Upper Mora CFRP - Walker Flats Inventory and Monitoring Report

Inventory and Monitoring Work 2017-2018

New Mexico Forest and Watershed Restoration Institute
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Contents

List of Figures

List of Tables

Acronyms and Abbreviations

Acronym, Abbreviation, or Term	Explanation or Definition as used by NMFWRI
CFRP	Collaborative Forest Restoration Program
NMFWRI	New Mexico Forest and Watershed Restoration Institute
RC&D	Resource Conservation and Development Council
USDA	United States Department of Agriculture
USFS	United States Forest Service
FFI	FEAT/ FIREMON Integrated
FEAT	Fire Ecology Assessment Tool
FHTET NIDRM	Forest Health Technology Enterprise Team National Insect and Disease Risk Maps (part of USDA – Forest Service's Forest Health Program)
FIREMON	Fire Effects Monitoring and Inventory System
LANDFIRE EVT	Landscape Fire and Resource Management Planning Tools Project (national mapping program) Existing Vegetation Type
NOAA NWS COOP	National Oceanic and Atmospheric Administration's National Weather Service Cooperative Observer Program (network of volunteer weather stations)
PLANTS symbol	Abbreviation of scientific name used in Plant List of Accepted Nomenclature, Taxonomy & Symbols (USDA database)
WUI	Wildland-Urban Interface, human development in and near undeveloped wildland vegetation
AVE and AVG	Average
BA/AC	Basal area per acre
DBH	Diameter at breast height (4.5 feet)
DIA	Diameter
DRC	Diameter at root collar (used for woodland species only)
DWD	Down woody debris
HD	Herbaceous dead (dead non-woody species)
HL	Herbaceous live (live non-woody species; herbs)
HT	Height
HUC	Hydrologic Unit Code
LiCrBHt	Live Crown Base Height, distance from ground to start of live crown
MC	Mixed-conifer
PJ	Piñon-Juniper
QMD	Quadratic mean diameter, always equal to or greater than mean DBH, always an average
SD	Standing dead (dead woody species)
SL	Standing live (live woody species)
TPA	Trees per acre (Trees/acre)
WF	Walker Flats unit (in plot IDs, abbreviated RC for Rio la Casa)
Chain	66 feet
Sapling	Height is over 4.5 feet but DBH is under 5"
Seedling	Height is under 4.5 feet
"Tree"	Height is over 4.5 feet, with DBH over 5"; includes "live" and "sick" individuals

USDA PLANTS symbols

Symbol	ITIS TSN	Scientific Name	Common Name	Family	Prf. Lifeform
2S			Shrub, other/unknown		Shrub
ABCO	181826	Abies concolor	white fir	Pinaceae	Tree
ABLAA	181833	Abies lasiocarpa var. arizonica	corkbark fir	Pinaceae	Tree
ACGL	28742	Acer glabrum	Rocky Mountain maple	Aceraceae	Tree
ALINT	181889	Alnus incana ssp. tenuifolia	thinleaf alder, mountain alder	Betulaceae	Tree
AMAL2	25109	Amelanchier alnifolia	Saskatoon serviceberry	Rosaceae	Tree
ARUV	23530	Arctostaphylos uva-ursi	Kinnikinnick, bearberry	Ericaceae	Subshrub
CEFE	28467	Ceanothus fendleri	Fendler's ceanothus, buckbrush	Rhamnaceae	Shrub
CEMO2	25136	Cercocarpus montanus	alderleaf mountain mahogany	Rosaceae	Tree
CLLI2	18702	Clematis ligusticifolia	western white clematis, Virgin's bower	Ranunculaceae	Vine
JAAM	24379	Jamesia americana	fivepetal cliffbush, waxflower	Hydrangeaceae	Shrub
JUCO6	194820	Juniperus communis	common juniper	Cupressaceae	Tree
JUMO	194853	Juniperus monosperma	oneseed juniper	Cupressaceae	Tree
JUSC2	194872	Juniperus scopulorum	Rocky Mountain juniper	Cupressaceae	Tree
MARE11	195045	Mahonia repens	creeping barberry, holly	Berberidaceae	Subshrub
PAMY	504149	Paxistima myrsinites	Oregon boxleaf, mountain lover	Celastraceae	Shrub
PIED		Pinus edulis	twoneedle pinyon	Pinaceae	Tree
PIEN	183291	Picea engelmannii	Engelmann spruce	Pinaceae	Tree
PIFL2	183343	Pinus flexilis	limber pine	Pinaceae	Tree
PIPO	183365	Pinus ponderosa	ponderosa pine	Pinaceae	Tree

PIPU	183307	Picea pungens	blue spruce	Pinaceae	Tree
POTR5	195773	Populus tremuloides	quaking aspen	Salicaceae	Tree
PRVI	24806	Prunus virginiana	Chokecherry, capulin	Rosaceae	Tree
PSME	183424	Pseudotsuga menziesii	Douglas-fir	Pinaceae	Tree
QUGA	19337	Quercus gambelii	Gambel oak	Fagaceae	Tree
RHTR	28791	Rhus trilobata	skunkbush sumac, three-leaf sumac	Anacardiaceae	Shrub
RICE	24457	Ribes cereum	wax currant	Grossulariaceae	Shrub
ROWO	24847	Rosa woodsii	Woods' rose	Rosaceae	Subshrub
RUID	24947	Rubus idaeus	American red raspberry	Rosaceae	Subshrub
SABE2		Salix bebbiana	Bebb willow	Salicaceae	Tree
SHCA	27779	Shepherdia canadensis	russet buffaloberry	Elaeagnaceae	Shrub
SODU2	25323	Sorbus dumosa	Arizona mountain ash	Rosaceae	Shrub
SYMPH	35330	Symphoricarpos	Snowberry, not ID'd to spp level	Caprifoliaceae	Shrub
SYRO		Symphoricarpos rontundifolius	roundleaf snowberry	Caprifoliaceae	Shrub
VACCI	23571	Vaccinium	Whortleberry	Ericaceae	Subshrub
VIAR2	28612	Vitis arizonica	canyon grape	Vitaceae	Vine
YUBA	43134	Yucca baccata	banana yucca	Agavaceae	Subshrub
YUCCA	43116	Yucca	Yucca, not ID'd to spp level	Agavaceae	Shrub

Project Setting

From October 2017 to October 2018, the New Mexico Forest and Watershed Restoration Institute (NMFWRI) monitoring crew conducted monitoring for the USFS in the Walker Flats unit of the Upper Mora CFRP, hereafter referred to as "Walker Flats."

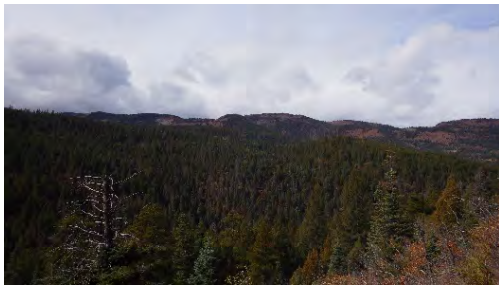


Figure 1. Project overview.

Walker Flats is located in Mora County near the community of Mora, NM, and is part of the 21,628-acre Upper Mora NEPA Planning Project proposed by the Adelante RC&D and other collaborators as a CFRP. From this 21,000 acre landscape assessment, 5,100 acres will be selected for a NEPA assessment. The proposal document "12-16 Capulin/Walker Flats NEPA Planning Projects (Planning-Revision)" contains some background information on the entire project area.

NMFWRI was provided spatial data on the following priority areas: Walker Flats (2,282 ac), Capulin A (2774 ac), Capulin B (3,607 ac), San Jose North (686 ac), and San Jose South/Rociada (399 ac). See Figure 1. Partway through the project, these priority areas were revised to include only Walker Flats and Capulin A. This report covers the monitoring done in the Walker Flats area, since this area was presented to NMFWRI as the highest priority for inventory.

This area is adjacent to a previous 200-acre CFRP project, which was called 03-01 La Jicarita/Walker Flats. See Figure 3 for a map of the previous treatment. A monitoring report on this project can be accessed on the NMFWRI website at https://nmfwri.org/restoration-information/cfrp/cfrp-long-term-monitoring/cfrp-long-term-monitoring-resources/La_Jicarita_5yr_review.pdf/view Other previous CFRPs in the area include 03-06 Upper Mora Watershed Restoration Phase II, which was 200 acres and completed in 2009; 31-10 Walker Flats Watershed Improvement Project-Final Phase, which was 260 acres and completed in 2012; and Forest Service and timber sale thinning on around 100 acres.[1]

Within this 2,282 acre area, the NMFWRI crew monitored 154 of 160 planned plots. See Figure 4 for planned plots, and Figure 5 for plots completed. An additional map showing access to the area can be found in Figure 7.

