November 17, 2010.

———. 2012. 2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated Report. Available at: http://www.nmenv.state.nm.us/swqb/303d-305b/2008-2010. Accessed January 2012.

New Mexico Department of Game and Fish. 2004a. Response to draft supplement to the final environmental impact statement for amendment of forest plans. Santa Fe, NM, USA.

———. 2004b. Winter Elk and Deer Sightability Index Survey Analysis. Federal Aid in Wildlife Restoration Grant W-93-R46, Projects 02.01 and 02.02, September 2004.

———. 2006. Threatened and Endangered Species of New Mexico 2006 Biennial Review. August 25, 2006. http://www.wildlife.state.nm.us/conservation/threatened_endangered_species/index.htm

———. 2010. Threatened and Endangered Species of New Mexico. 2010 Biennial Review.

New Mexico Partners in Flight. 2007. New Mexico Bird Conservation Plan Version 2.1. C. Rustay and S. Norris, compilers. Albuquerque, NM.

New Mexico Rare Plant Technical Council. 2010. Available at: http://nmrareplants.unm.edu/about.html. Accessed Dec 2010.

New Mexico State Listed Noxious Weed List. 2009. Available at: http://plants.usda.gov/java/noxious?rptType=State&statefips=35

Nowak, Ronald M. 1994. Walker's Bats of the World. John Hopkins University Pres. Baltimore, MD. 287 (218) pp.

Office of the President, 1994. Executive Order 12898 of February 11, 1994. Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations. Federal Register Vol 59. Number 32.

Ohlander, C. A. 1998. Water resources analyses, Clean Water Act—Monitoring and Evaluation, part 7 Stream Health (TWalk). Unpublished manuscript. Denver, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Region.

Omi, P. N. and E. J. Martinson. 2002. Effect of fuels treatment on wildfire severity. Final Report. Submitted to the Joint Fire Science Program Governing Board.

Omi, P. N. and E. J. Martinson. 2007. Tested by Fire: What happens when wildfires meet fuel treatments? Fire Science Brief- Joint Fire Science Program. 1. 1-6.

Orland, B., T. Daniel, J. L. Paschke and J. Hetherington. 1993. Visualization of Forest Management Issues on the Dixie National Forest. Final Report, May 1993. Forest Pest Management, Region 4, Ogden, UT.

Owen, Suzanne M., Carolyn Hull Sieg, Catherin A. Gehring, and Matthew A. Bowker. 2009. *Above and belowground responses to tree thinning depend on the treatment of tree debris.* Forest Ecology and Management, 259, pp. 71–80.

Page, Doug. 2006. Preliminary thinning guidelines for the maintenance of pinyon-juniper ecosytems. Bureau of Land Management Southwest Utah Zone Forester, Cedar City, UT.

Pearson, G. A. 1950. Management of ponderosa pine in the southwest. USDA Forest Service Agricultural Monograph No. 6.

Perkins, J. M., and T. Schommer. 1992. Survey protocol and an interim species conservation strategy for Plecotus townsendii in the Blue Mountains of Oregon and Washington. U.S. Dept. of Agriculture, Forest Service. Pacific Northwest Region, Wallowa Whitman National Forest, Baker City, OR. 23pp. Available: http://fishandgame.idaho.gov/cms/tech/cdc/cdc_pdf/U92PER01.pdf

Pollet, J. and Omi, P. N. 2000. Effect of Thinning and Prescribed Burning on Crown Fire Severity in Ponderosa Pine Forests. Pages 137-141, In: Proceedings, The Joint Fire Science Conference and Workshop, Grove Hotel, Boise, Idaho, June 15-17, 1999, Volume 2 of 2 volumes.

Pueblo of Isleta, 2005. Pueblo of Isleta Fire Management Plan.

Pyne, S. J., P. L. Andrews and R. D. Laven. 1996. Introduction to Wildland Fire. 2nd ed.

Reynolds, R. T., R. T. Graham, M. H. Reiser, R. L. Bassett, P. L. Kennedy, D. A. Boyce, G. Goodwin, R. Smith, and E. L. Fisher. 1992. Management recommendations for the Northern Goshawk in the Southwestern United States. General Technical Report RM-217, 90 pp. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO, USA.

