

**Canjilon Wildland Urban Interface  
Project Analysis:  
Canjilon Ranger District  
Carson National Forest, New Mexico**



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## **Acknowledgements**

Dr. Jim L. Fridley- Advisor and Committee Chair  
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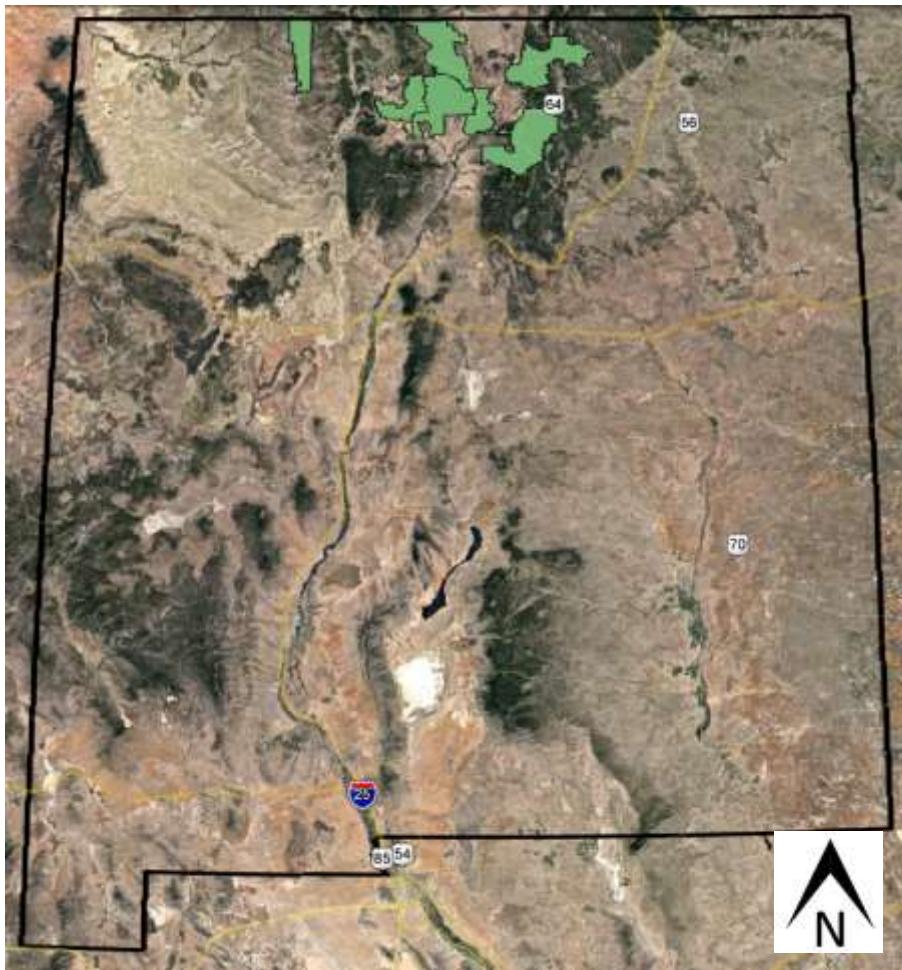
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## **Introduction**

There is approximately 1.5 million acres that make up the Carson National Forest, which is one of 155 national forests and 20 grasslands that collectively make up the 193 million acres of the National Forest System (NFS). The NFS is administered by the United States Forest Service (USFS), which was established in 1905 under the United States Department of Agriculture (USDA)<sup>1</sup>. The Carson National Forest was established in 1908<sup>2</sup> under the NFS.

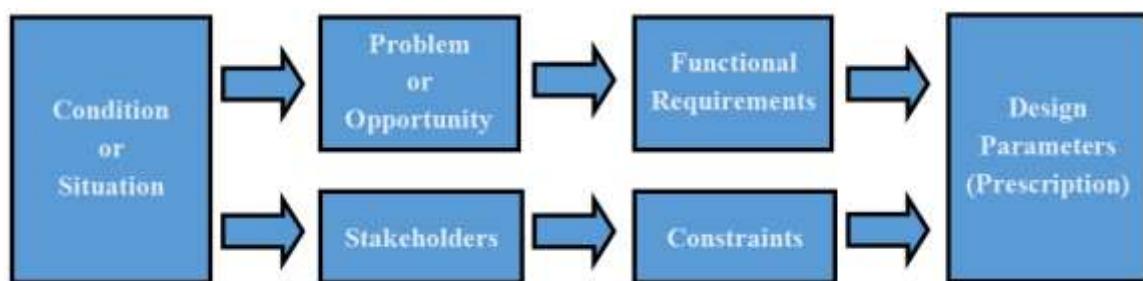
The Canjilon Wildland Urban Interface Project (CWUI) is an ongoing endeavor of the Carson National Forest (Figure 1) to reduce fire risks facing the forest and its neighboring communities. It has been implemented as a series of vegetation removal projects on about 35 individual units. The individual units have thus far ranged in size from 16 to 315 acres each, for a total of 3,760 acres.



**Figure 1:** State view of the Carson National Forest consisting of 1.5 million acres.  
(Google Earth Imagery with US Forest Service shapefiles).

The CWUI project was formally initiated in 2011 when the Carson National Forest issued a ‘decision notice’ culminating a multi-year process for developing a plan to address increasing concern of wildfire risks on the forest. The current paper aims to examine the CWUI project by exploring its overall goals, the specific functional requirements, constraints, and design parameters of each unit, as well as the results of implementing the design parameters (or prescriptions) on the individual units.

Appreciative design is a framework used to describe design in, for example, engineering, architectural, and public policy. The Appreciative design process was developed between 1985 and 1995 to enable disciplined engineering and design of messy problems that have both social and technical elements<sup>3</sup>. It emphasizes design as a stakeholder based process for meeting functional requirements. Appreciative design is a structured process to search for a best-set solution to technical and organizational problems<sup>3</sup>. It also recognizes a hierarchical structure for design. The combination of its stakeholder emphasis and hierarchical structure made it appropriate for framing and examining the CWUI project.



**Figure 2:** Framework components contribute to the development of design parameters.

Figure 2 utilizes the terminology of appreciative design and shows the two paths that combine to form a process, which results in the determination of a final design. The paths start with the current condition or situation that creates a problem and generates interest or concern in stakeholders. One path defines a problem as a set of functional requirements to be met. The problem is conceptually solved when a suitable set of design parameters are found or specified.

The second path establishes constraints that must be met for a solution to be acceptable. Stakeholders can be any group or individual that is interested, affected, and/or concerned with the current conditions. These stakeholders, through expressing their thoughts/opinions, propose constraints that may be necessary for any possible design solution to be successful. Ultimately, in any successful solution to the problem, the

functional requirements and the constraints must be satisfied through the specification of design parameters.

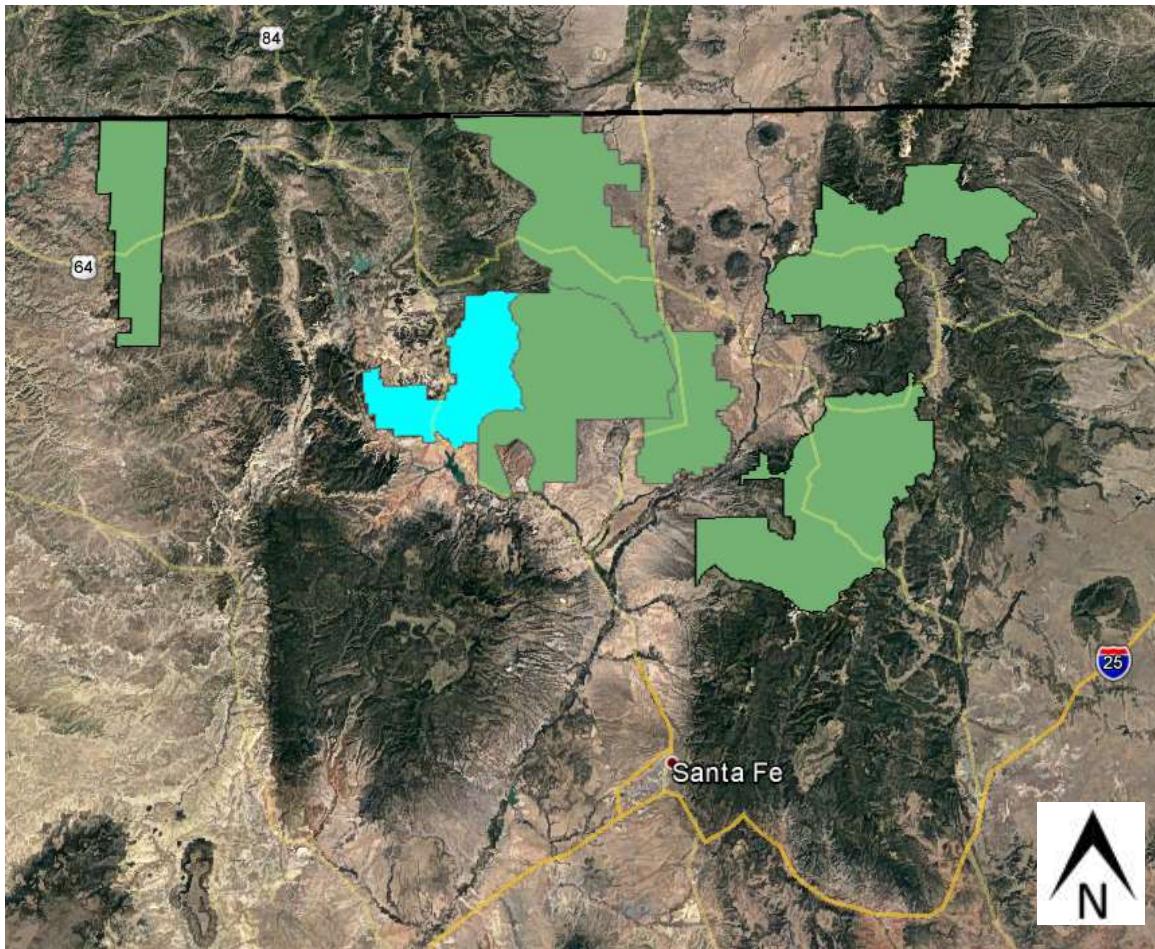
The Appreciative Design framework is used in this current paper to provide a structure for examining the CWUI project. The project is examined in three hierarchical levels. The first, or higher, level established the CWUI project as a solution to a problem faced by the Carson National Forest related to wildfire risk and resulting from a broad combination of environmental and social conditions. The second level is the program administration design. The administrative level established the overall general guidelines to how the CWUI project would be administered. This was primarily achieved by the completion of an Environmental Assessment (EA). The third, or lower, level is currently establishing specific on-the-ground woods operations as solutions to the practical problem of implementing the CWUI project that was inherited by the managers and professionals on the Canjilon Ranger District.