Landscape Context

The 2,282 acres surveyed by NMFWRI are located in part within the Rio La Casa-Mora River watershed (HUC12: 110800040308), which is a total of 23.58 square miles[2]. From the Walker Flats unit, the Cañoncito and Encinal Creek drainages flow into the Mora River south of Cleveland and eventually on to the Canadian River.

[1] (Adelante RC&D), page 2
[2] (USDA NRCS Geospatial Data Gateway)

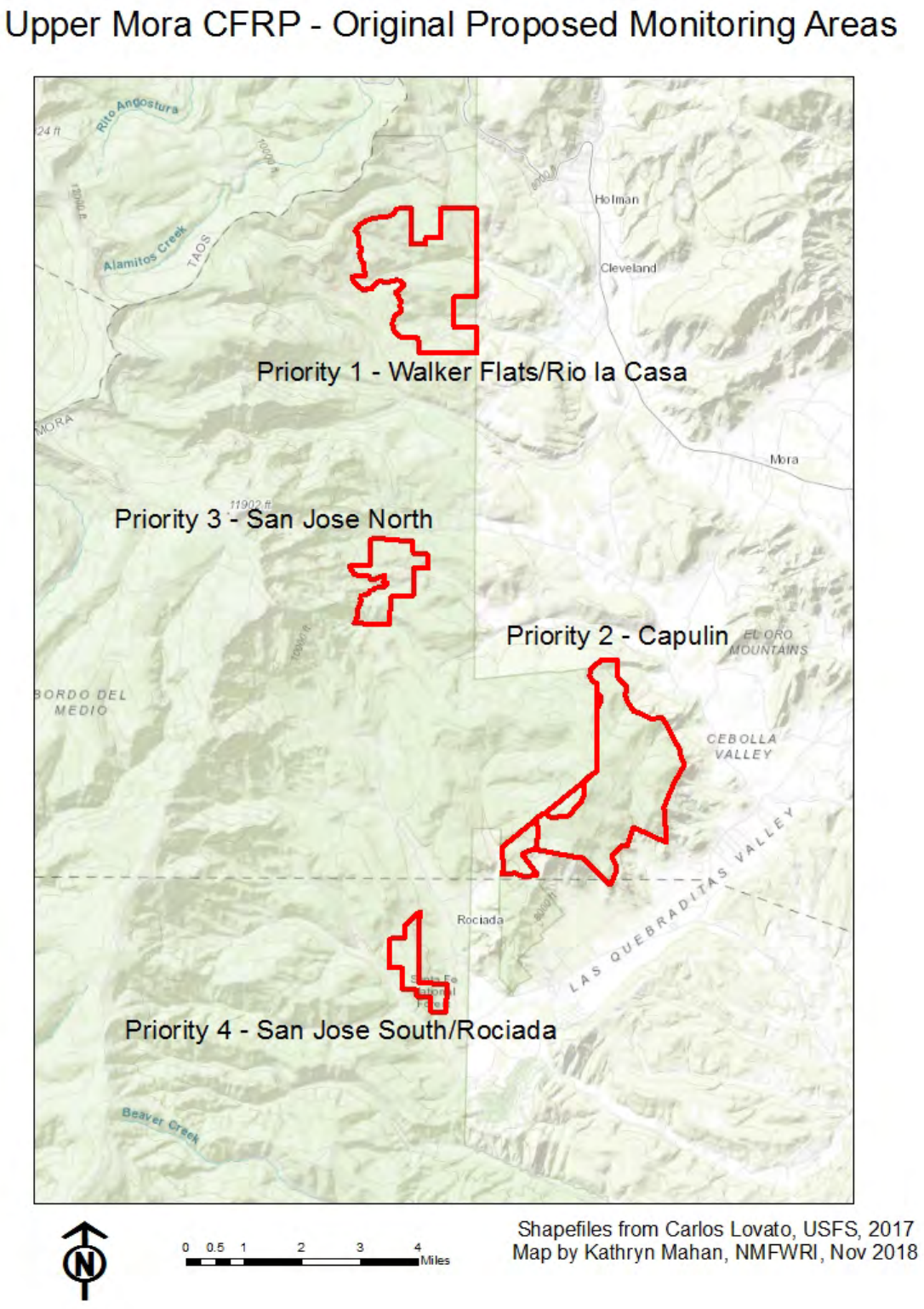


Figure 2. Upper Mora CFRP: original 4 monitoring units proposed to NMFWRI by the SFNF.

Note: The Capulin boundary shown in this map is the amended Capulin 2A boundary.

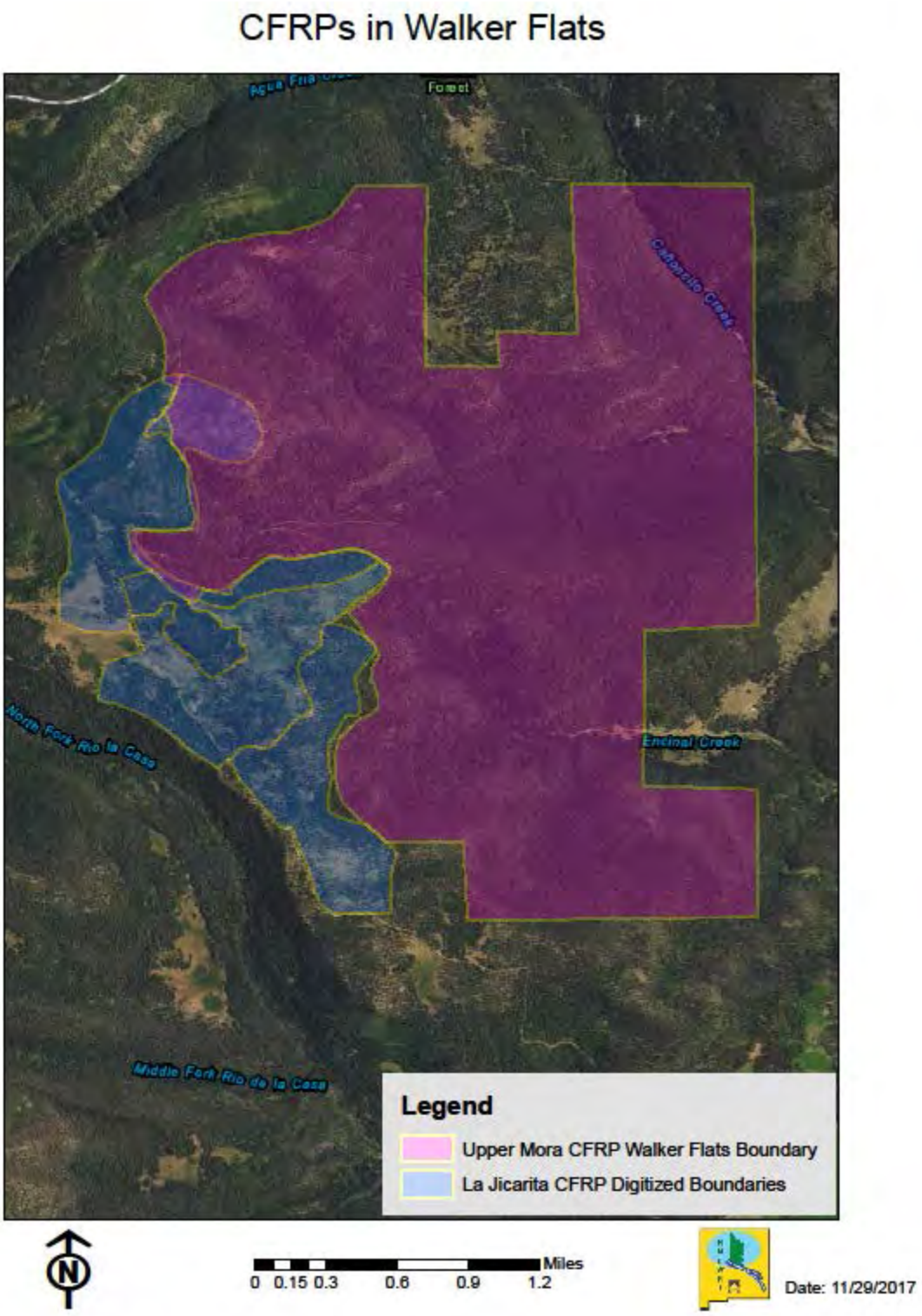


Figure 3. Walker Flats current and previous CFRP areas.