Reynolds, R. T., S. M. Joy, and D. G. Leslie. 1994. Nest productivity, fidelity, and spacing of northern goshawks in Arizona. Studies in Avian Biology 16:106-113.

Reynolds, R. T., J. D. Wiens, and S. R. Salafsky. 2006. A review and evaluation of factors limiting northern goshawk populations. Studies in Avian Biology No. 31:260-273.

Reynolds, R. T., R. T. Graham, and D. A Boyce. 2006. An ecosystem-based conservation strategy for the northern goshawk. Studies in Avian Biology No. 31:299-311.

Reynolds, R. T., R. T. Graham, and D. A Boyce. 2008. Northern goshawk habitat: an intersection of science, management, and conservation. Journal of Wildlife Management 72(4):1047-1055.

Richardson, D. M. 1998. Ecology and biogeography of Pinus. Cambridge University Press, Cambridge. 527 pp.

Robson, S. G., and E. R. Banta. 1995. Groundwater Atlas of the United States–Arizona, Colorado, New Mexico, Utah: U.S. Geological Survey Hydrologic Atlas HA 730-C. Available at: http://pubs.usgs.gov/ha/ha730/ch_c/index.html. Assessed 30 April 2010.

Roccaforte, J. P., P. Z., Fulé and W. W. Covington. 2008. Landscape-scale changes in canopy fuels and potential fire behavior following ponderosa pine restoration treatments. International Journal of Wildland Fire. 2008. 17, 293-303.

Romme, W. H., C. D. Allen, J. Bailey, W. L. Baker, B. T. Bestelmeyer, P. Brown, K. Eisenhart, L. Floyd-Hanna, D. Huffman, B. F. Jacobs, R. Millerm, E. Muldavin, T. Swetnam, R. Tausch and P. Wesiberg. 2007. Historical and modern disturbance regimes of piñon-juniper vegetation in the Western U.S. Colorado Forest Restoration Institute and the Nature Conservancy. 13 pp.

Rosenberger, R. S., and E. L. Smith. 1998. Assessing Forest Scenic Beauty Impacts of Insects and Management. FHTET 98-08. USDA Forest Service Forest Health Technology Enterprise Team, Fort Collins, CO.

Rothermel, R. C. 1972. A mathematical model for predicting fire spread in wildland fuels. Res. Pap. INT-115. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 40 pp.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966 - 2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, MD) http://www.mbr-pwrc.usgs.gov/bbs/bbsold.html

Savage, M., 1991. Structural dynamics of a southwestern pine forest under chronic human disturbance. Annals of the Association of American Geographers 81, 271–289.

Schmidt, Kirsten M., James P. Menakis, Colin C. Hardy, Wendel J. Hann, and David L. Bunnell. 2002. Development of course-scale spatial data for wildland fire and fuel management. General Technical Report, RMRS-GTR-87, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 39 pp. plus CD.

Scott Joe H. and Burgan, Robert E. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Spread Model. Gen. Tech. Rep RMRS-GTR-153, Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 pp.

Scott, J. H.; Reinhardt, E. D. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. Res. Pap. RMRS-RP-29. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station: 59 pp.

Squires, J. R and P. L. Kennedy. 2006. Northern goshawk ecology: an assessment of current knowledge and information needs for conservation and management. Studies in Avian Biology No. 31:8-62.

Stednick, John D. 1996. *Monitoring the Effects of Timber Harvest on Annual Water Yield*. Journal of hydrology, vol. 176, 79-95.

Stednick, J. D. 2006. In G. E. Dissmeyer. 2000. Drinking Water from Forests and Grasslands, A Synthesis of the Scientific Literature. USDA Forest Service General Technical Report SR3-39.

Strenger, S., S. Sebring, W. Robbie, F. Escobedo, C. Vaandrager, V. Andrew, E. Brooks, C. Krasine, B. Nielsen, and R. Fletcher. 2007. Terrestrial Ecosystems Survey of the Cibola National Forest and National Grasslands. USDA Forest Service, Southwestern Region. 696 pp.

Strom, B. A., and P. Z. Fule. 2007. Pre-wildfire fuel treatments affect long-term ponderosa pine forest dynamics. International Journal of Wildland Fire 16:128–138.