## **Canjilon Wildland Urban Interface Project: Level one – CWUI fuels reduction program design**

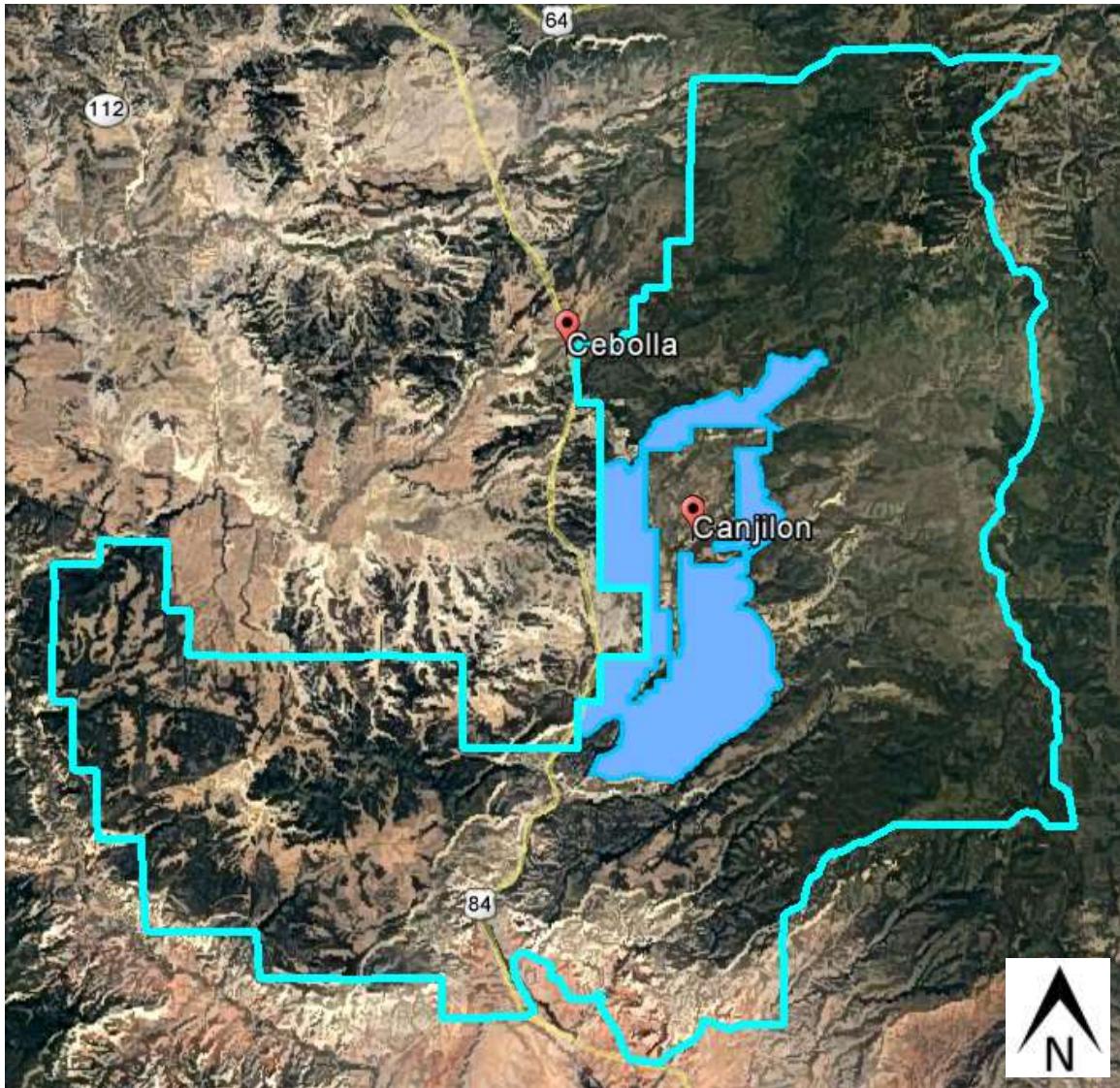
### **Conditions**

#### Location

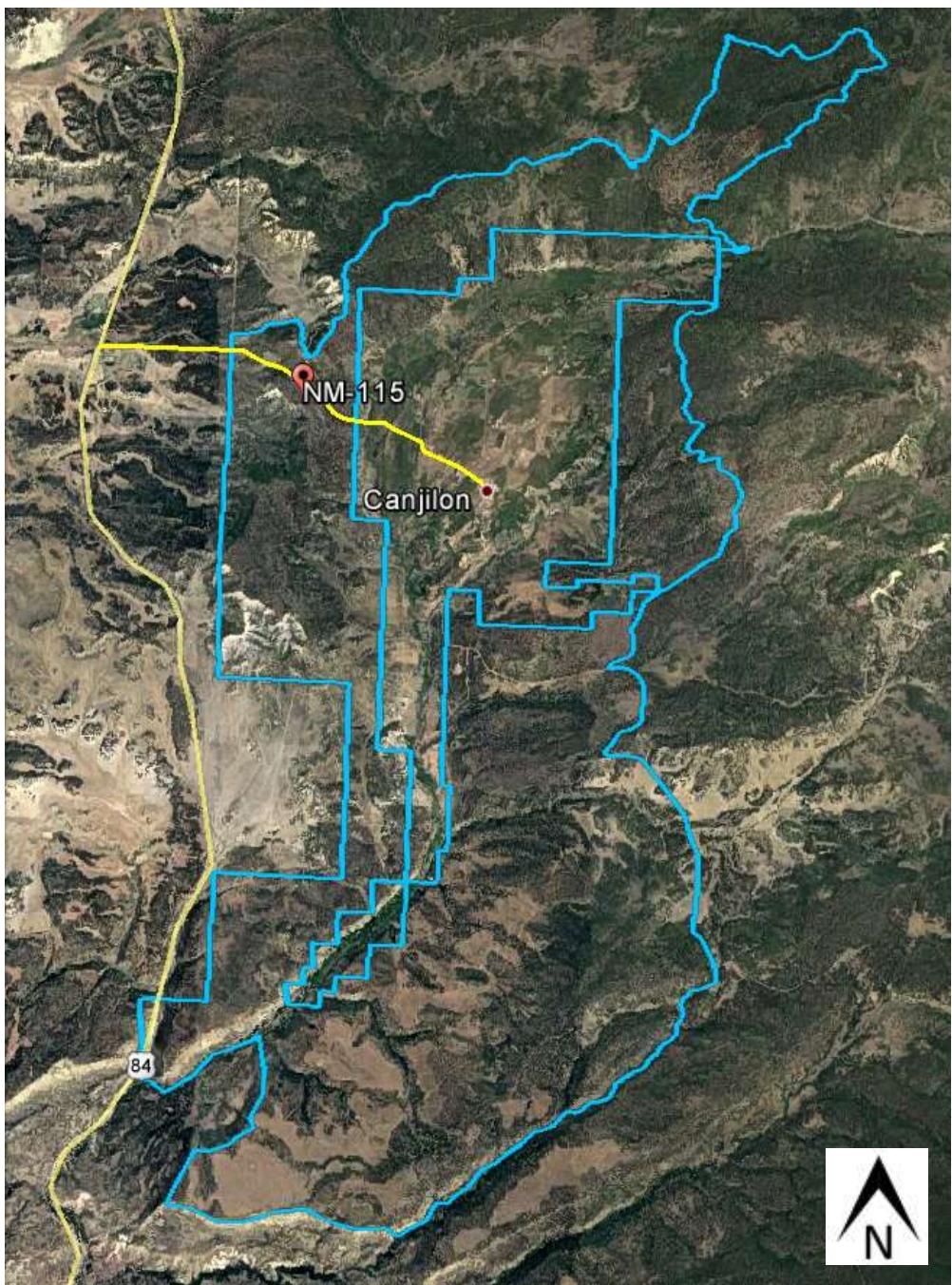
The Carson National Forest (NF) is located in the northern most portion of New Mexico (NM). It extends across four counties: Rio Arriba, Taos, Colfax, and Mora county. The 12,182-acre CWUI project is located on the Canjilon Ranger District (RD), one of six districts on the Carson NF (figures 3 & 4). The community of Canjilon is located in Rio Arriba County in North central NM. It can be accessed from Chama, NM by driving south via US Highway 84 approximately 30 miles to the turnoff of NM Highway 115. Take NM Highway 115 East for 3 miles to the center of Canjilon. NM Highway 115 is the only paved access road for both Canjilon and Placita Garcia residents (figure 5).



**Figure 3:** Carson National Forest with District boundaries of the six ranger districts. Canjilon Ranger District is highlighted in blue and consists of 150,706 acres. (Google Earth Imagery with US Forest Service shapefiles)



**Figure 4:** Canjilon Wildland Urban Interface Project surrounds the community of Canjilon and consists of 12,182 acres (shaded in blue). (Google Earth Imagery with US Forest Service shapefiles)



**Figure 5:** One paved access road to the community of Canjilon. (Google Earth Imagery with US Forest Service shapefiles)

### Social/Economic Conditions

The population of the community of Canjilon was recorded at 256, based on 2010 census data<sup>4</sup>. Data do not exist for the Placita Garcia area, which is adjacent to Canjilon and is included within the boundary of the CWUI project. The 2010 EA for the CWUI project approximated the population to be around 500. Based on 2010 census data, 71% of the population in Rio Arriba County is Hispanic<sup>4</sup>. The Hispanic population of Canjilon is likely higher with many of the residents being descendants of the Spanish land grant families. Community members still have strong ties to the land and utilize the Carson NF as a place for recreational outdoor activities and for obtaining forest products, such as firewood, vigas (beams), latillas, and flagstone.

Most homes in Canjilon rely on firewood as a secondary source of heat. Currently, the Canjilon RD only sells personal use firewood. This allows for up to ten cords of wood per household. People have requested that the district sell commercial fuelwood that would allow an individual to remove more than ten cords and allows them to sell it for personal income.

The 1.5 million acre forest had approximately 150 employees during the summer of 2015 with 16 of those employees reporting to the Canjilon RD. The timber sales, woodmills, and timber markets in NM have decreased over the years. The lack of markets and infrastructure (woodmills) contribute to the decline of the economy. Some small-scale woodmills continue to exist but are functioning near full capacity. Much of the timber that needs to be removed is of poor quality and is much more suited for fuelwood rather than timber production. The fuelwood market is one that the Carson NF wants to tap into but currently lacks the personnel to implement the sales and inspections. This market would expand to businesses in bigger cities. Fuelwood haulers come from as far as 150 miles, in order to harvest the firewood.

### Environmental Conditions

New Mexico average temperatures started to rise in the mid-1990s and have been above average since then<sup>5</sup>. Canjilon receives an average annual precipitation of 10 inches per year, five inches less than the NM average<sup>6</sup>. However, Tierra Amarilla is located 20 miles north of Canjilon and has an average annual precipitation of 24 inches per year<sup>7</sup>. Canjilon experiences an average of 10 inches of snowfall per year with snow occasionally accumulating to several feet. Canjilon is on the cusp between dry ponderosa forests, piñon-juniper (PJ) stands, and sagebrush openings. The elevation of Canjilon ranges from 7,600 to 8,000 feet. Precipitation fell below average from 1999 to 2005<sup>5</sup>. These drought conditions left many NM species struggling to survive. The most visibly stressed ecosystems being PJ woodlands. Stressed Piñon trees began to slowly die off, simply because of the lack of water. Then the vulnerable drought stricken trees experienced a bark beetle outbreak. Piñon Ips Bark beetle outbreaks from 2001-2003 devastated the piñon pine populations throughout the southwest<sup>8</sup>. This becomes a concern for

communities that are dominated by PJ stands. The canopy cover type within the CWUI project is as follows<sup>9</sup>:

- Piñon-Juniper (4,926 acres)
- Ponderosa (3,723 acres)
- Sagebrush (128 acres)

The other contributing factors that affected forest stands were the lack of fire in these ecosystems for over 100 years<sup>10</sup> and livestock grazing that removed the herbaceous vegetation<sup>11</sup>. The removal of herbaceous materials, by livestock, led to a reduction of fine fuels that would have carried the fire. Since the establishment of the USFS in 1905, firefighters have become increasingly effective at locating fires and putting them out before they grow to sizes that are uncontrollable.

Fire frequency in PJ woodlands range from zero to over 200 years<sup>10</sup>. This wide range depends on the location of the PJ stand, vegetative species composition (i.e. sagebrush, grasses, forbs, etc.), slope, and aspect<sup>10</sup>. PJ stands on relatively flat terrain with the presence of fine fuels will allow for a more frequent fire regime since fires will likely occur more often. Terrain with steep slopes, rock outcrops, and/or bare ground will have a mixed fire regime since fire does not have the ability to carry through the stand. Stands that have not seen fire in over 200 years are likely adapted to stand replacing fires. The lack of fire has allowed for the spread of PJ woodlands into areas where they historically did not exist.

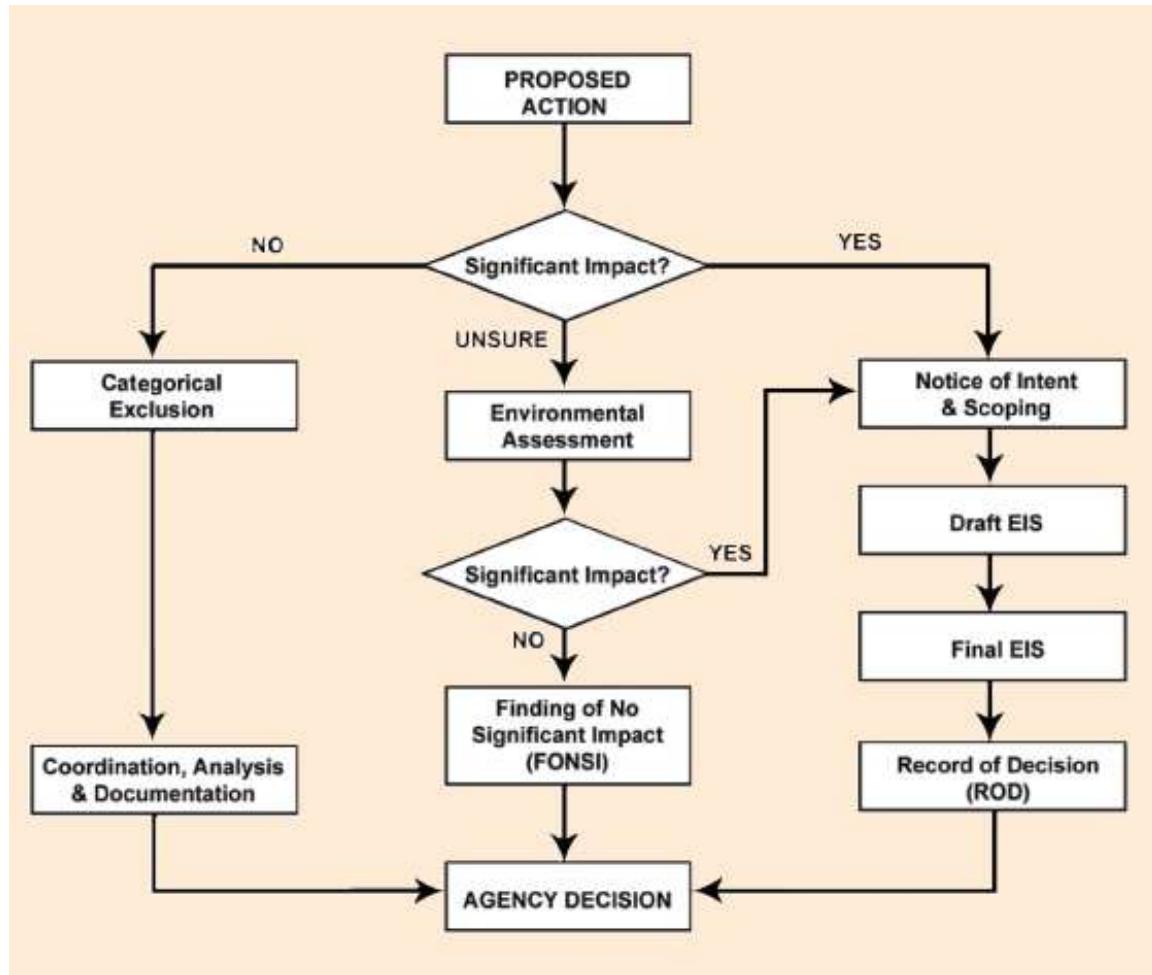
Fire frequency in Ponderosa stands ranges from 0-35 years<sup>12</sup>. Many of these stands have been excluded from fire since the Carson NF was established in 1908. The result is an increase in small diameter ponderosa trees with closed, continuous canopies. Since ponderosa stands have evolved with frequent fires, the litter component in these stands has accumulated over the years. These conditions leave the stand vulnerable to crown fires that can potentially remove all vegetation within the stand.