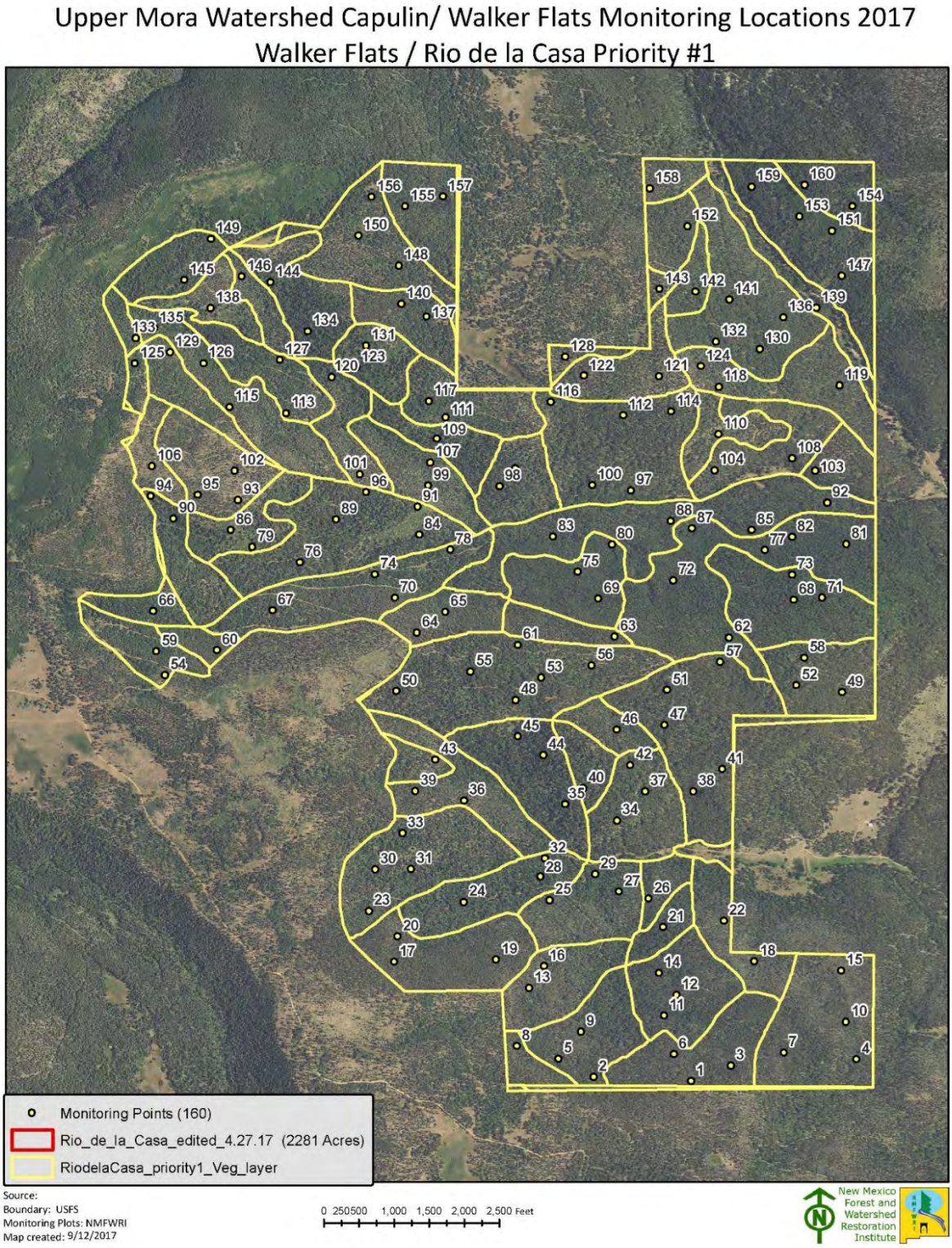


Figure 4. Walker Flats planned plots and stand boundaries.

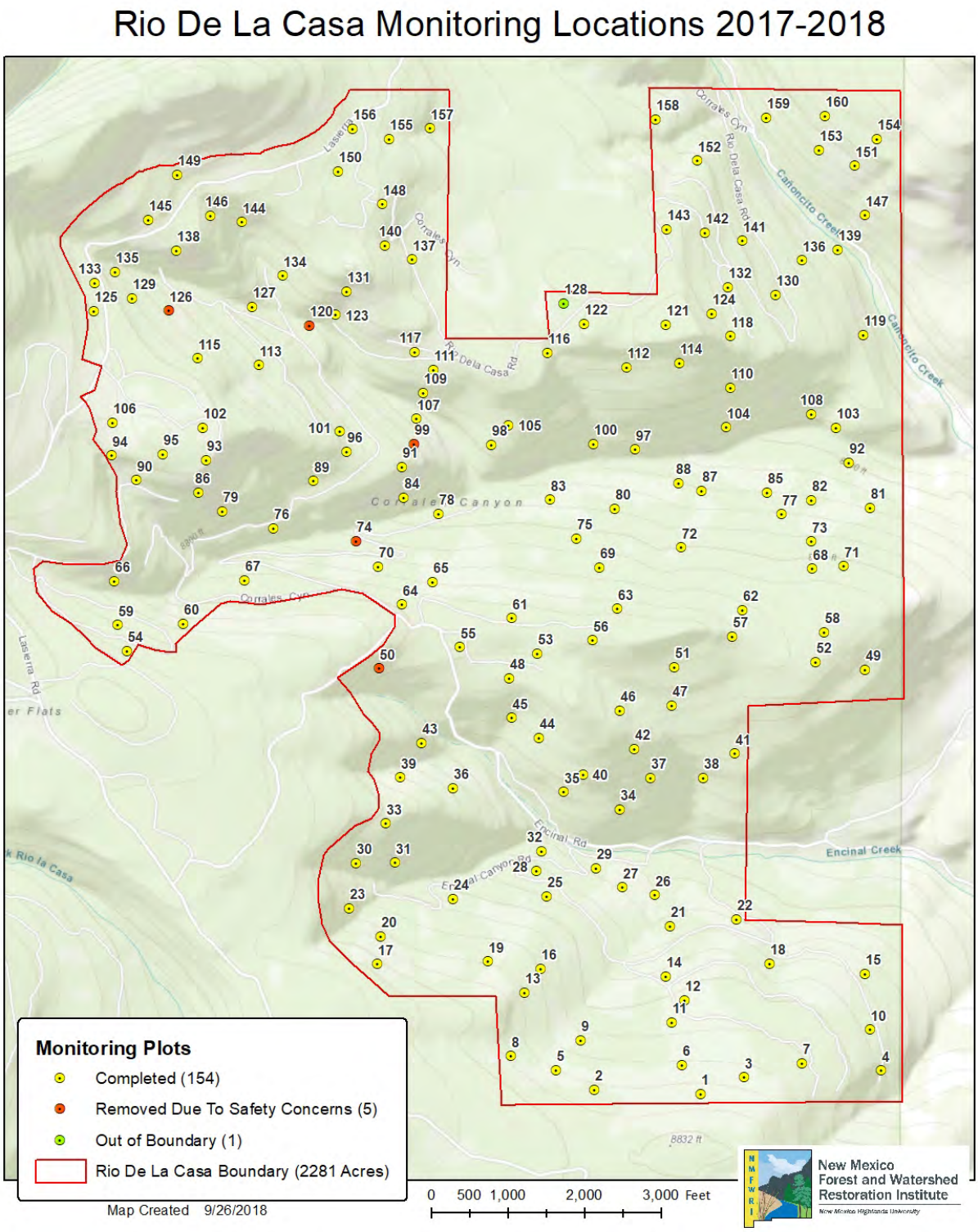


Figure 5. Walker Flats completed plots.