SWCA Environmental Consultants. 2006. East Mountains Community Wildfire Protection Plan. 45 pp.

———. 2008a. Torrance County Community Wildfire Protection Plan. 161 pp.

———. 2008b. Middle Rio Grande Bosque Community Wildfire Protection Plan. 143 pp.

Swetnam, T. M., C. H. Baisan, A. C. Caprio, R. Touchan, and P. M. Brown. 1992. Tree-ring reconstruction of giant sequoia fire regimes. Final Report to the Sequoia, Kings Canyon and Yosemite National Parks. Laboratory of Tree-Ring Research, Tucson, AZ. 90 pp.

Swetnam, T. M.; Brown, P. M. 1992. Oldest known conifers in the southwestern United States: temporal and spatial patterns of maximum age. Paper presented at: Workshop on old-growth forests in the Rocky Mountains and Southwest: The status of our knowledge. Portal, AZ, March 9-13, 1992; 24-38.

Taylor, Jonathan G. and Terry C. Daniel. "Perceived Scenic and Recreational Quality of Forest Burn Areas." in Proceedings-Symposium and Workshop on Wilderness Fire, Missoula, MT, November 15–18, 1983. General Technical Report INT-182

Touchan, R., Allen, C. D., Swetnam, T. W., 1996. Fire history and climatic patterns in ponderosa pine and mixed conifer forests of the Jemez Mountains, northern New Mexico. In: Allen, C.D. (Ed.), Fire Effects in Southwestern Forests. Proceedings of the Second La Mesa Fire Symposium. USDA Forest Service General Technical Report RM-GTR-286, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO, pp. 33–46.

Torrance Soil Survey. 1970. Soil Survey. Torrance Area, New Mexico. USDA Soil Conservation Service and Forest Service.

TREAT. 2010. Treatment for Restoration Economic Analysis Tool–User Guide. USDA Forest Service. 10 pp.

U.S. Census Bureau. 2000. State and County Quick Facts. Available: http://quickfacts.census.gov. Accessed 29 April 2010.

———. 2009. Small Area Income and Poverty Estimates 2009, http://www.census.gov/did/www/saipe/ Accessed 10/21/2011.

———. 2010. State and County Quick Facts 2010. http://quickfacts.census.gov/qfd/index.html. Accessed 10/20/2011

U.S. Department of Agriculture. 1999. FSM 2509.18-99-1, Soil Condition Rating Guide.

U.S. Department of Agriculture. 2000. Biological Aassessment on Wildland-Urban Interface Catastrophic Wildfire Risk Reduction Projects. Forest Service, Region 3. Albuquerque, NM.

U.S. Department of Agriculture. 2010. Southwestern Region Climate Change Trends and Forest Planning. Forest Service, Region 3. Albuquerque, NM.

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS). 2010a. Web Soil Survey. Available at: http://websoilsurvey.nrcs.usda.gov. Accessed 28 April 2010.

———. 2010b. The PLANTS Database. Baton Rouge: National Plant Data Center. Available at: http://plants.usda.gov. Accessed 28 April 2010.

U. S. Department of Agriculture, Forest Service. 1974. National Forest Landscape Management Volume 2, Chapter 1 The Visual Management System. Forest Service Handbook No. 462. Washington, DC.

———. 1985. Cibola National Forest Final Land Management Plan (forest plan) Environmental Impact Statement (EIS). Albuquerque, NM. http://fsweb.cibola.r3.fs.fed.us/planning/index.shtml

———. 1990. Forest Service Handbook FSH 2509.22 Soil and Water Conservation Practices. USDA Forest Service, Southwestern Region, Albuquerque, NM.

———. 1992. Rocky Mountain Forest and Range Experiment Station General Technical Report RM-217, Management Recommendations for the Northern Goshawk in the Southwestern United States, 1992. Available: http://www.fs.fed.us/rm/pubs_rm/rm_gtr217.pdf

———. 1997. Plant Associations of AZ and NM, Volume 1: Forests, p. 229

———. 1999a. Mountainair Ranger District Geographic Area Assessments, Version 1.

———. 1999b. Forest Service Handbook FSH 2509.18-99-1 Soil Management Handbook. USDA Forest Service, Southwestern Region, Albuquerque, NM.