In 2002, the Montoya Fire started east of the community of Canjilon. This fire was human caused and burned 4,257 acres. Some of the eastern CWUI project boundary borders the fire scar with some small sections of the fire scar included within the CWUI project boundary<sup>9</sup>. The boundary was selected by calculating the potential spread of a fire, within one to two burn periods, to the communities of Canjilon and Placita Garcia<sup>9</sup>. A burn period is referred to as the part of each 24-hour period where fires spread most rapidly<sup>13</sup>. Estimating the 24 to 48-hour spread potential of fire in surrounding areas was the deciding factor as to the size of the CWUI project area. Reducing hazardous fuels from within the CWUI project area will allow for adequate time and resources to be dispatched to the location of the fire.

## Public Policy Conditions

### National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 was developed to assure that government agencies give proper consideration to the environment before undertaking any federal action that affects the environment<sup>14</sup>. A flow chart of the NEPA process can be seen in figure 6.



**Figure 6:** The NEPA process flow chart shows the steps that must be implemented depending on what level of NEPA is required for the project<sup>15</sup>

## National Fire Plan

The National Fire Plan, the 10-year Comprehensive Strategy Implementation Plan developed for it, the Healthy Forest Restoration Act, and the Upper Chama Community Wildfire Protection Plan were all driving forces that lead to the development of the CWUI project. On September 8, 2000 the secretaries of Agriculture and the Interior submitted a report to the president in response to the wildfires of 2000<sup>16</sup>. This report led to the evolution of the National Fire Plan (NFP)<sup>17</sup>. The plan addresses multiple points with the most critical being the reduction of hazardous fuels.

In 2001, the secretaries of Agriculture and the Interior, along with other key stakeholders, developed the 10-year Comprehensive Strategy Implementation Plan<sup>18</sup>. This was done with the NFP in mind. This strategy was designed to prioritize the protection of communities and at-risk watersheds, collaboration between governments and stakeholders, and accountability through performance measures and monitoring<sup>18</sup>.

## Healthy Forest Restoration Act

The Healthy Forest Restoration Act (HFRA) of 2003<sup>19</sup> allows for the USDA and the US Department of Interior (USDI) to expedite the planning, development and implementation of hazardous fuels reduction projects on land managed by the USDA Forest Service and USDI Bureau of Land Management. The HFRA also allows for better collaboration between federal agencies, communities, and local governments to address wildfire risks<sup>19</sup>. The most effective way for communities to benefit from HFRA is by developing a Community Wildfire Protection Plan<sup>20</sup> (CWPP). Not only does the community benefit from having a better understanding of the fire risks of the community, but also communities with CWPPs in place will be given priority for funding of hazardous fuels reduction projects that are carried out under the HFRA<sup>20</sup>.

In order for CWPPs to be approved, they must meet three criteria: collaboration by government representatives and stakeholders, prioritized fuel reduction treatments that would protect essential infrastructure and communities, and recommend treatments of structural ignitability that would reduce the probability of structures being consumed by wildfires<sup>21</sup>.

## Upper Chama Community Wildfire Protection Plan

The 2008 Upper Chama Community Wildfire Protection Plan was prepared for Northern Rio Arriba County. Each community within the northern portion of the county was assessed and given a hazard rating of low, moderate, high, or extreme risk. The community of Canjilon had a hazard rating of high based on a combination of contributing factors, including access roads, terrain, inadequate defensible space, and vegetation surrounding the community<sup>22</sup>.

## **Problem, Problem Owner, and Stakeholders**

The risk of wildfires became a reality with an increasing number of mega-wildfires throughout the western US. Communities, similar to Canjilon, enclosed by forests are of high concern due to the proximity of fuel loads and inadequate evacuation routes. Federal lands managed by the Carson NF surround the community of Canjilon. Increased awareness, momentum, and the identification of Canjilon as a high-risk community led the Carson NF to take action. The set of social/economic, environmental, and policy conditions described above, along with their role as managers of about 1.5 million acres, led the forest to assert itself as the problem owner and used the NEPA process to develop an EA.

In January 2008, the Carson NF listed the CWUI project in the schedule of proposed actions for the forest. A scoping letter was sent out to the Carson NF mailing list in July 2010 to begin seeking input from stakeholders including the Native American tribes, state agencies, local governments, the general public and others. Public meetings were also held to begin identifying any issues that needed to be addressed<sup>23</sup> before the formal development of the EA. Once stakeholders and their concerns were identified, the Carson NF formally began the NEPA process. The CWUI project was proposed primarily to respond to goals and objectives of the NFP<sup>17</sup> and the Carson National Forest Plan<sup>9, 24</sup>. The EA for the CWUI project was submitted in October 2010. The EA only had two alternatives with alternative 1 being no action and alternative 2 being the proposed action<sup>9</sup>. The EA was then reviewed with the Finding of No Significant Impact (FONSI) to the environment<sup>23</sup>.

Stakeholders were identified in the NEPA process in order to identify their concerns as early as possible. These concerns can be vague or precise and can come from any individual or organization. These concerns are submitted as comments that can be in favor of or against the project. A partial list of CWUI project stakeholders includes:

- Locals/ Community members
- Home Owners
- General Public/ Tax Payers
- Fuelwood Harvesters
- Contractors
- Rio Arriba County
- NM State Forestry (NMSF)
- NM Department of Game & Fish (NMDGF)
- Hunters/Anglers
- Outdoor Recreational Users
- Native American Tribes
- USDA-Forest Service Personnel

## **Functional Requirements and Constraints**

The EA identified seven overarching goals (Functional Requirements) based on existing conditions that presumably express the desires of the problem owner (the Carson NF):

- Reduced forest fuels
- Reduced ladder fuels
- Reduced risk of uncharacteristically intense fire
- Reduced risk to life, property, and natural resources
- Increased safety to fire suppression crews
- Development of sustainable forest conditions
- Restoration of natural ecological systems

These goals are intended to be vague in order to express the general intent of the project. The lack of fire, caused by multiple factors, has resulted in the seven goals. These goals address concerns of many stakeholders and could likely be used for all projects on the Carson NF. This project was scoped as a fuels reduction project because of the decreased functions of these forest stands. Due to the drastic changes in composition and structure of these stands, they all face the potential to be moonscaped in the event of an uncontrollable wildfire. This would result in an abundance of sediment, erosion, and runoff concerns that would change the ecological functions of the systems. This would also derail the development of sustainable forest conditions, resulting in a drastic change in habitat type, a direct use/function for wildlife purposes.

Additionally, the EA identified some constraints that presumably express the desires of the problem owner and/or stakeholders:

- Maintain resulting tree densities through additional thinning and prescribed burning.
- Maintain snags for wildlife
- (When thinning) primarily remove trees less than 12 inches in diameter; however, a few larger ponderosa pine trees that are in poor health or in stands with continuous canopy cover that can contribute to crown fire will also be selected for removal.
- (When thinning) lop and scatter, pile, or chip slash, and use prescribed fire to reduce slash accumulations and eliminate fuel concentrations.

These specific constraints were identified during the EA process. They are the guidelines that the general public can comment on. The implementation phase, after the EA was completed, may be more stringent depending on the stand but cannot exceed any quantities or specifications listed in the final decision notice.

## **Design Parameters**

The EA provided a specific solution or method (design parameter specification) for achieving the Functional Requirements:

- Thin ponderosa pine, piñon/juniper, and sagebrush on approximately 11,147 acres of the project area.

In March 2011, the Canjilon District Ranger officially signed the decision notice. The Canjilon District Ranger decided to implement alternative two as outlined in the EA, allowing for the CWUI project to proceed. This decision set the parameters determining what activities are allowed in order to achieve the desired outcome, as written in the EA.

## **CWUI Project: Level 2 –CWUI program administration design**

### **Conditions**

Forest level personnel played a substantial role in the development of the CWUI project at the early stages of the project, primarily in the development of the NEPA component. The CWUI project was first announced as a proposed forest action in January 2009 and was the responsibility of the forest until the EA was submitted in October 2010. During that time period, an Interdisciplinary Team consisting of 13 forest personnel was in charge of preparing all of the proper documentation for the project<sup>9</sup>. The Final Decision Notice and the FONSI report were signed in March of 2011<sup>23</sup>. This report transitions the forest level emphasis to the district level for implementation.

### **Problem, Problem Owner, and Stakeholders**

The USFS has the direct stewardship responsibility of the National Forest System<sup>1</sup>. Each forest is tasked with managing, implementing, and prioritizing projects at the forest level. The Forest Supervisor is in charge of a particular forest and reports to the Regional Forester, who reports to the Chief of the USFS stationed in Washington, D.C. The Carson NF consists of six districts, each containing a District Ranger. This district ranger oversees the district employees and answers to the Forest Supervisor. The District Ranger is in charge of all activities that occur on the district and usually have a variety of professionals and technicians that help accomplish the tasks of the forest.

Due to budgetary constraints and the shrinking size of the Carson NF workforce, the forest has classified many of the historically district-based positions as zoned or forest wide positions. This is a more holistic approach that encourages Carson NF employees to view all projects as forest level projects rather than district projects. This would make the Carson NF the problem owner rather than the Canjilon Ranger District.

At the forest level, the key stakeholders are forest service personnel. The 13 USFS positions members of the Interdisciplinary Team that developed the EA include:

- West Zone NEPA Coordinator
- Fire and Fuels Specialist
- Foresters
- Silviculturist
- West Zone Range Staff
- West Zone Wildlife Biologist
- West Zone Archeologist
- Assistant Fire Management Officers (2)
- West Zone Recreation Staff
- West Zone Recreation Assistant
- Soils and Watershed

Members of this Team all have the potential to shape the project, given that they can convince other members of the team that their views are the most ideal. Many of the internal stakeholders that took part in the development of the EA also play a role later in the implementation level of the project.

### **Functional Requirements and Constraints**

The hierarchical structure of the USFS is necessary for large organizations and streamlines the reporting of information from the Washington D.C. office to the district level. Each of the nine USFS Regions has targets that they must strive to achieve. Some of these targets involve the completed acreage of thinning projects, hazardous fuels reduction projects, and prescribed fires. The targeted acreage is disseminated to the Regional levels, which in-turn, is disseminated to each forest. Each forest reports the target acreage versus the completed acreage up the chain of command at the end of each fiscal year.

Functional requirements at the forest level must be kept in mind when planning multiple-year projects. The forest supervisor must ensure that the forest has sufficient work-force personnel to complete the project in the allotted time frame. This can potentially constrain a project if the forest does not contain the infrastructure to implement it in a timely manner. The other forest level constraint is securing funding. The USFS firefighting personnel currently have a soft-cap when it comes to the allocated yearly budgets. Fighting fires takes priority and the funds are made available at the time of need. This creates an unbalanced allocation of funds. In 2015, the USFS spent more than half of their funds suppressing the nation's fires<sup>25</sup>. This forced the agency to re-allocate funds in order to internally absorb the costs. The additional costs are pulled from other departments within the USFS agency. Each Region is required to free up the additional funds needed to cover the costs of fighting fires all season and each forest must do their

part to provide the region with the appropriate amount of additional funds. These constraints must be dealt with at the forest level and are mostly unpredictable events that cause these scenarios.

## **Design Parameters**

The design parameters laid out in the NEPA analysis takes precedents over the project. Only parameters that were analyzed during the NEPA analysis can be implemented. If those conducting the project want to utilize a treatment method that was not in the NEPA analysis, a new NEPA analysis and decision notice must be conducted. For this reason, the forest level plays an important role in communicating with district level personnel to ensure that the chosen treatment methods are realistic and truly the best alternatives for the given project.

The district personnel are responsible for designing and implementing the unit prescriptions and on-the-ground operations. They conduct the operations as specified in the EA, in order to satisfy the functional requirements and constraints, from level one and two.

The Silviculturist is responsible for signing off on the final prescription but the forester may assist the Silviculturist by preparing a draft prescription for a particular unit. The forester and the forestry technicians are responsible for the layout of the thinning unit, answering particular questions from the contractors in regards to the prescription, and periodic inspections of the units.

## **CWUI Project: Level 3 – Thinning unit design**

### **Conditions**

Once the decision had been made through the EA process to undertake thinning as the method to meet the listed functional requirements, subject to the listed constraints, the emphasis shifted from the forest level to the district personnel (primarily the Silviculturist, Foresters, and Forestry Technicians). The conditions for level three are based on thinning unit level design and implementation while inheriting conditions from level one and two. In appreciative design, at each level the designers and implementers inherit the conditions, functional requirements, constraints, and design parameters of all the levels above. Additionally, they may impose their own constraints that become part of the design parameters.

## **Problem, Problem Owner, and Stakeholders**

Shapefiles for the thinning units were created for all of the CWUI before the EA was finalized (level 1). Many of these units were partitioned, merged or morphed as the implementation process began<sup>26</sup>. The implementation process required manipulation based on the funding source and the stakeholders involved in the implementation phase. An example would be grant funding from the Collaborative Forest Restoration Program. The unit was awarded to a small, local contractor that was allowed three years to complete the implementation phase. The unit was then broken up into three small equal sized sections while the same prescription was kept, since it was written for the unit as a whole.