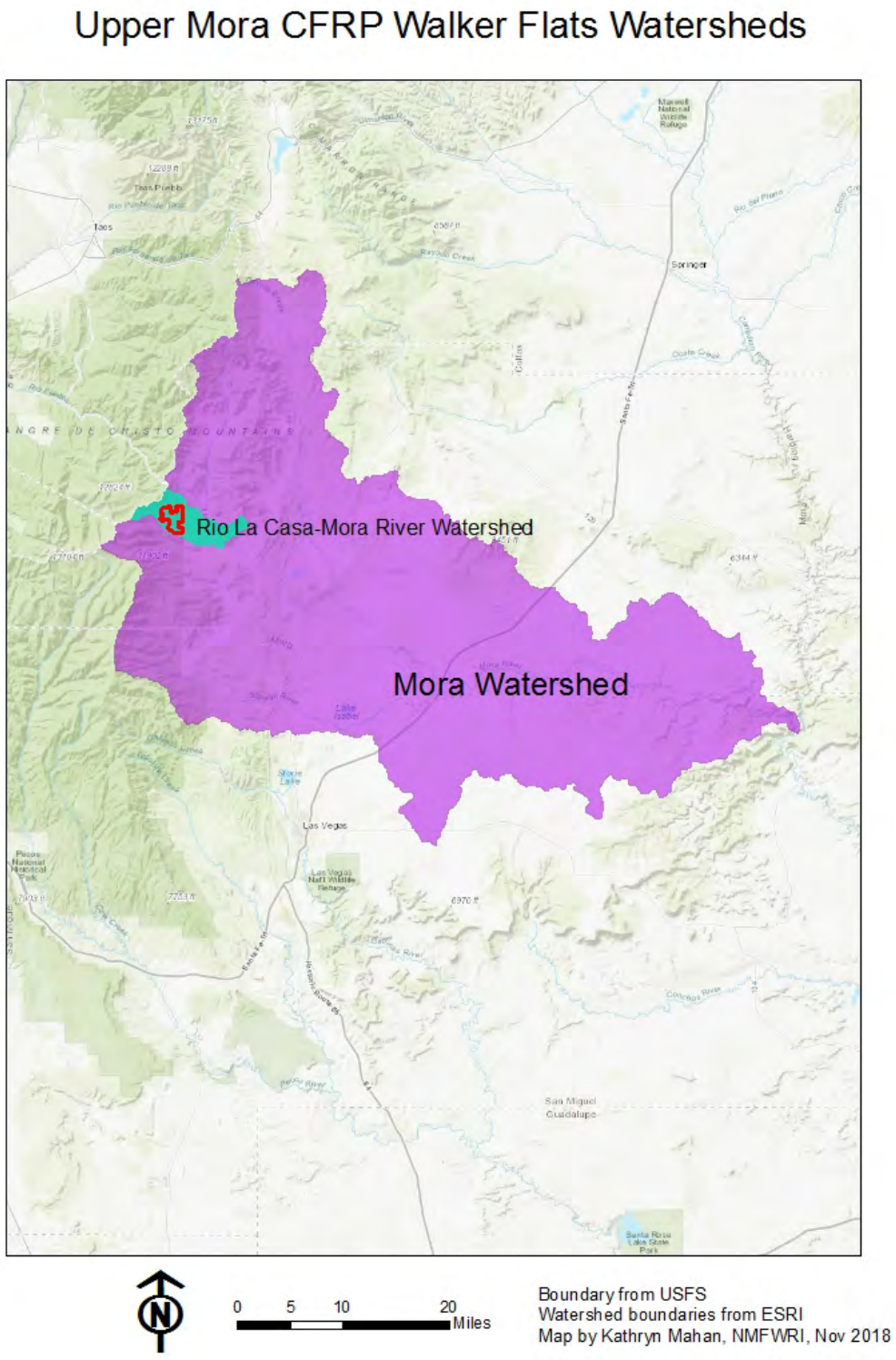


Figure 6. Walker Flats in context of its watersheds.

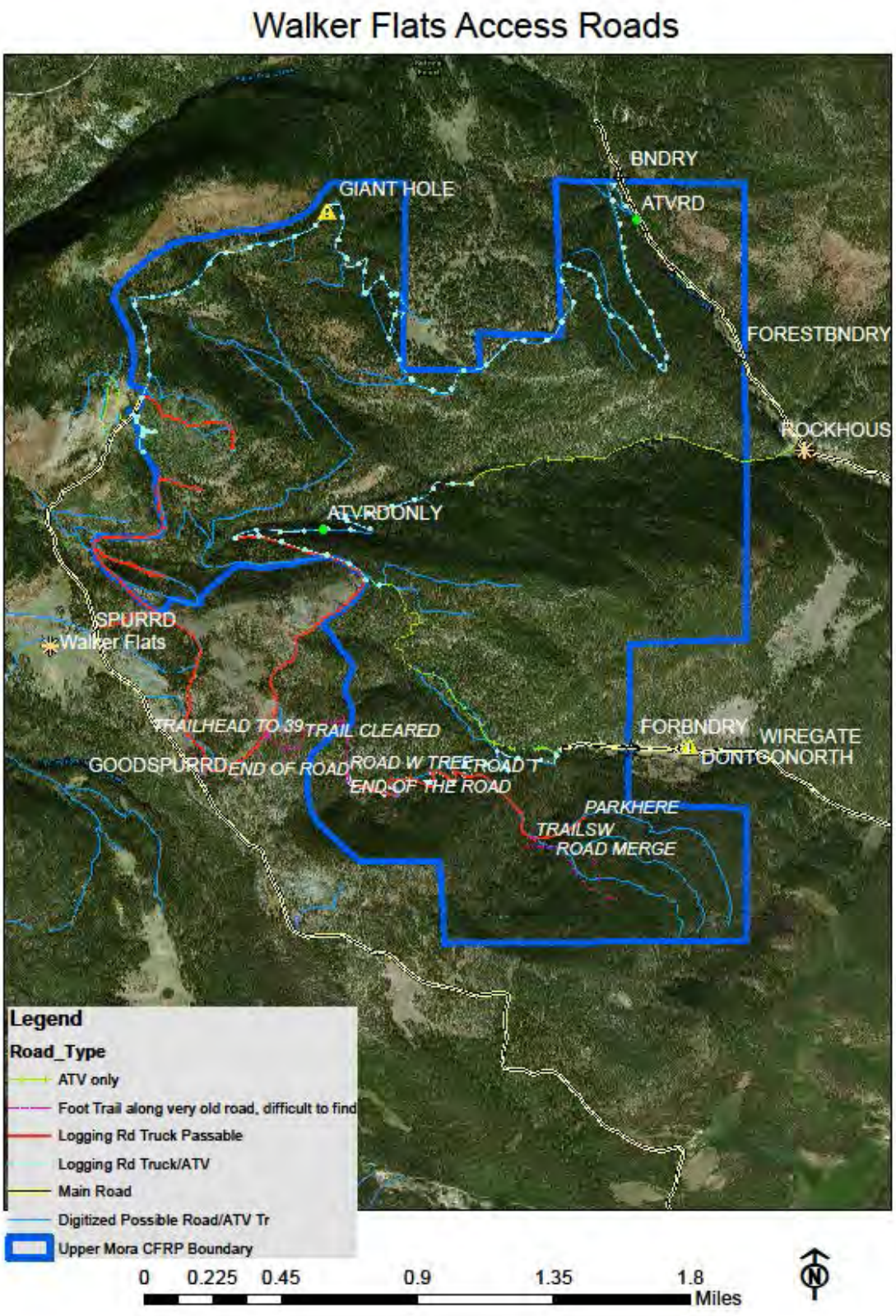


Figure 7. Walker Flats access roads as mapped by NMFWRI field crew.

Climate

According to the Western Regional Climate Center, using an NOAA NWS COOP station in Gascon and monthly climate summaries collected from 1953 to 2016, the average summer high for the area is 76.4 degrees Fahrenheit; the average winter low is 15 degrees Fahrenheit. The average total precipitation is 23.84 inches/year, and the average total snowfall is 114.8 inches/year.[3] The community of Gascon is approximately 9 miles south of Walker Flats, along the mountains. Gascon is located at 8051 feet and the area surveyed by NMFWRI ranged in elevation from 7800 feet to 9200 feet.