———. 2004a. FSM 2500 Watershed and Air Management Chapter 2526 Riparian Area Management.

———. 2004b. FSM 2500 Watershed and Air Management Chapter 2521Watershed Condition.

———. 2005a. Wildland Fire in Ecosystems: Effects of Fire on Soils and Water. RMRS-GTR-42-Volume 4. USDA Forest Service, Rocky Mountain Research Station, Albuquerque, NM.

———. 2005b. Cibola National Forest, Management Indicator Species Report for the Cibola National Forest and Grasslands. Revised March 2005.

———. 2006. Cibola National Forest Fire Management Plan. Cibola National Forest, Albuquerque, NM.

———. 2007. Regional Forester's List of Sensitive Animals and Plants. Southwestern Region, Albuquerque, NM, USA. http://www.fs.usda.gov/detail/r3/plants-animals/?cid=FSBDEV3_022105

———. 2010a. *Cumulative Watershed Effects of Fuel Management in the Western United States.* RMRS-GTR-231.

———. 2010b. Cibola National Forest Breeding Bird Survey Report for 2010. Prepared by Hart R. Schwarz, Oct., 2010. Supplemented in 2011.

———. 2011a. Watershed Condition Framework. United States Department of Agriculture, Forest Service, FS-977. Washington, DC.

U.S. Department of the Interior. 2001. The National Fire Plan. GAO-01-1022T.

U.S. Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Washington, DC: U.S. Environmental Protection Agency.

U.S. Fish and Wildlife Service. 1995. Mexican Spotted Owl Recovery Plan, 1995. Available as link: http://www.fws.gov/southwest/es/mso/recovery_plan.htm

———. 2011. List of species by county for New Mexico: Bernalillo, Torrance. Ecological Services, Albuquerque, New Mexico. http://www.fws.gov/southwest/es/EndangeredSpecies/EndangeredSpecies_Lists/EndangeredSpecies_ListSpecies.cfm

Van Wagner, C. E. 1977. Conditions for the start and spread of crown fire. Canadian Journal of Forest Research. 7. 23-34.

Weaver, H. 1947. Fire, natures thinning agent in ponderosa pine stands. Journal of Forestry 45: 437-444.

West, N. E. 1984. Successional patterns and productivity potentials of piñon-juniper ecosystems. In: Developing strategies for rangeland management. National Research Council/National Academy of Sciences. Westview Press, Boulder, CO. 1301-1332.

Westerling, A. L., H. G. Hidalgo., D. R. Cayan, and T. W. Swetnam. 2006. Warming and earlier spring increase in Western U.S. Forest Wildfire Activity. Science. 313 (5789): 940-943.

Western Regional Climate Center. 2010. Bernalillo, New Mexico. Available at: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm0903. Accessed 28 April 2010.

Wilcox, B. P. and D. D. Breshears. 1995. Hydrology and ecology of piñon-juniper woodlands: conceptual framework and field studies. pp. 109–119. In: D. W. Shaw, E. F. Aldon, C. LoSapio (tech. coordinators) Proc.: Desired future conditions for piñon-juniper ecosystems, Flagstaff, AZ, August 8-12, 1994. USDA Forest Serv. Gen. Tech. Rep. RM-258. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Woodbridge, B., and P. J. Detrich. 1994. Territory occupancy and habitat patch size of northern goshawks in the southern Cascades of California. Studies in Avian Biology 16:83-87.

Woodbridge, B. and Hargis, C. D. 2006. Northern Goshawk Inventory and Monitoring Technical Guide Gen. Tech. Report WO-71. Washington, DC: USDA Forest Service. 80 pp.

Wright, R. J. and S. C. Hart. 1997. Nitrogen and phosphorus status in a southwestern ponderosa pine forest after 20 years of interval burning. Ecoscience, 4, pp. 526–533.

Youtz, J. A., R. T. Graham, R. T. Reynolds, and J. Simon. 2007. Implementing northern goshawk habitat management in southwestern forests: A template for restoring fire-adapted forest ecosystems. Proceedings of the 2007 National Silviculture Workshop. Gen. Tech. Rep. PNW-GTR-733. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 306 pp.