Stakeholders of the CWUI project are those individuals or groups that are interested, affected, and/or concerned about any treatment decisions that were made in regards to the CWUI project area. Collaboration with key stakeholders was shown to be crucial to the CWUI project since the planning stage. The USFS collaborated with the general public throughout the NEPA analysis process in order to get a final plan that is agreeable with the public and the USFS<sup>26</sup>. Integrating the publics' concerns throughout the project minimized delays of the project by decreasing the possibility of litigations. Stakeholders in level three typically were locals that stood to be impacted more than general stakeholders that were further from the project area. Many of those locals harvest firewood from the units, making them key stakeholder that must be kept in mind while treatment occurred.

## **Functional Requirements and Constraints**

Many of the overarching goals of the project were chosen to address certain functional requirements. Stands within CWUI are facing issues that no longer allowed them to function. PJ stands had encroached on meadows throughout the Carson NF, including mesas within CWUI. This encroachment had led to a reduction of meadows and open spaces. These meadows can no longer function as non-tree habitats needed for many wildlife species found on the Carson NF.

Ponderosa stands could no longer function as frequent fire habitats because of the lack of fire. These stands are now in abundance of unhealthy, small diameter trees and are becoming dysfunctional and will likely not persist if a wildfire engulfs all of the vegetation. Allowing for fire to once again become part of the system is a functional requirement to restore these ecosystems.

The desired canopy structure of the units within CWUI is driven by functional requirements. The general prescription for PJ stands calls for a non-uniform spacing consisting of clumps ranging from one to three tree clumps. The Rocky Mountain Research Station released a General Technical Report for ponderosa stands that calls for clumps of ponderosa to range from singletree clumps to over twenty-tree clumps<sup>12</sup>.

Clumps function as habitat for wildlife such as Abert's squirrels that move from one tree branch to another. The root mass of clumps also function as support systems for neighboring trees that have been growing together, which in turn function as a niche for soil inhabitants.

### Constraints

Implementation of the CWUI project must follow what was specified in the EA. This created constraints, many of which were either opinions that were expressed during the NEPA process or legal constraints imposed by the USFS.

Based on a review of CWUI prescriptions, some constraints were clearly listed as such. Other constraints were not clearly identified as constraints but function as a constraint.

Listed constraints consisted of the following:

- Protect archeological sites by not driving over or cutting within them.
- Fell trees away from road systems so that stumps face away from road systems.
- Stump heights must be less than six inches unless natural obstacles exist. Then it is four inches above the natural obstacle.
- Leave trees with active nests or cavities to protect bird nests and potential wildlife habitat.
- Avoid travel and road use when road conditions are very wet and muddy to avoid resource damage.
- Avoid damaging leave trees during felling operations.
- No cut trees shall be left hanging on leave trees. All hung up trees shall be brought to the ground.
- Avoid wet/boggy areas and drainage bottoms during spring/storm runoff periods.
- Do not fell trees across existing fences

Other constraints that were not clearly listed include the following:

- Cut logs into 8 ft. sections.
- Reducing dwarf mistletoe throughout the stand

### **Design Parameters**

The design parameters for each thinning unit are expressed in the form of a Project Unit Prescription. The prescription is a document that is used as the legal guide for treatment of a unit. The final prescription must be signed by the certified Silviculturist for it to be valid. The structure of these prescriptions is seen in box 1. The prescription, implementation, removal of wood products, and disposal of slash are intended to collectively achieve the seven overarching goals while staying within the constraints outlined in the EA.

The prescription is important for understanding current conditions, expected conditions after treatment, and any future treatments that should occur in order to meet a specific, long-term objective. The prescriptions should be used by future Silviculturists to gain an understanding of the desired long-term conditions of that stand. Some stands require multiple entries at set intervals. It is common for the next entry to occur when a new Silviculturist is present because of the time gaps between treatments. For this reason, prescriptions should clearly state the years of re-entry and the treatment type. A blank prescription template used by the Carson NF is provided in Appendix II.

The prescription has a set of detailed thinning specifications that must be followed by the contractor. These specifications include residual tree species, their quality, spacing, and often the percentages of each VSS class (Table 1). Restoration protocols for these stand types call for retention of clumps of trees to be left behind in order to mimic historical stand conditions. The details of the clumps and their sizes are written into the specifications section of the prescription.

Slash treatment must fall within the constraints listed in the EA. Slash treatments are selected by the Silviculturist and the three options are lop and scatter, pile, or chip slash. The appropriate method is selected based on the quantity of fine fuels capable of carrying a prescribed fire. If continuous fine fuels exist, lop and scatter is the preferred method. Otherwise, piling is chosen so that the prescribed fire can consume the fuel loads. Chip slash is preferred in areas where aesthetics is the deciding factor.

The boles of the trees must be cut into eight-foot sections or smaller and have the limbs detached. This allows for fuelwood haulers to remove firewood from the unit with their forest-wide, dead and down fuelwood permits. After thinning, inspections, and the removal of fuelwood has occurred, the slash is left to cure until the forest can utilize prescribed burns to remove the majority of the slash. The slash typically cures for 1.5 to 3.5 years and sometimes longer depending on weather conditions and available manpower. Until the slash is removed or decomposed, the overarching goals are not satisfied. Although the amount of combustible material has decreased by the removal of fuelwood, the slash from thinning still persists and is simply a redistribution of the small diameter fuels.

**Box 1:** The general structure of the unit prescriptions for the CWUI project.

### **Structure of CWUI Prescriptions**

- Presale Cutting Unit Summary
  - Existing Site Condition
- Treatment Objectives
- Leave Tree Preference list
- Thinning specifications
- Slash treatment
  - Pile or lop and scatter
- Constraints and Special Considerations
- Post thinning treatments
- Desired Outcomes
- Attachments
  - Road maps to cutting unit(s)
  - Hawksworth 6-class dwarf mistletoe rating system (DMR), if applicable  
(appendix II)

### **Costs, Contracts, and Compliance**

The price per acre varies based on the existing site conditions, prescription specifications, slash treatment type, and the funding source being utilized<sup>26</sup>.

The Existing Site Condition section gives the contractor a baseline of what the stand currently looks like. Some of the key components are found on the presale cutting unit summary section on the first page of the prescription. They include slope, canopy cover, elevation, habitat type, region 3 Vegetative Structural Stage (VSS) class (Table 1), Basal Area, mistletoe, cover type. The prescription specifications are the details of what the desired outcome should be. These specifications entail desired spacing requirements, diameter limits, tree species preference, and other constraints. The unit prescription, with the presale cutting unit summary attached, is used to calculate the amount of work necessary to treat the unit.

If the funding source is federal, then the USFS must go through open competitive bid. This is where the contractors each submit a final bid on their cost for treating the unit. The lowest bidder is not necessarily the contractor that does the best work. Therefore, the forest can pick from the list of bidders while taking into consideration their references to

past projects and their costs. This allows the forest to minimize costs while still obtaining quality work. After the selection, the contractor signs the official contract agreement, finalizing the start and end dates.

If the funding is from the state, then the state agency chooses a contractor from a list of approved contractors that have settled on a set price agreement. The two state agencies that have paid for treatments on the CWUI project are NMDGF and NMSF. Each of which has their own list of pre-approved contractors that they can pick from. The contractors are paid directly from the state agency paying for the treatments. The prescriptions for these units must be written by the USFS Silviculturist and be approved by the funding state agency. The agency works with USFS personnel to ensure that the unit is completed to specifications written in the prescription. Funding from state agencies is a direct result of collaboration efforts to coordinate projects that would meet the objectives of the state agency and the USFS<sup>26</sup>. The awarded contractor for the state follows a similar contract agreement with the state agency.

The contractors are responsible for requesting a formal inspection of the unit. This can be done periodically or in stages so that the contractor does not have to wait until the completion of the entire unit. Funds are only released after the USFS personnel and the funding state agency (if applicable) inspect the completed unit.

**Table 1:** Vegetative Structural Stage (VSS) is a six-class vegetation scheme used to describe the developmental stages of a forest ecosystem<sup>27</sup>. Table 1 is the amended version used by USFS Region 3.

<b>VSS</b>	<b>Stage Category</b>	<b>Diameter at Breast Height (4.5 feet)</b>
VSS 1	Grass-forb/shrub	0-0.9"
VSS 2	Seedling-sapling	1-4.9"
VSS 3	Young Forest	5-11.9"
VSS 4	Mid-age Forest	12-17.9"
VSS 5	Mature Forest	18-23.9"
VSS 6	Old Forest	24" or greater

The costs of treatments (Table 2) within CWUI have a wide range. This is based on the funding source and type of treatment. The differences in cost are largely due to treatment of the slash. Lopping and scattering of the slash below two feet can be accomplished while conducting hand-felling operations. The same individual operating the chainsaw can also cut the slash down to smaller pieces while distributing them. Piling of the slash

requires an additional individual, or additional time for the sawyer, to pile the branches away from residual trees. This increases the cost of the treatment. Mastication requires a masticator and an operator. This treatment type was used on one unit within the CWUI project. It required some hand felling and additional lop and scatter of slash that was created by the hand felling.

**Table 2:** The approximate price range for thinning units implemented in CWUI project area. Included is the approximate average costs paid for through federal funds or state funds<sup>26</sup>.

Slash Treatment	Price Range (per acre)	Federally Funded (Average)	State Funded (Average)
<b>Lop and scatter</b>	\$115- \$1,410	\$225/acre	\$1,000/acre
<b>Pile</b>	\$278- \$1,410	\$400/acre	\$1,000/acre
<b>Mastication</b>	\$150- \$900	\$300/acre	\$700/acre

## **Outcomes**

A USFS representative that has been part of the entire CWUI project process answered the following in an interview.

### **Has work in the Canjilon WUI been successful? Please Elaborate.**

“Work in the CWUI has been successful. A lot of our secondary benefits [Functional Requirements] of the primary purpose and need have been realized. We have started to see improved stand conditions, more resilient forests, improved wildlife habitat, improved forage for wildlife and livestock, provided much needed fuelwood for communities, and built upon partnerships and collaborated with external stakeholders. The public, for the most part, has been accepting of the treatments we are conducting, so we feel we have been successful in that regard since we included the public in developing this project and took a lot of their input and incorporated it into the final NEPA analysis. The fact that we have been able to leverage funding from both internal and external funding sources to get these acres treated is success. To date, we have been able to complete 54% of the NEPA cleared mechanical treatments in the project, with another funding proposal pending that would increase this amount to 66%. This has happened over the last 6 years since the decision was signed, so the

anticipated 10-year timeline for mechanical treatments being completed is on track.”

“The primary purpose of these treatments is yet to be tested. Yes, we have reduced fuel loading and broken up fuel continuity throughout the project area; however, we have yet to have a wildfire under 95 – 97<sup>th</sup> percentile conditions to truly evaluate whether these treatments actually will have an impact on fire behavior, severity, and intensity. However, available research indicates that the treatments we have implemented will have a positive effect<sup>26</sup>. ”

The treatments that have been conducted so far have all contributed to accomplishing the seven overarching goals of the project listed in the purpose section. This is viewed as a success for the project based on the scope of the NEPA analysis.

Another aspect of success could look at the implementation of groups and clumps. This would require a guide that would allow the stand to be rated based on restoration of canopy structure. This would be in addition to the trees per acre guidelines set out in the prescription and would not be required if the sole intent of the project is to reduce fuels. A quantitative method of measuring clumps sizes would allow for true restoration of these stands. This would also require historical data and/or additional research to gain a better understanding of what the historical conditions were like.

#### CWUI Thinning Units

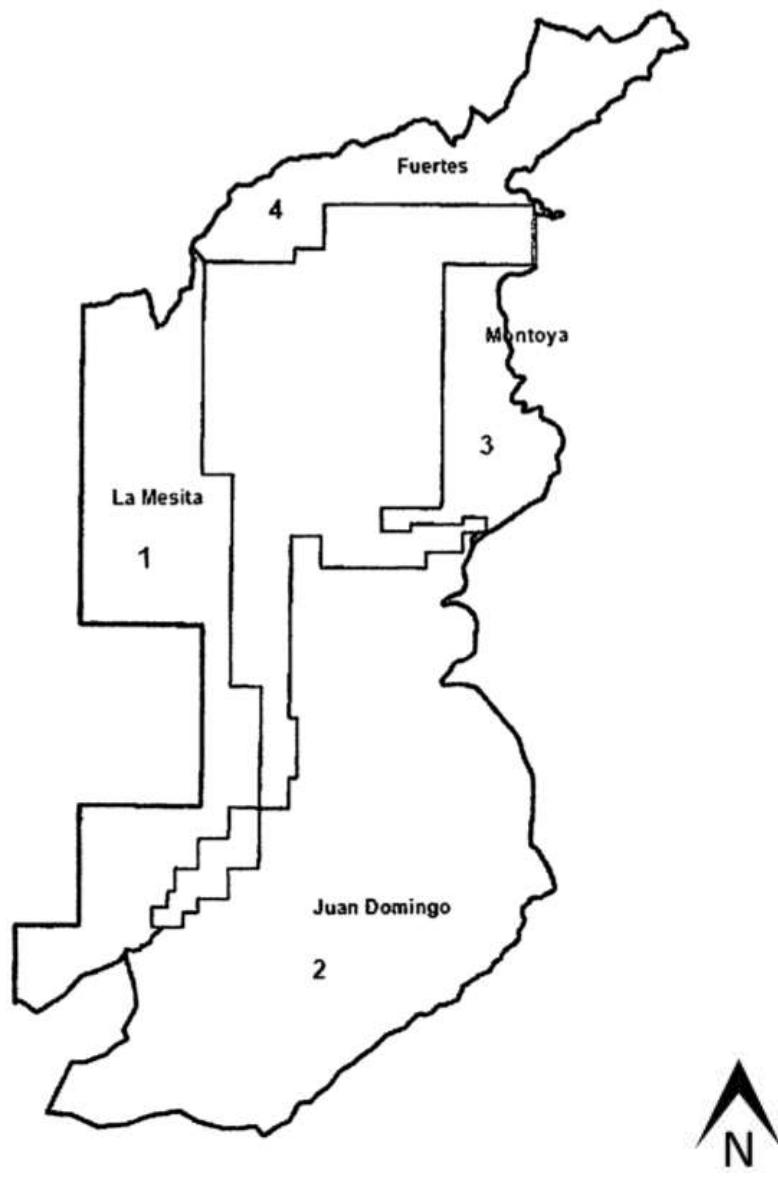
As of August 2016, 19 thinning units, totaling 1,923 acres, have been completed. Funding for an additional 16 units, comprised of 1,837 acres, had been committed with completion deadlines of August 2017. Table 3 is a breakdown of Completed units and their acreage.