Soils

The soils for the Walker Flats project need to be considered carefully along with slope restrictions for areas of concern for project implementation. Soil hazard ratings as described by each soil series are highlighted below to accurately describe the soil hazard rating. The soil condition hazard ratings described below include Harvest Equipment Operability and the Suitability for Log Landings.

Description for Harvest Operability

Ratings for this interpretation indicate the suitability for use of forestland harvesting equipment. The ratings are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification of the soil, depth to a water table, and ponding. Standard rubber-tire skidders and bulldozers are assumed to be used for ground-based harvesting and transport.

The ratings are both verbal and numerical. Rating class terms indicate the degree to which the soils are suited to this aspect of forestland management. "Well suited" indicates that the soil has features that are favorable for the specified management aspect and has no limitations. Good performance can be expected, and little or no maintenance is needed. "Moderately suited" indicates that the soil has features that are moderately favorable for the specified management aspect. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. "Poorly suited" indicates that the soil has one or more properties that are unfavorable for the specified management aspect. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration.

Table 1. Harvest Equipment Operability soil rating classes within the Area of Interest (AOI) which is the Walker Flats Project Area

Rating	Acres in AOI	Percent of AOI
Poorly suited	1,331.1	58.3%
Moderately suited	936.4	41.0%
Well suited	16.0	0.7%
Totals for Area of Interest	**2,283.4**	**100.0%**

[3] (Western Regional Climate Center, 2016)

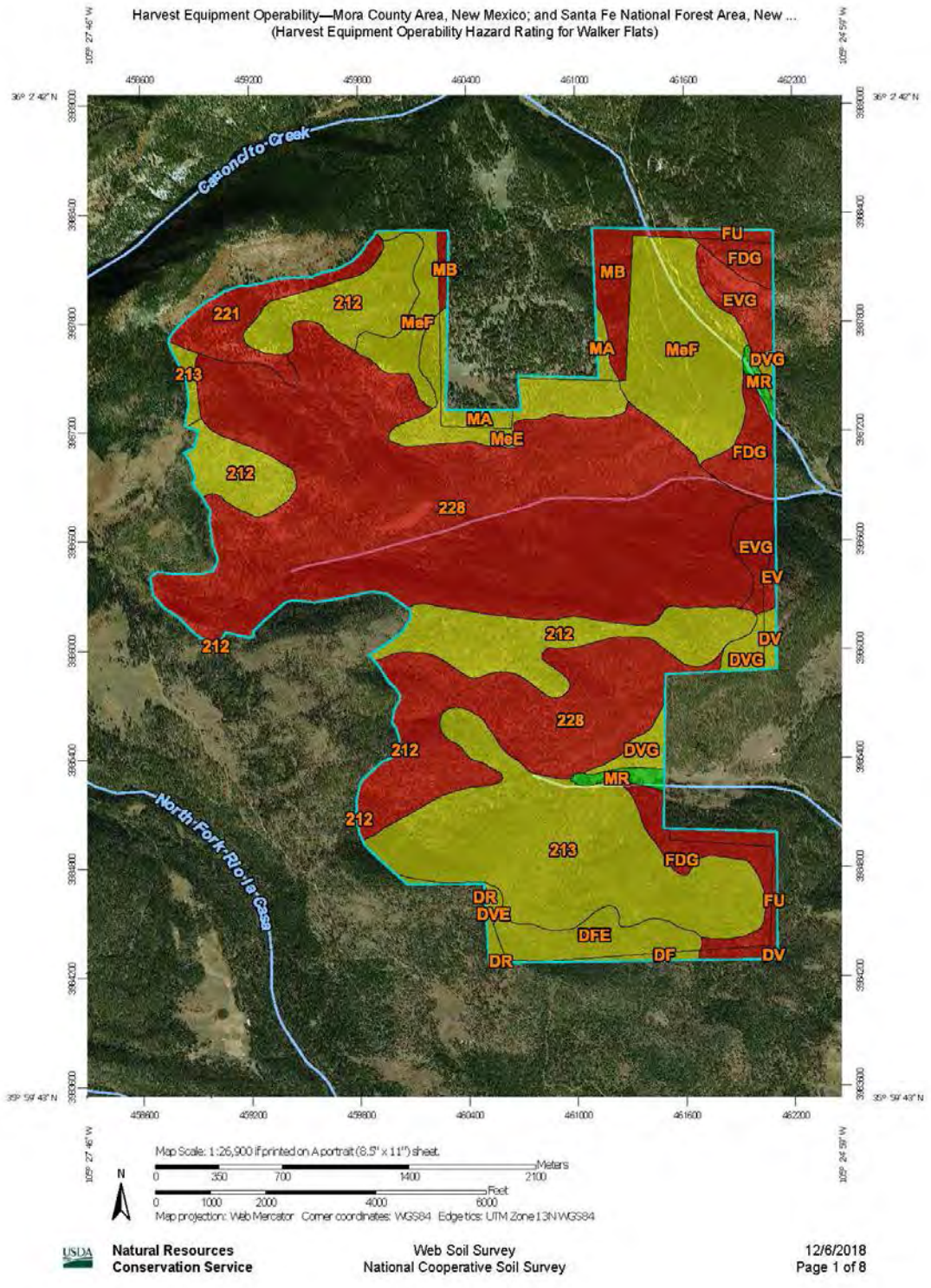
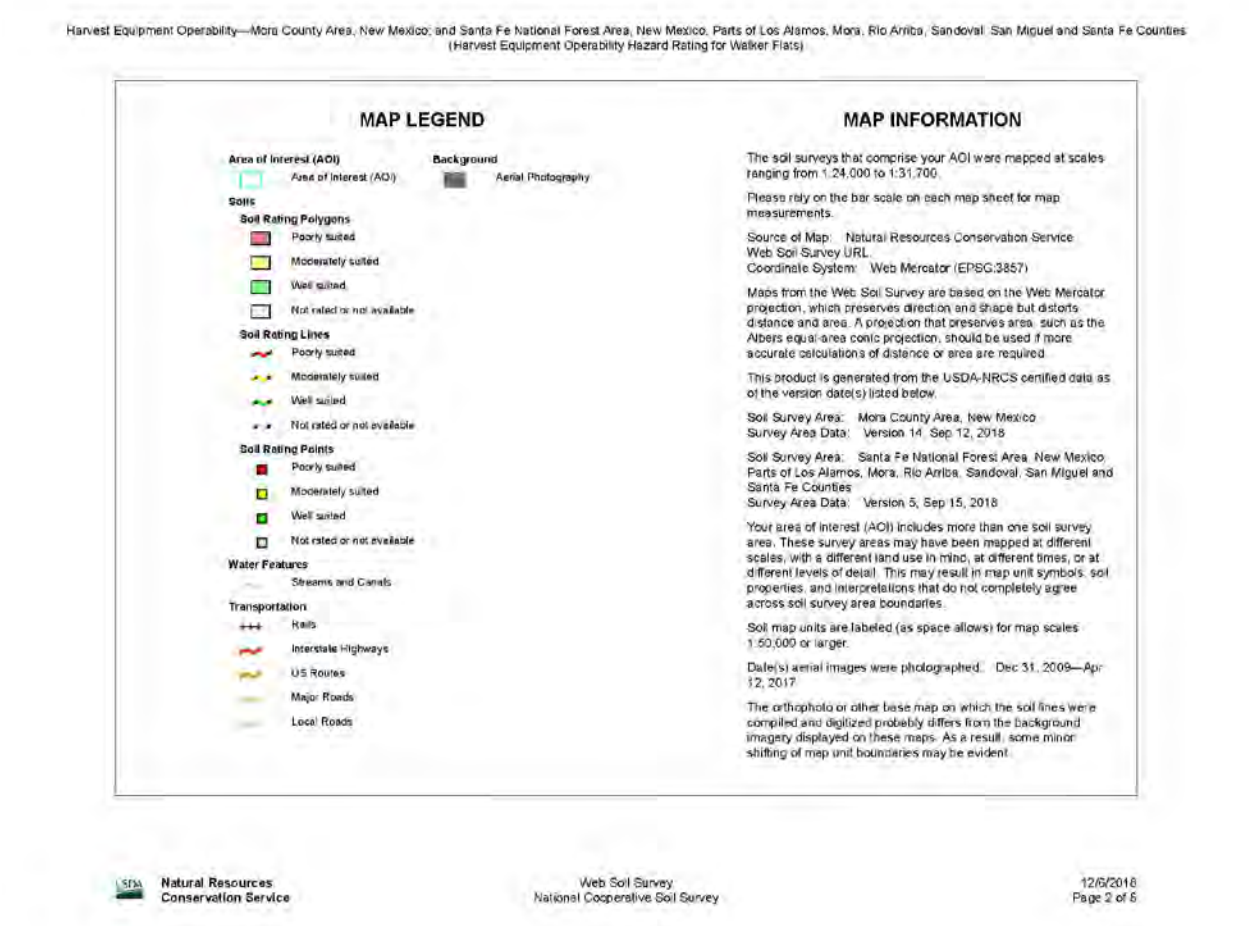


Figure 8. Harvest Equipment Operability soil rating for the Walker Flats project area



Description for Suitability for Log Landings

This interpretation shows the suitability of soils for use as log landings in forested areas. Ratings are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification of the soil, depth to a water table, ponding, flooding, and the hazard of soil slippage.