The CWUI project was broken up into four Priority Treatment Blocks for categorizing purposes (figure 7). Figures 8 and 9 show the locations of each thinning unit within each treatment block.

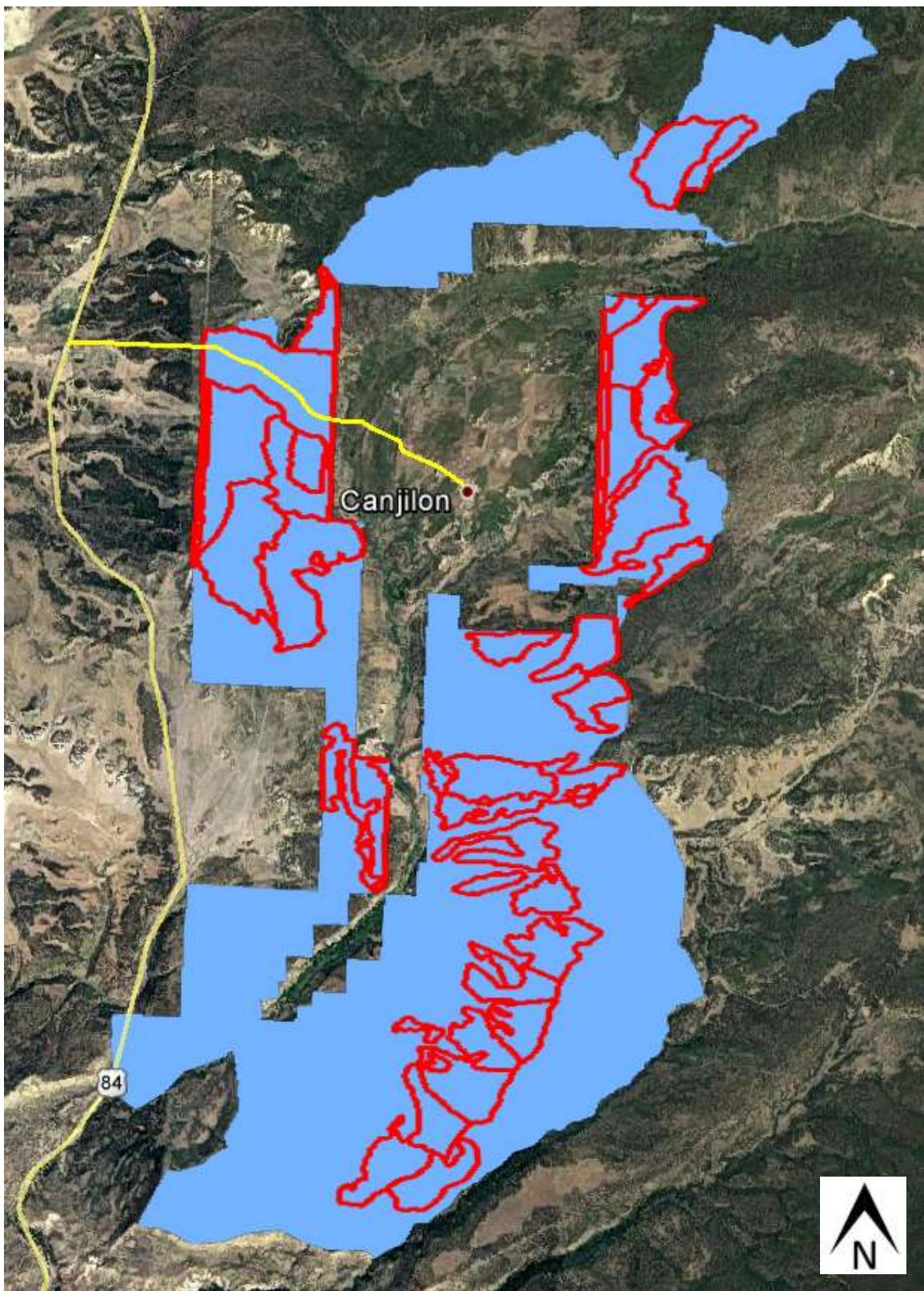
**Table 3:** A complete list of the CWUI thinning units that are completed or currently in-progress as of August 2016.

	<b>Treatment Block</b>	<b>Unit</b>	<b>Completed as of August 2016</b>	<b>Acres</b>
1	La Mesita (1)	SR115-CCC-SRS HWY 115 Corridor	Yes	315
2	La Mesita (1)	SRS- Unit 1- Power line corridor	Yes	40
3	La Mesita (1)	SRS- Unit 2	Yes	62
4	La Mesita (1)	SHFP 2016 FA Thinning	No	60
5	La Mesita (1)	SHFP 2016 Unit 1	No	124
6	La Mesita (1)	SHFP 2016 Unit 2	No	250
7	La Mesita (1)	SHFP 2016 Unit 3	No	253
8	La Mesita (1)	NMSF 4	No	109
9	La Mesita (1)	NMSF 5	No	88
10	Juan Domingo (2)	CCC CFRP Unit 1	Yes	100
11	Juan Domingo (2)	CCC CFRP Unit 2	Yes	16
12	Juan Domingo (2)	CCC CFRP Unit 3	Yes	28
13	Juan Domingo (2)	CCC CFRP Unit 4	Yes	77
14	Juan Domingo (2)	La Alba CFRP Unit 1a & 1b	Yes	79
15	Juan Domingo (2)	La Alba CFRP Unit 2	Yes	96
16	Juan Domingo (2)	La Alba CFRP Unit 3	Yes	140
17	Juan Domingo (2)	NMDGF BGEF Unit 1	Yes	134
18	Juan Domingo (2)	NMDGF BGEF Unit 2	Yes	68
19	Juan Domingo (2)	NMSF 2	Yes	98
20	Juan Domingo (2)	NMSF 3	Yes	60
21	Juan Domingo (2)	NMSF 6	No	161
22	Juan Domingo (2)	NMSF 7	No	106
23	Juan Domingo (2)	NMSF 8	No	29
24	Juan Domingo (2)	NMSF 9	No	111
25	Juan Domingo (2)	NMSF 10	No	113
26	Juan Domingo (2)	RMYC- SRS- Stewardship	Yes	79
27	Juan Domingo (2)	SHFP-WO-FY15- WFHF	Yes	87
28	Montoya (3)	SHFP-WO-FY15- M16	Yes	180
29	Montoya (3)	SHFP-WO-FY15- M19	Yes	52
30	Montoya (3)	SHFP 2016 Unit 4	No	39
31	Montoya (3)	SHFP 2016 Unit 5	No	136
32	Montoya (3)	SHFP 2016 Unit 6	No	91
33	Montoya (3)	SHFP 2016 Unit 7	No	56
34	Montoya (3)	SHFP 2016 Unit 8	No	111
35	Fuertes (4)	NMSF 1a & 1b	Yes	212
Sum				3,760

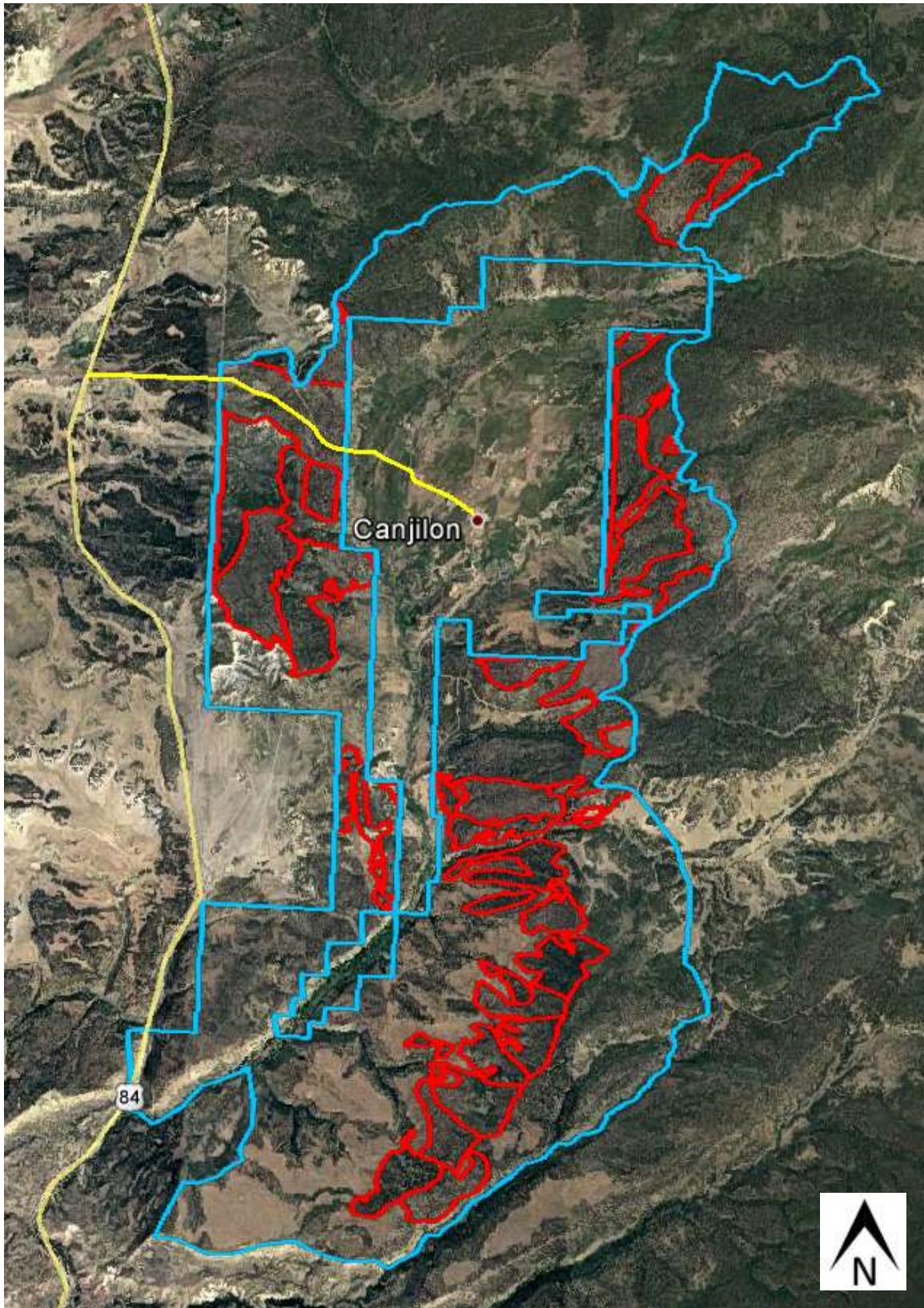
## Priority Treatment Blocks Canjilon WUI



**Figure 7:** CWUI was broken up into 4 Priority Treatment Blocks<sup>9</sup>. All thinning units are categorized into these blocks.



**Figure 8:** Shows all of the unit boundaries in red and where they are located within the larger blocks of the CWUI Project area (shaded in blue). (Google Earth Imagery with US Forest Service shapefiles)



**Figure 9:** Shows the terrain and forested areas within the CWUI Project boundary in blue. The thinning unit boundaries can be seen outlined in red. (Google Earth Imagery with US Forest Service shapefiles)

## **Lessons Learned**

Securing funding is a challenging part of the CWUI project. The implementation process required securing funds from multiple avenues, both internal and external. This is where collaboration proved effective in supporting the implementation of the CWUI project. Another potential source to treat stands could have been to continue with personal use and commercial use fuelwood blocks. This program benefited dozens of stakeholders and gave the community a sense of ownership in the project since they were actively assisting the USFS with treatments<sup>26</sup>. However, this was discontinued because of lack of USFS personnel.

Prescribed fire treatments have been an obstacle. The public is less accepting of this in units where there has been prescribed fire induced mortality<sup>26</sup>. The disposal of slash piles after thinning treatments has been challenging in the PJ stands because of their large quantities. This leads to increased mortality, a perception not viewed as positive by the general public. The USFS is utilizing adaptive management to try jackpot burning/broadcast burning, rather than piles, in PJ stands in hopes to ameliorate mortality<sup>26</sup>.

Restoration efforts are limited since there is a diameter cap in place for the CWUI project. This diameter cap of 12 inches was chosen during the NEPA analysis and cannot be changed without re-conducting a NEPA analysis. Removal of large trees that have bad form, are severely diseased, or dying cannot be removed because of the diameter cap. There are also situations where the stands are even aged and many of them are above the diameter limit. Creating an un-even aged structure in this stand would require the removal of some larger trees in order to create gaps and openings for the next cohort of trees.



## **References**

1. USDA. The United States Forest Service- An Overview. 2008. Retrieved from:  
[http://www.fs.fed.us/documents/USFS\\_An\\_Overview\\_0106MJS.pdf](http://www.fs.fed.us/documents/USFS_An_Overview_0106MJS.pdf)
2. The National Forests of the United States. Forest History Society. Retrieved from:  
<http://www.foresthistory.org/>
3. Dooley, J.H., Christopher J. Lanning, and David N. Lanning. 2015. Conceptual Specification of Forest Residues Balers using the Appreciative Design Method. American Society of Agricultural and Biological Engineers, St. Joseph, Michigan. 2015 ASABE Annual International Meeting. Retrieved from:  
<http://elibrary.asabe.org/azdez.asp?search=1&JID=5&AID=45925&CID=norl2015&v=&i=&T=1&urlRedirect>
4. US Census Bureau. Canjilon, N.M. 2010.
5. South Central Climate Science Center. 2013. Drought History for the Northern Mountains of New Mexico. Retrieved from: <http://www.southcentralclimate.org/>
6. Graphiq Inc. 2017. Weather Data. Canjilon, N.M.. Retrieved from:  
<https://rainfall.weatherdb.com/>.
7. Graphiq Inc. 2017. Weather Data. Tierra Amarilla N.M.. Retrieved from:  
<https://rainfall.weatherdb.com/>
8. Bentz, Barbara; Logan, Jesse; MacMahon, Jim; Allen, Craig D.; Ayres, Matt; Berg, Ed; Carroll, Allan; Hansen, Matt; Hicke, Jeff; Joyce, Linda; Macfarlane, Wallace; Munson, Steve; Negron, Jose; Paine, Tim; Powell, Jim; Raffa, Ken; Regniere, Jacques; Reid, Mary; Romme, Bill; Seybold, Steven J.; Six, Diana; Tombak, Diana; Vandygriff, Jim; Veblen, Tom; White, Mike; Witcosky, Jeff; Wood, David. 2009. Bark beetle outbreaks in western North America: Causes and consequences. Bark Beetle Symposium; Snowbird, Utah; November, 2005. Salt Lake City, UT: University of Utah Press.
9. USDA Forest Service, Southwestern Region. Environmental Assessment for Canjilon Wildland Urban Interface, Carson National Forest. October 2010.
10. Tausch, R.J and Sharon Hood. 2007. Chapter 4. Pinyon/Juniper Woodlands. USDA Forest Service. Gen. Tech. Rep. RMRS-GTR-202. Retrieved from:  
[http://www.fs.fed.us/rm/pubs/rmrs\\_gtr202/rmrs\\_gtr202\\_057\\_071.pdf](http://www.fs.fed.us/rm/pubs/rmrs_gtr202/rmrs_gtr202_057_071.pdf)
11. Swetnam, T.W.; Betancourt, J.L. 1998. Mesoscale disturbance and ecological response to decadal climatic variability in the American Southwest. Journal of Climate. 11: 3128-3147.
12. Reynolds, Richard T.; Sánchez Meador, Andrew J.; Youtz, James A.; Nicolet, Tessa; Matonis, Megan S.; Jackson, Patrick L.; DeLorenzo, Donald G.; Graves, Andrew D. 2013. Restoring composition and structure in Southwestern frequent- re forests: A science-based framework for improving ecosystem resiliency. Gen. Tech. Rep. RMRS- GTR-310. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 76 p.
13. USDA. Forest Service. Fire Terminology. Retrieved from:  
<https://www.fs.fed.us/nwacfire/home/terminology.html>
14. National Environmental Policy Act. 1969. United States Congress. Washington, D.C.

15. USDA. US Forest Service. Retrieved from:  
[http://www.fs.usda.gov/Internet/FSE\\_MEDIA/stelprd3822590.gif](http://www.fs.usda.gov/Internet/FSE_MEDIA/stelprd3822590.gif)
16. Babbit, Bruce and Dan Glickman. September 2000. Managing the Impact of Wildfires on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000. Retrieved from:  
<https://www.doi.gov/sites/doi.gov/files/migrated/pmb/owf/upload/2000-Report-to-the-President.pdf>
17. USDA Forest Service; US Department of the Interior. 2001. National Fire Plan. A report to the President in response to the wildfires of 2000, Sept. 8, 2000: managing the impact of wildfires on communities and the environment. Washington, DC.
18. Department of Interior. August 2001. A Collaborative Approach for Reducing Wildfire Risks to Communities and the Environment. 10-Year Comprehensive Strategy. Retrieved from:  
<https://www.doi.gov/sites/doi.gov/files/migrated/pmb/owf/upload/10-year-strategy-final.pdf>
19. Act, H. F. R. (2003). United States Congress. Washington, DC. Retrieved from:  
<https://legcounsel.house.gov/Comps/Healthy%20Forests%20Restoration%20Act%20Of%202003.pdf>
20. Department of Interior and USDA Forest Service. 2016. Retrieved from:  
<https://www.forestsandrangelands.gov/communities/cwpp.shtml>
21. Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities. March 2004. Retrieved from:  
<https://www.forestsandrangelands.gov/>
22. Walsh Environmental Scientists and Engineers, Barker, J.R. 2008. Upper Chama Community Wildfire Protection Plan. New Mexico Energy, Minerals, and Natural Resources Department. Retrieved from:  
<http://www.emnrd.state.nm.us/SFD/FireMgt/documents/UpperChamaCWPP.pdf>
23. USDA. Canjilon Wildland Urban Interface Project, Decision Notice: Finding of No Significant Impact. 2011
24. USDA. Forest Service. Southwestern Region. Carson National Forest Plan. September 1986. Retrieved from:  
<http://www.fs.usda.gov/detail/carson/landmanagement/planning/>
25. Paul Rhynard. August 5, 2015. News Release. Forest Service Report: Rising firefighting Costs Raises Alarms. Release No. 0225.15 Retrieved from:  
<https://www.usda.gov/wps/portal/usda/usdahome?contentid=2015/08/0225.xml>
26. Romero, Jonathan R.. Carson National Forest. West Zone Fuels Forester. Personal interview. 30 November 2016.
27. Vandendriesche, Don. A compendium of NFS Regional Vegetation Classification Algorithms. 2013. United States Department of Agriculture. Forest Service. Forest Management Service Center. Fort Collins, CO. (pp. R3-4)

## **Appendix I**

Visuals for the 19 completed units, 1,923 acres as of August 2016, were taken by overlaying the unit boundaries (courtesy of the Carson NF) on satellite imagery from Google Earth. The historical satellite imagery was used as a visual of the unit before it was treated and was compared to more recent satellite imagery after the treatments occurred. The side-by-side comparisons showed the change in vegetation, a direct result of thinning. Many of the units were awaiting prescribed fire as a means to dispose of the remaining slash accumulated from thinning. Unit NMSF 2 and NMSF 3 were examples of units that were recently thinned and awaiting appropriate conditions to properly treat slash accumulation.

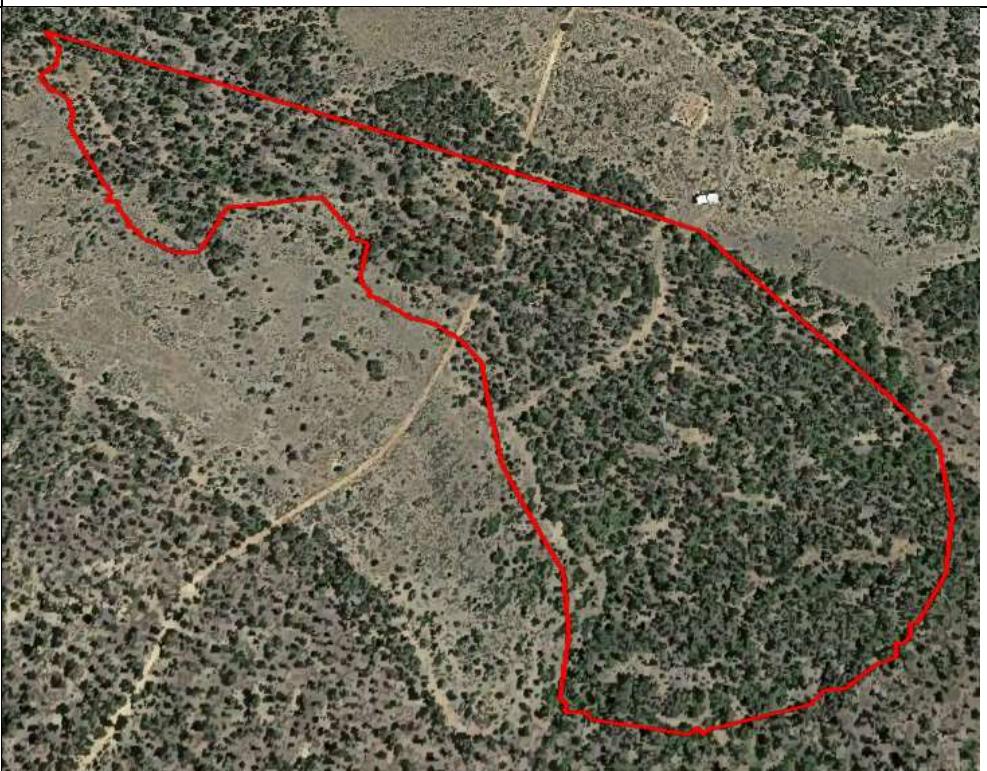
Treatment Block: La Mesita	Unit: SR115-CCC-SRS-HWY 115 Corridor	Acres: 315
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 8/14/2009)	
		

Treatment Block: La Mesita	Unit: SRS- Unit1- Poweline Corridor	Acres: 40
		
Before (Google Earth Image: 5/31/2013)	After (Google Earth Image: 6/16/2016)	

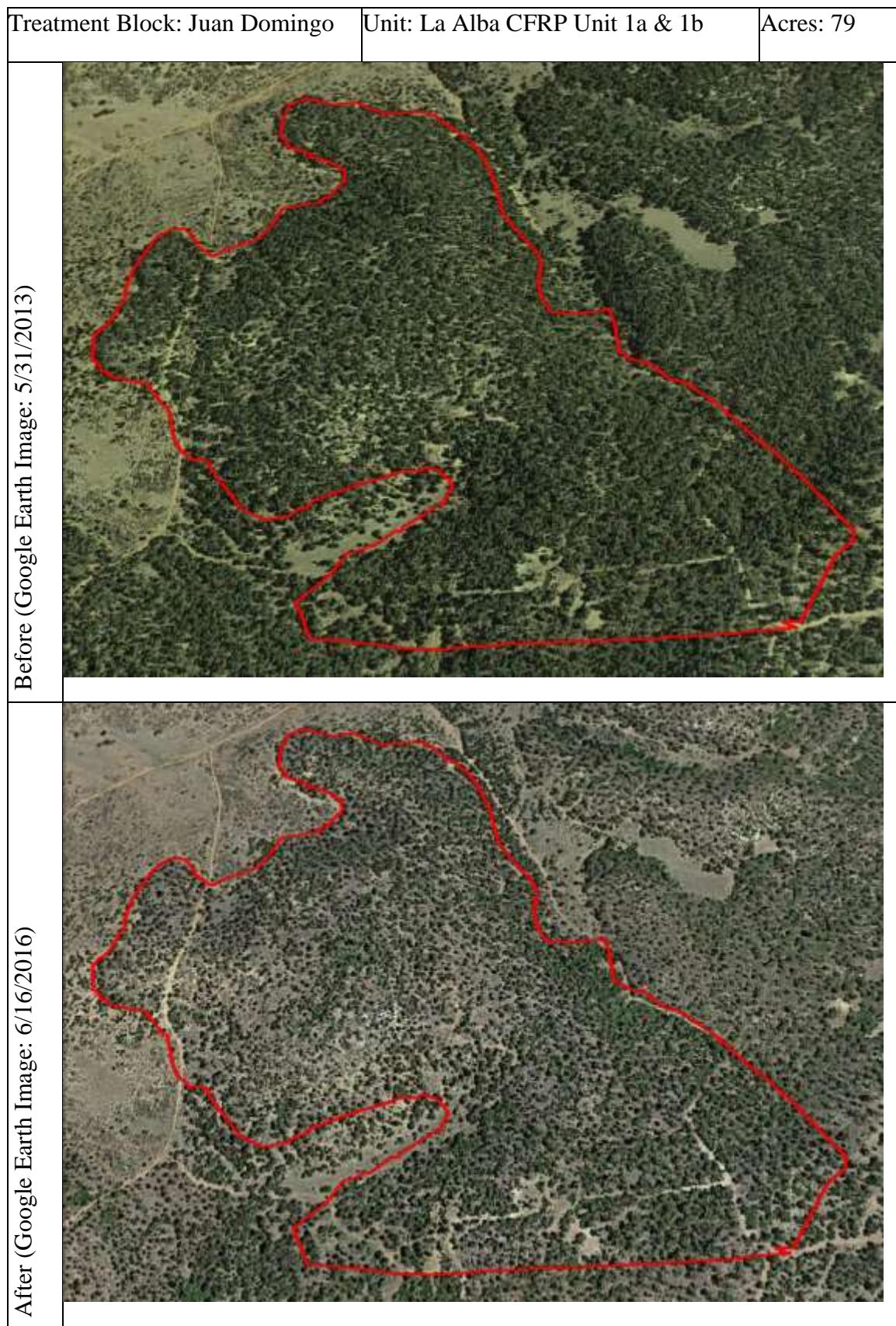
Treatment Block: La Mesita	Unit: SRS- Unit 2	Acres: 62
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	
		