The ratings are both verbal and numerical. Rating class terms indicate the degree to which the soils are suited to this aspect of forestland management. The soils are described as "well suited," "moderately suited," or "poorly suited" to use as log landings. "Well suited" indicates that the soil has features that are favorable for log landings and has no limitations. Good performance can be expected, and little or no maintenance is needed. "Moderately suited" indicates that the soil has features that are moderately favorable for log landings. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. "Poorly suited" indicates that the soil has one or more properties that are unfavorable for log landings. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration.

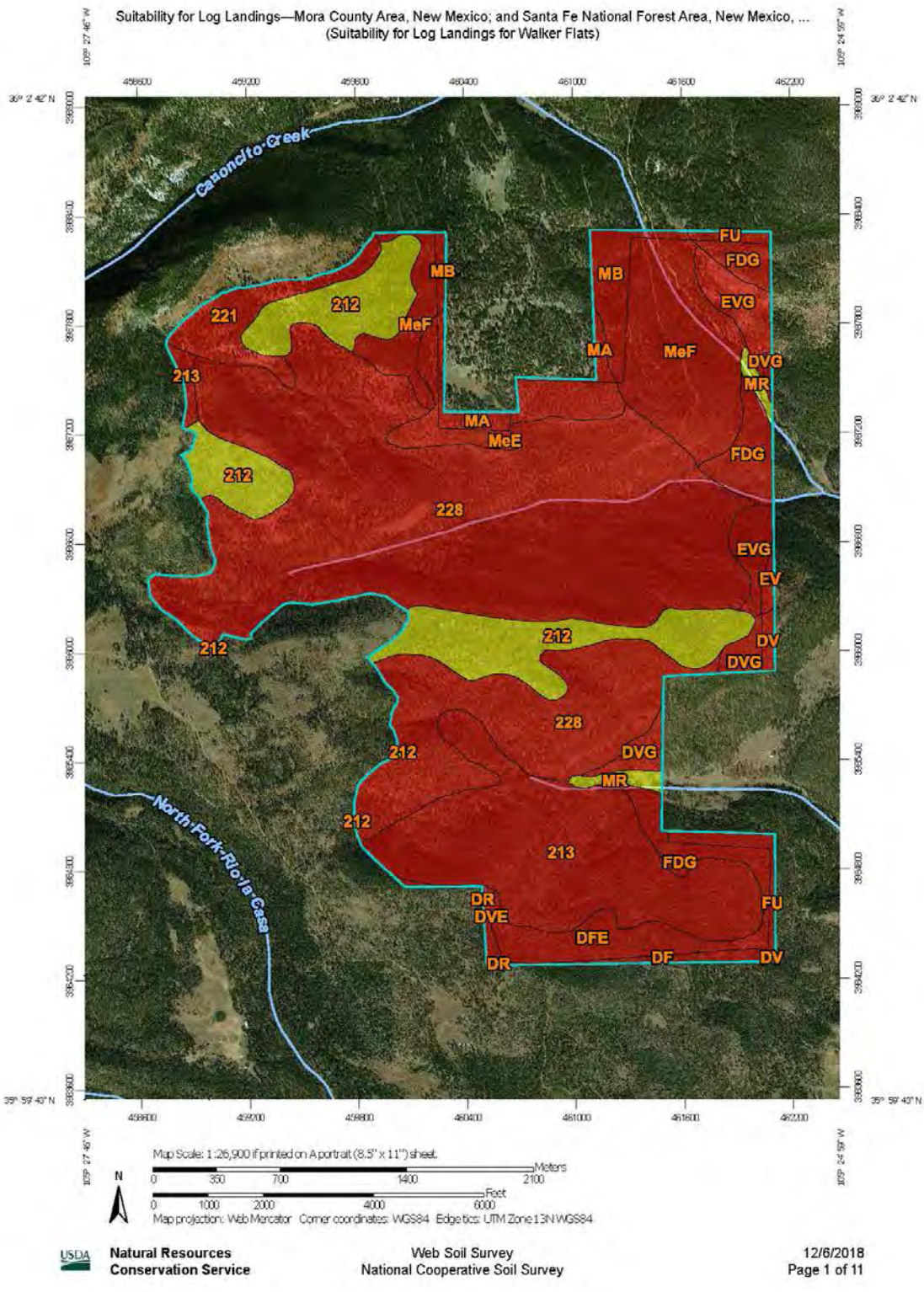


Figure 9. Suitability for Log Landings Soil Rating for Walker Flats project area

Suitability for Log Landings—Mora County Area, New Mexico; and Santa Fe National Forest Area, New Mexico, Parts of Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel and Santa Fe Counties
(Suitability for Log Landings for Walker Flats)

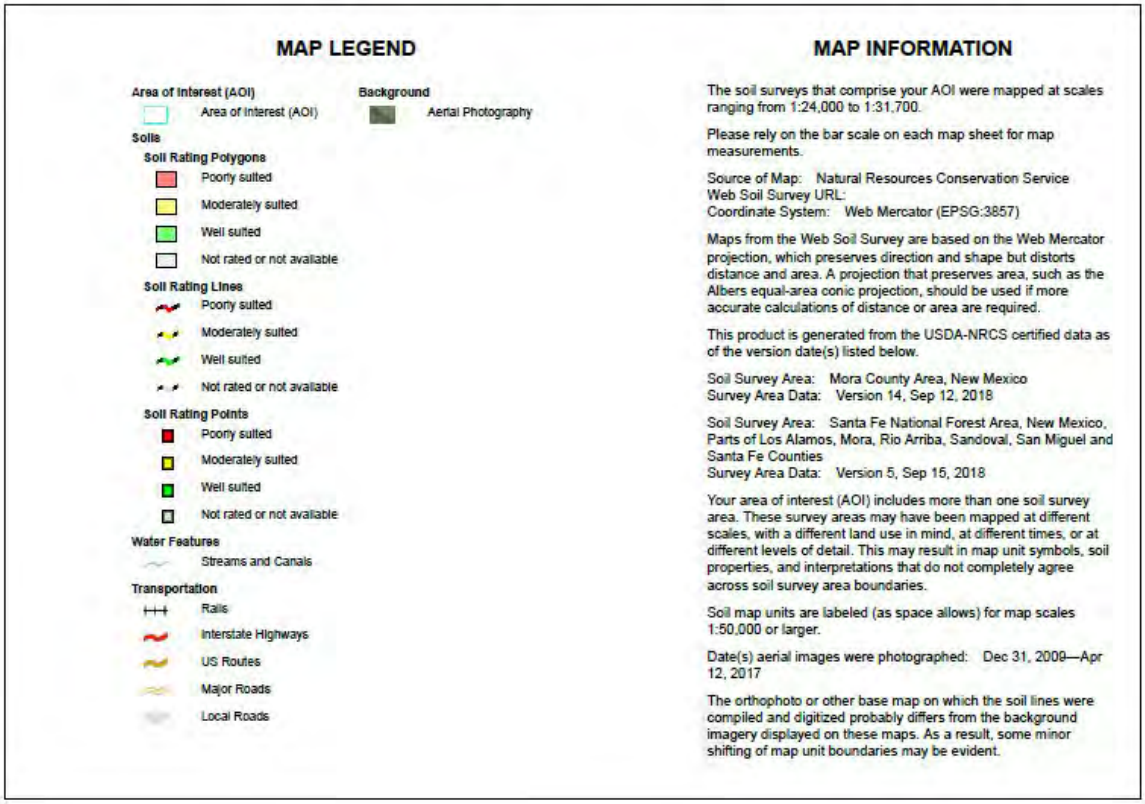


Table 2. Suitability for Log Landings soil rating classes within the Area of Interest (AOI) which is the Walker Flats Project Area

Rating	Acres in AOI	Percent of AOI
Poorly suited	2,025.5	88.7%
Moderately suited	258.0	11.3%
Totals for Area of Interest	**2,283.4**	**100.0%**

Figure 10, below, shows the presence of various soil associations within the project unit. Table 3 quantifies the soil associations by percent occurrence within the Walker Flats unit where NMFWRI plots were located. Soil series descriptions follow.