Treatment Block: Juan Domingo	Unit: CCC CFRP Unit1	Acres: 100
		
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	

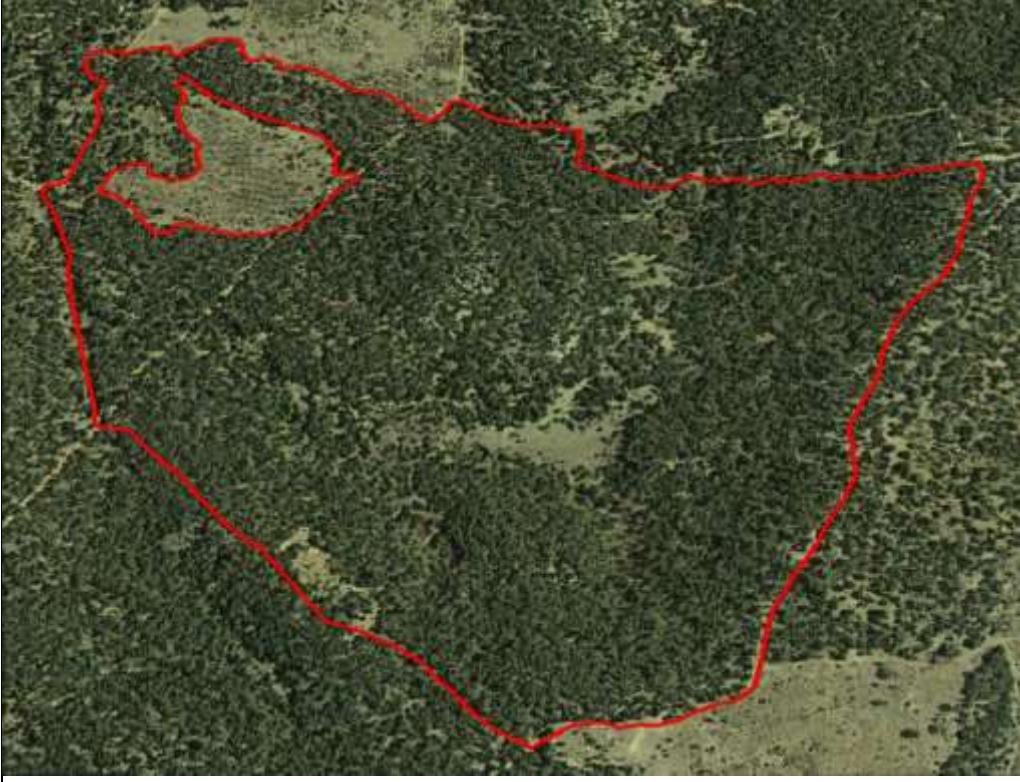
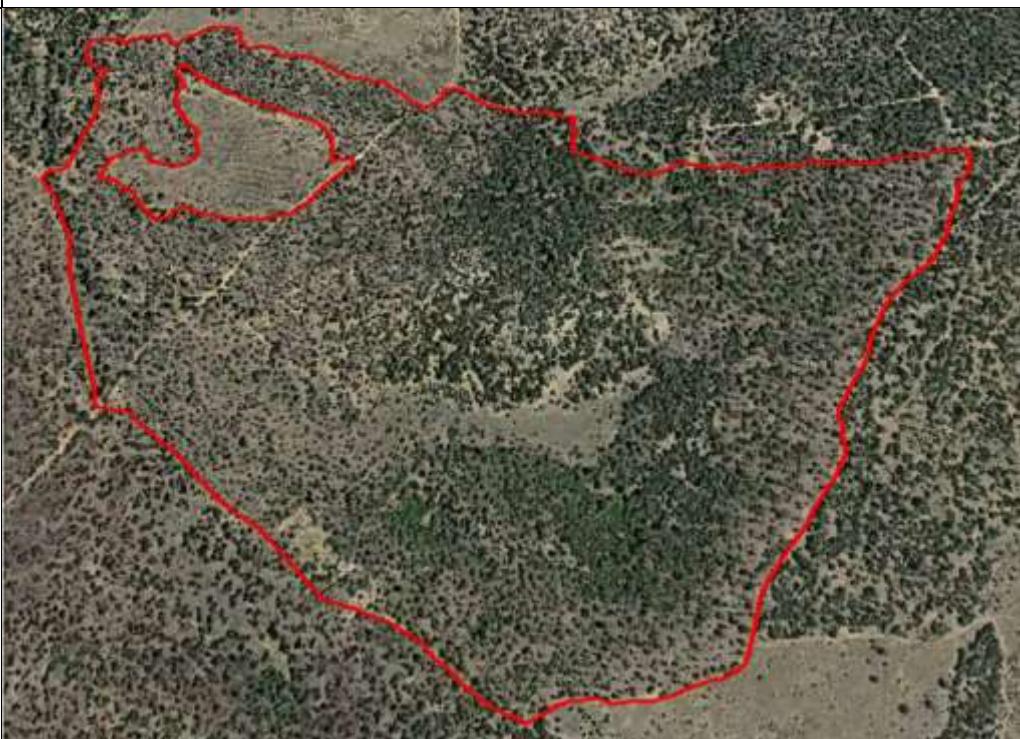
Treatment Block: Juan Domingo	Unit: CCC CFRP Unit 2	Acres: 16
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	

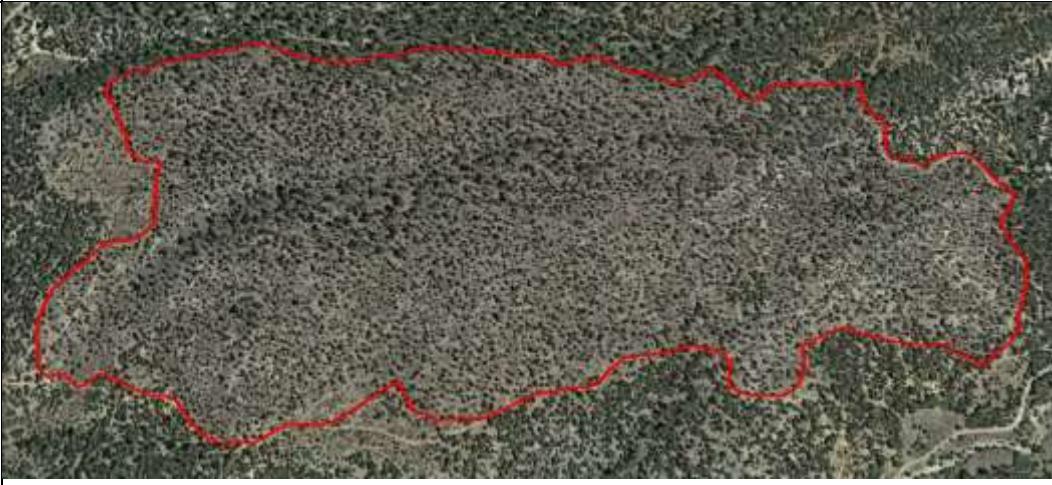
Treatment Block: Juan Domingo	Unit: CCC CFRP Unit 3	Acres: 28
Before (Google Earth Image: 5/31/2013)		
After (Google Earth Image: 6/16/2016)		

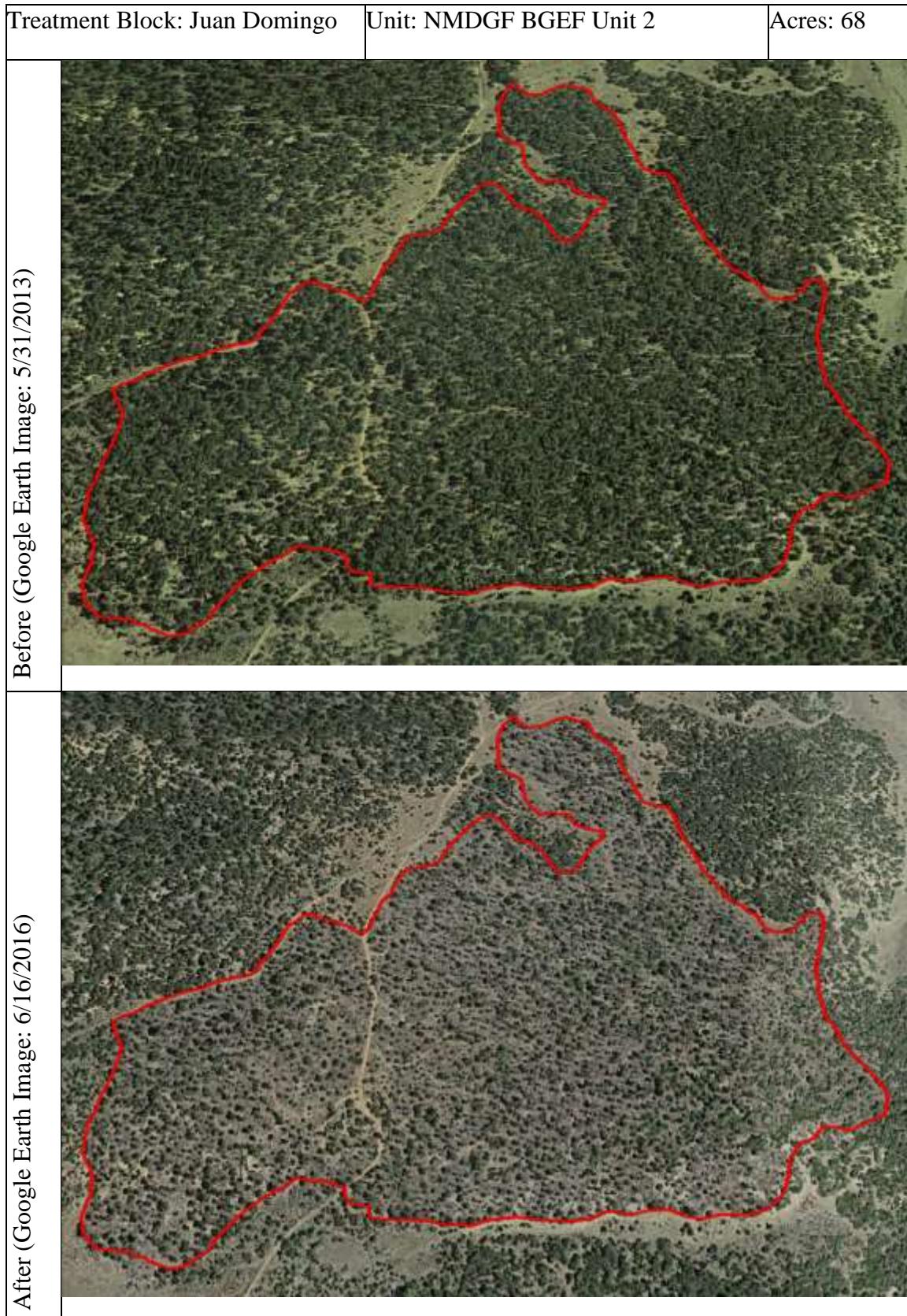
Treatment Block: Juan Domingo	Unit: CCC CFRP Unit 4	Acres: 77
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	
		

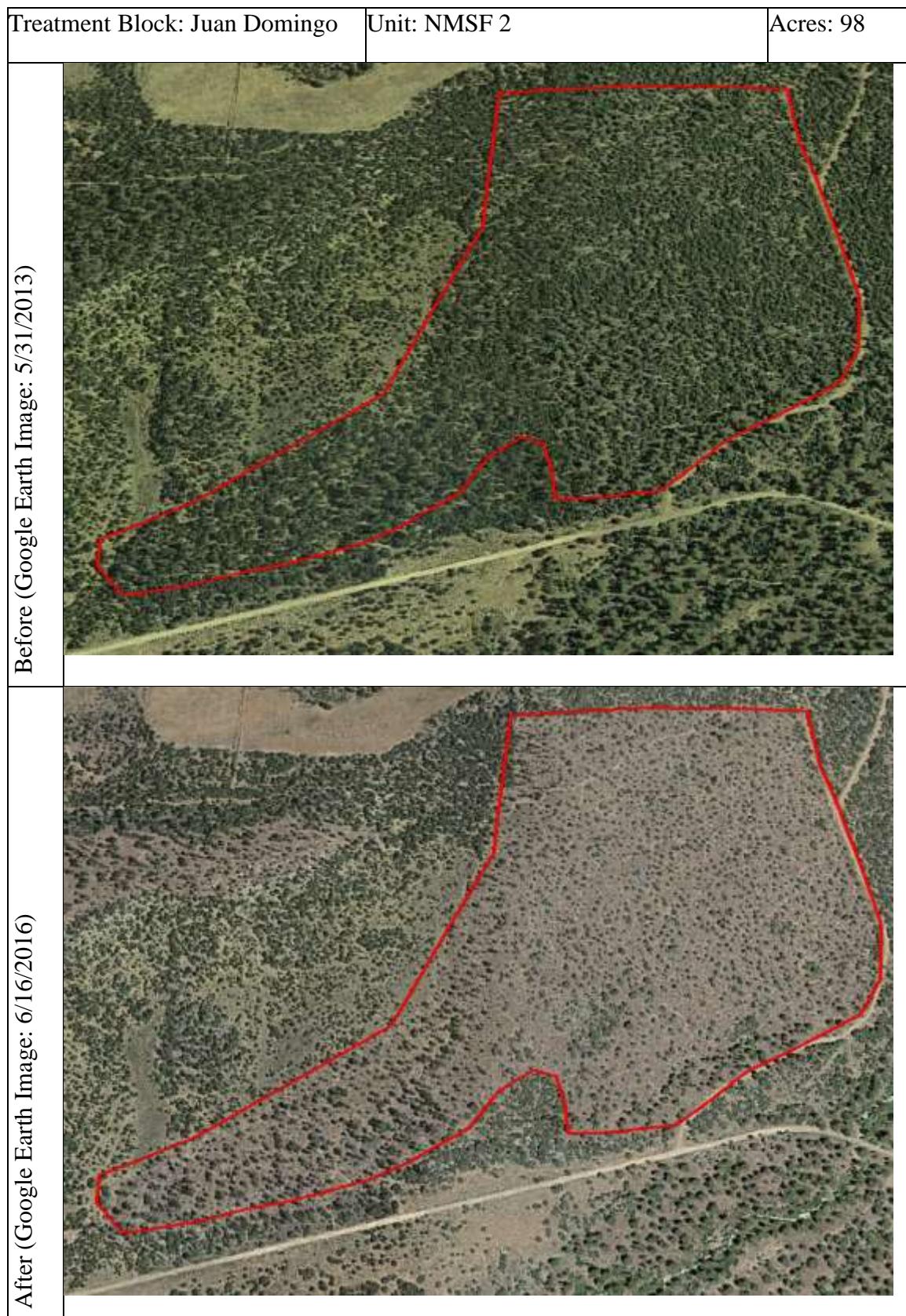


Treatment Block: Juan Domingo	Unit: La Alba CFRP Unit 2	Acres: 96
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	
		