Table 3. Soil information for map units in the Walker Flats polygon. [4]

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DF	Dargol-Fuera association, hilly	6.6	0.3%
DR	Dargol-Rocio-Vamer association, hilly	0.6	0.0%
DV	Dargol-Rocio-Vamer association, very steep	6.4	0.3%
EV	Eutroboralfs-Rock outcrop-Vamer complex, extremely steep	5.0	0.2%
FU	Fuera-Dargol association, very steep	28.3	1.2%
MA	Maes-Etoe complex, hilly	22.3	1.0%
MB	Maes-Etoe complex, extremely steep	42.3	1.9%
Subtotals for Soil Survey Area		**111.6**	**4.9%**
Totals for Area of Interest		**2,283.4**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
212	Derecho family, 0 to 15 percent slopes	242.0	10.6%
213	Derecho family, 15 to 40 percent slopes	316.9	13.9%
221	Ring family-Rock outcrop complex, fire, 40 to 120 percent slopes	56.6	2.5%
228	Etown, moderately deep-Derecho families-Rock outcrop association, 15 to 120 percent slopes	1,056.1	46.3%
DFE	Dargol, stony-Fuera association, 5 to 25 percent slopes	52.1	2.3%
DVE	Dargol-Rocio-Vamer association, 5 to 25 percent slopes, stony	9.2	0.4%
DVG	Dargol-Rocio-Vamer association, 25 to 50 percent slopes, stony	30.2	1.3%
EVG	Haplustalfs, very stony-Rock outcrop-Vamer complex, frigid, 35 to 65 percent slopes	52.9	2.3%
FDG	Fuera-Dargol, stony association, 25 to 55 percent slopes	89.9	3.9%
MeE	Maes-Etoe complex, 8 to 30 percent slopes	60.4	2.6%
MeF	Maes-Etoe complex, 20 to 65 percent slopes	189.6	8.3%
MR	Moreno-Brycan association, 3 to 15 percent slopes	16.0	0.7%
Subtotals for Soil Survey Area		**2,171.8**	**95.1%**
Totals for Area of Interest		**2,283.4**	**100.0%**

[4] (NRCS: Web Soil Survey, 2018)

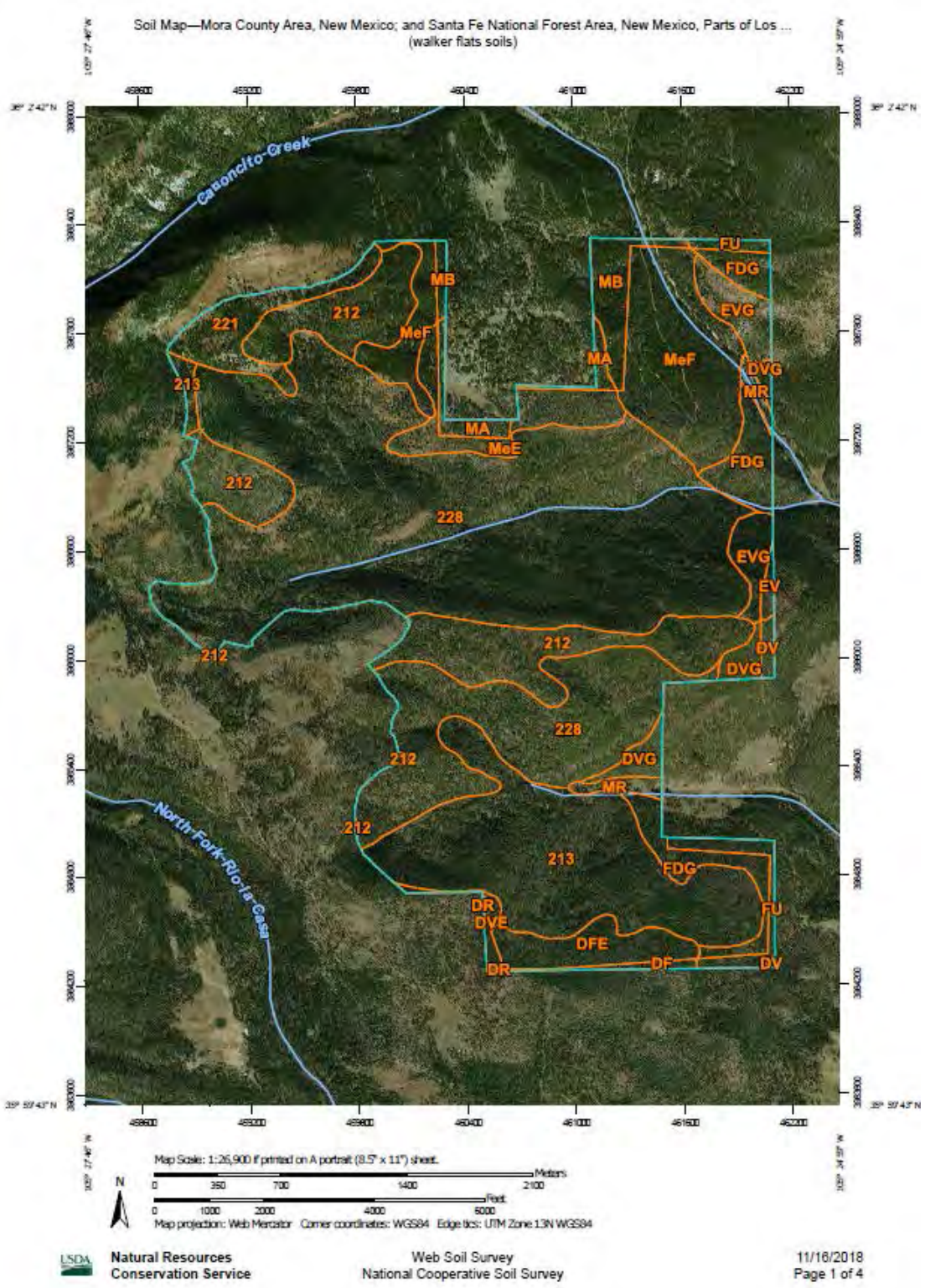


Figure 10. Soils map for surveyed area of Walker Flats (from NRCS).

The majority of the plots are located in soil unit 228, Etown, moderately deep-Derecho families-Rock outcrop association, 15 to 120 percent slopes, which is a mountain slope soil unit.

As shown in Table 3 and Figure 10, above, there are many soil map units present in the monitoring area from two different surveys. The following descriptions are included for map units with representation totaling 228 acres or greater area (i.e., 10% of the unit).