Treatment Block: Juan Domingo	Unit: La Alba CFRP Unit 3	Acres: 140
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	
		

Treatment Block: Juan Domingo	Unit: NMDGF BGEF Unit 1	Acres: 134
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	
		

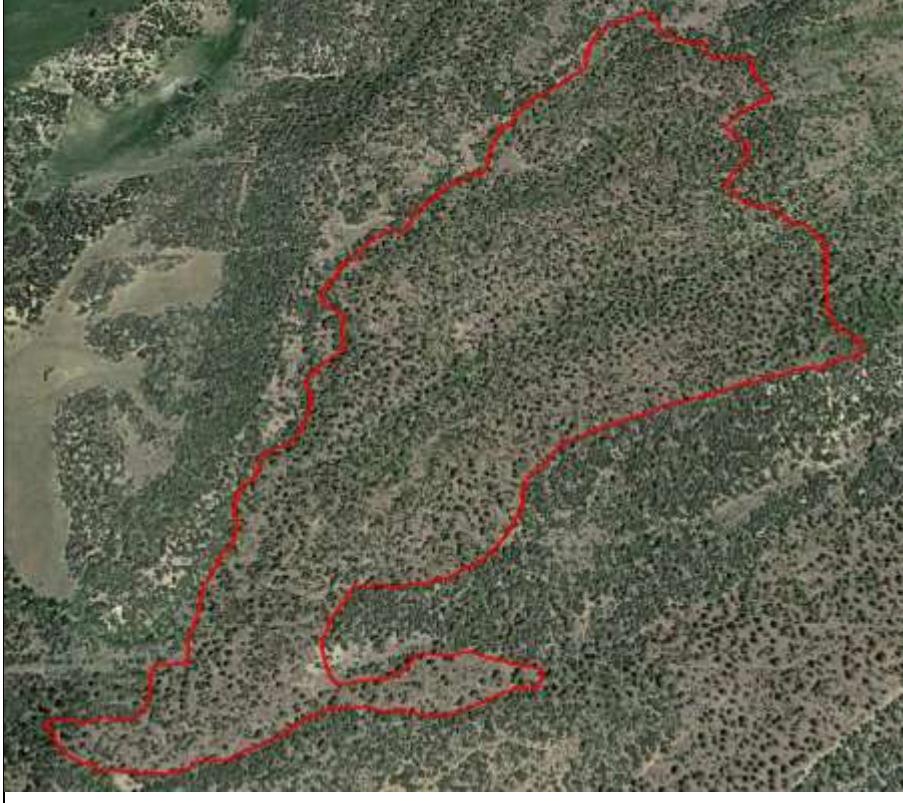




Treatment Block: Juan Domingo	Unit: NMSF 3	Acres: 60
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	An aerial comparison of a forested area. The top image (Before) shows a dense green forest with a red polygon outline. The bottom image (After) shows the same area significantly deforested, appearing brown and sparsely vegetated, with the same red polygon outline. This visual indicates a loss of approximately 60 acres of forest cover between May 2013 and June 2016.

Treatment Block: Juan Domingo	Unit: RMYC-SRS Stewardship	Acres: 79
After (Google Earth Image: 6/16/2016)	Before (Google Earth Image: 5/31/2013)	
		

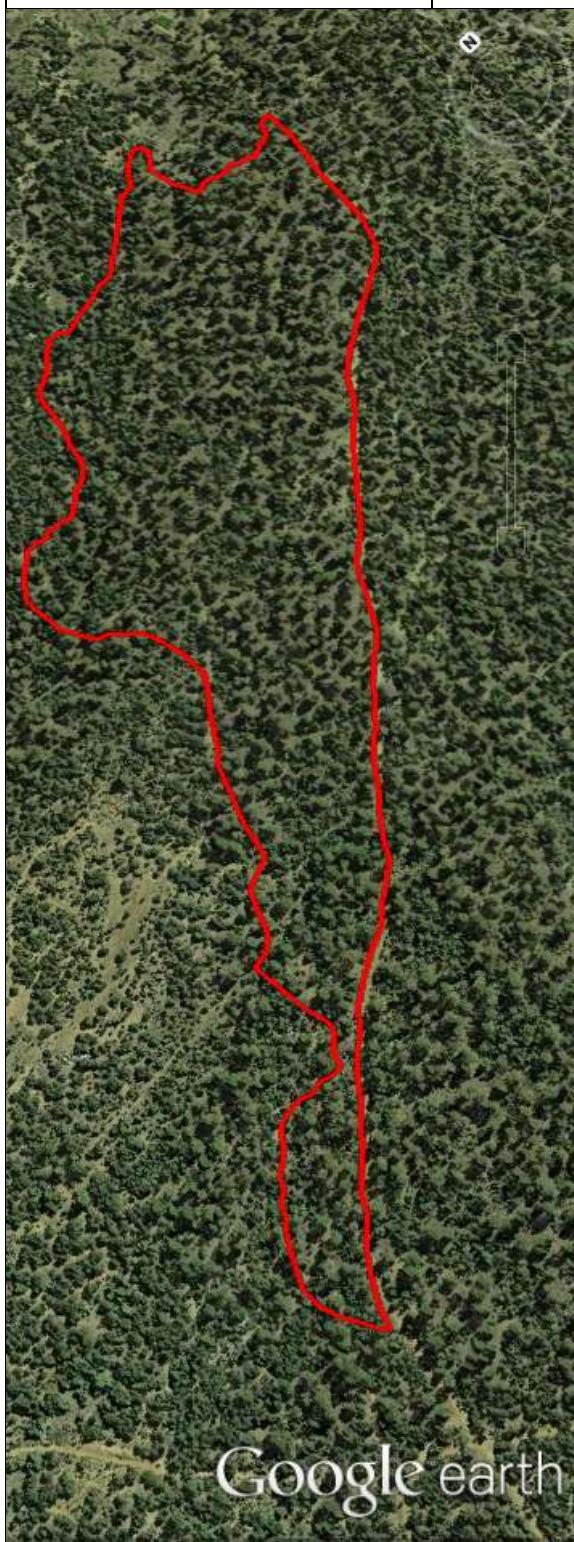
Treatment Block: Juan Domingo	Unit: SHFP- WO- FY15- WFHF	Acres: 87
Before (Google Earth Image: 5/31/2013)		
After (Google Earth Image: 6/16/2016)		

Treatment Block: Montoya	Unit: SHFP- WO- FY15- M16	Acres: 180
Before (Google Earth Image: 5/31/2013)		
After (Google Earth Image: 6/16/2016)		

Treatment Block: Montoya

Unit: SHFP- WO- FY15-M19

Acres: 52



Google earth

Google earth

Before (Google Earth Image: 5/31/2013)

After (Google Earth Image: 6/16/2016)

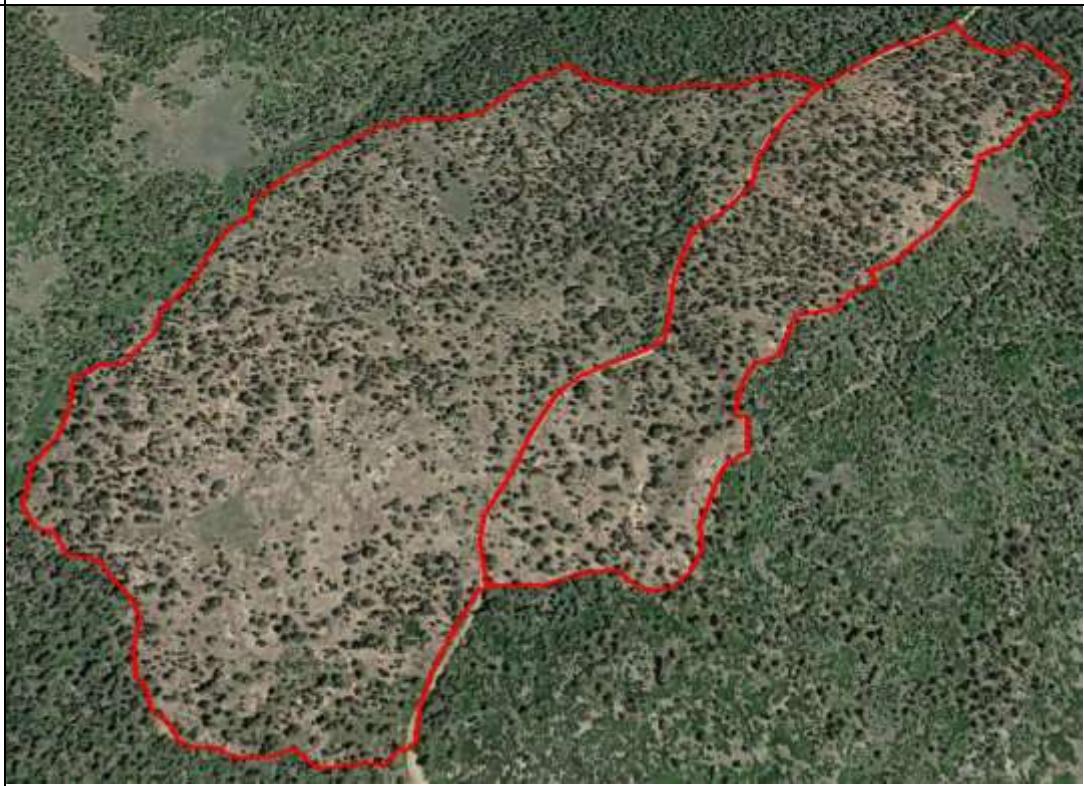
Treatment Block: Fuertes

Unit: NMSF 1a & 1b

Acres: 212

After (Google Earth Image: 6/16/2016)

Before (Google Earth Image: 5/31/2013)



## Appendix II

USDA, FOREST SERVICE

### PRESALE CUTTING UNIT SUMMARY (REF: FSM 2431.23)

P R E  T R E A T M E N T	EXISTING SITE CONDITIONS	I D E N T I T Y	CUTTING UNIT NO	LOCATION	SITE(S)		
		PROJECT NAME	ACRES EST. _____ TRAV. _____				
		T R E A T M E N T	TREATMENT SUMMARY YR      TREATMENT				
		M A P	CERTIFIED SILVICULTURIST _____ DATE _____				
L A Y O U T C R U I S E	MITIGATIONS						
	BD NEEDS						
	KV NEEDS						
	ESTIMATED NET VOLUME _____ MBF/AC      TOTAL MBF _____ CORDS/AC      TOTAL CORDS	SLOPE %	ASPECT	ELEV	HABITAT TYPE & PHASE		
	INDICATE METHOD TO MARK BOUNDARIES & TREES METHOD OF MARK - UNIT BOUNDARIES - GROUP BOUNDARIES - TREES -	S I T E	TES UNIT	SITE INDEX	COVER TYPE	VSS CLASS	BA/ AC
	NEW STANDS? ACRES _____ STAND NO. _____ ACRES _____ STAND NO. _____	MISTL ETOE	BF/AC SOFT- WOOD	CC%	DAMAGE	MSO HAB ITAT	
LAYOUT COMPLETED BY _____ DATE _____ CRUISE DESIGNED BY _____ DATE _____							

R3-FS-2400-50 (CARSON NF EDITION)

**PROJECT NAME:**  
**SITE:**

**CUTTING UNIT:**

**LOCATION:**

**NAME OF TREATMENT:**

**TREATMENT OBJECTIVES:**

**LEAVE TREE PREFERENCE GUIDE:**

Species Preference:

1.

**Pre-commercial Thin:**

1.

**Slash Treatment:**

**CONSTRAINTS AND SPECIAL CONSIDERATIONS:**

1.

**POST THINNING TREATMENTS:**

1.

**Desired Outcome:**

**Prepared BY** \_\_\_\_\_ **DATE -** \_\_\_\_\_

**COMPLETED BY** \_\_\_\_\_ **DATE -** \_\_\_\_\_

Attach the following if applicable:

- Hawksworth Rating System
- Road maps to get to sites

## Appendix III

### Hawksworth six-class Dwarf Mistletoe Rating System

Step 1: Divide live crown into thirds

Step 2: Rate each third separately

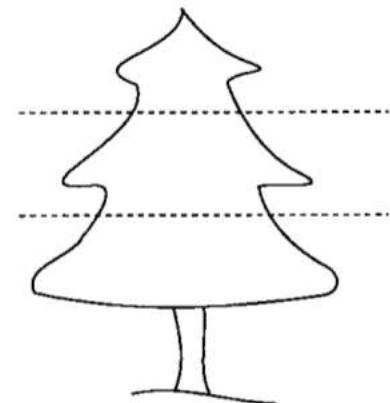
Assign each third either 0, 1, or 2:

0 - No visible infection

1 - Light, less than 1/2 of branches have mistletoe plants

2 - Heavy, more than 1/2 of branches have mistletoe plants and/or brooms

Step 3: Add ratings of each third to obtain total tree rating



EEE

Total rating	Infection level
0	none
1 or 2	light
3 or 4	moderate
5 or 6	heavy

#### Example

This third has no visible infection

0

Less than half this third is infected

1

More than half this third is infected

2

Total rating for this tree

3