Map unit 228 Etown, moderately deep-Derecho families-Rock outcrop association, 15 to 120 percent slopes covers 1056 acres. The Etown series soils are deep, well-drained, clayey-skeletal soils found on mountain slopes. They are not a dominant soil type in northern New Mexico. They formed from colluvial and alluvial material originating from sandstone and shale and have moderately slow permeability. They commonly support Douglas-fir, white fir, aspen, understory shrubs, and mountain grasses, and most often occur between 9,000 and 11,000 feet in elevation.[5]

Map unit 213 Derecho family, 15 to 40 percent slopes, covers 317 acres, and map unit 212 Derecho family, 0 to 15 percent slopes, covered 242 acres. The Derecho series soils are deep, well-drained clayey-skeletal soils found on canyon and mountain slopes, most commonly on southern aspects. They have a moderate distribution in the high mountains of northern and north-central New Mexico. They formed from weathering of shale and sandstone material and have moderately slow permeability. They commonly support Gambel oak, mountain mahogany and grasses with some Douglas-fir, white fir, and ponderosa pine, and most often occur between 8,000 and 10,500 feet in elevation.[6]

There are also several minor map units with components in the Dargol series. The Dargol series soils are moderately deep, well-drained, fine mixed soils found on ridges, mountain slopes, hills and mesas. They are found extensively throughout northern New Mexico and southern Colorado. They formed from slope alluvium and residual material from shale and sandstone, and have very slow permeability. They commonly support ponderosa pine, Douglas-fir, white fir, and piñon-juniper with an understory of oak, mountain mahogany, Arizona fescue, pine dropseed, junegrass, mountain muhly, Parry's oatgrass, and muttongrass. These soils most often occur between 7,000 and 9,500 feet in elevation.[7]

[5] (National Cooperative Soil Survey , 1999)
[6] (National Cooperative Soil Survey, 1999)
[7] (National Cooperative Soil Survey, 2007)

Vegetation

According to the USDA NRCS Web Soil Survey, there are numerous ecological sites within the study area. Common understory vegetation varies by site but includes, for graminoids: Arizona fescue, black grama, blue grama, California brome, Columbia needlegrass,common wolfstail, Danthonia, green needlegrass, Kentucky bluegrass, little bluestem, Metcalfe's muhly, mountain muhly, mutton bluegrass, muttongrass, needleandthread, New Mexico feathergrass, nodding brome, pine dropseed, plains lovegrass, piñon ricegrass, prairie Junegrass, redtop, rushes sand dropseed, sedges, sheep fescue, sideoats grama, slender grama, Thurber's fescue, Thurber's needlegrass, tufted hairgrass, western wheatgrass and yellow Indiangrass. Common forbs include: blueleaf strawberry, Canada violet, lupine, silverweed cinquefoil, sprucefir fleabane, Parry's goldenrod and yarrow. Common shrubs include: alpine bearberry, common snowberry, grouse whortleberry, kinnickinnick, mountain lover, mountain snowberry, New Mexico locust, Parish's snowberry, ragweed sagebrush, serviceberry, shrubby cinquefoil, skunkbush sumac, true mountain mahogany and wax currant. Common trees found in the understory included common juniper, Gambel oak, ponderosa pine, Rocky mountain juniper, twoneedle piñon, and wavyleaf oak.[8]

Field crew observations not included in the NRCS Web Soil Survey list included, for shrubs: Arizona mountain ash, Bebb's willow, buckbrush, canyon grape, chokecherry, creeping barberry, mountain alder, raspberry, Rocky Mountain maple, roundleaf snowberry, russet buffaloberry, waxflower, western white clematis, Woods' rose, and yucca. Other trees recorded included blue spruce, corkbark fir, Douglas-fir, Engelmann spruce, limber pine, oneseed juniper, quaking aspen, and white fir.

GIS Land Cover Classifications for the Study Area

Our GIS specialist created a map from the LANDFIRE dataset of land cover classifications. LANDFIRE classified the area as predominantly Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland with significant representation of Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland, Southern Rocky Mountain Ponderosa Pine Woodland, Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland, and *Abies concolor* Forest Alliance. LANDFIRE also identified minor components of Colorado Plateau Pinyon-Juniper Woodland, Rocky Mountain Montane Riparian Forest and Woodland, Southern Rocky Mountain Ponderosa Pine Savanna, among others. See Figure 11, below.

[8] (NRCS: Web Soil Survey, 2018)

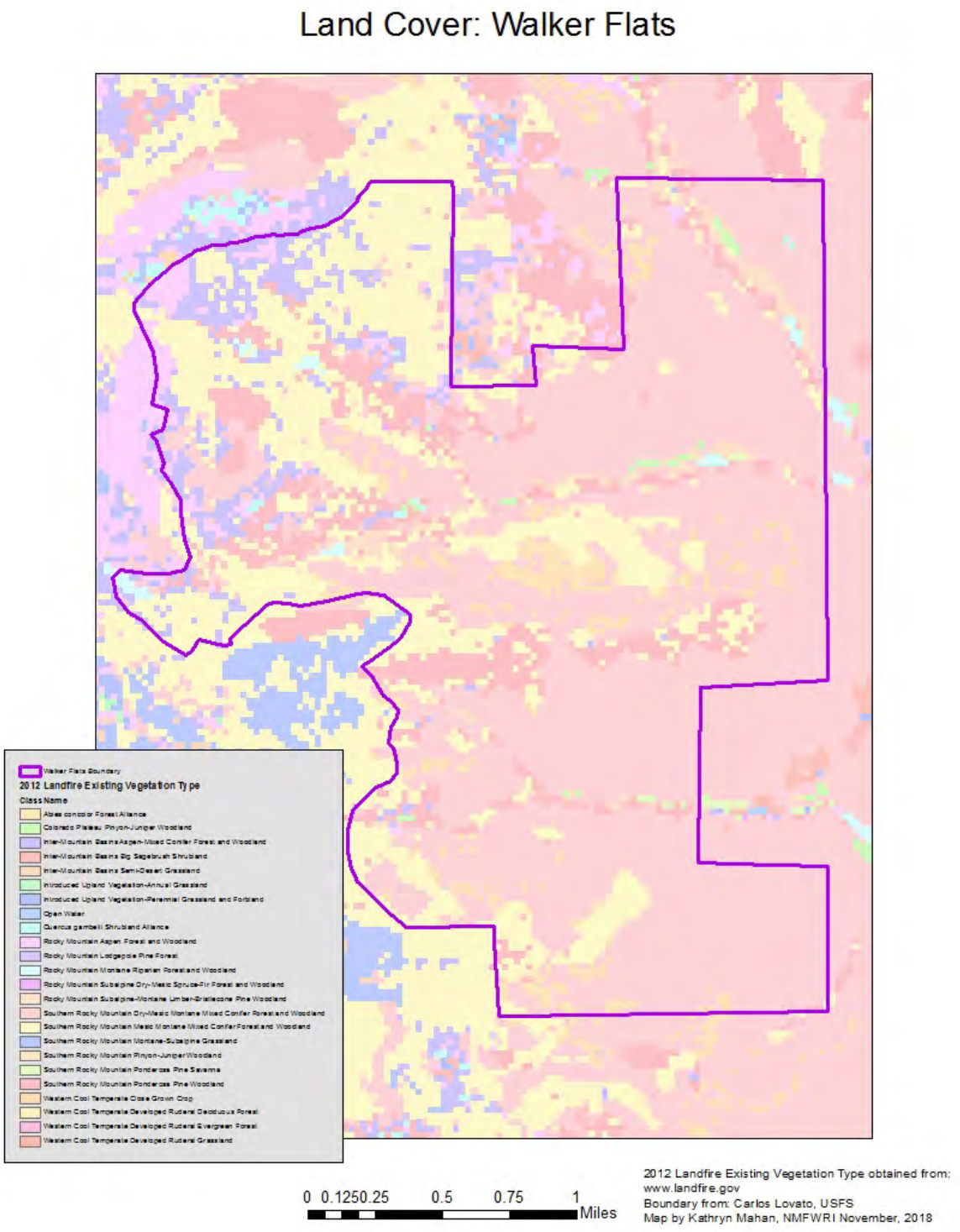


Figure 11. Land Cover Classification.

Rare plants

According to the New Mexico Rare Plant Technical Council, rare plants existing in Mora County include Wittmann's milkvetch (*Astragalus wittmannii)*, Gunnison's mariposa lily (*Calochortus gunnisonii var. perpulcher),* Heilia's alpine whitlowgrass (*Draba heilii)*, Pecos fleabane (*Erigeron subglaber)*, New Mexico stickseed (*Hackelia hirsuta)*, and Arizona willow (*Salix arizonica).* [9]

None of these plants were recorded by the NMFWRI field crew, but this crew was not specifically trained in rare plant identification.

Insects and Diseases

According to National Insect and Disease Risk Map, the Rio la Casa watershed is 95% treed, with 33% of the treed area at risk. The watershed as a whole is projected to lose between 1-30+% of its basal area to diseases and 1-35+% of basal area loss to all pests between 2013 and 2027 (see Figure 12, below). In addition, the Rio la Casa watershed is at risk from 1 to >30% of basal area loss from bark beetles including the ips engraver beetle, mountain pine beetle, spruce beetle, Douglas-fir beetle, and the fir engraver. This same watershed is also at risk of aspen and cottonwood decline and root diseases. [10]

[9] (New Mexico Rare Plant Technical Council, 2005)
[10] (USDA Forest Service, n.d.)

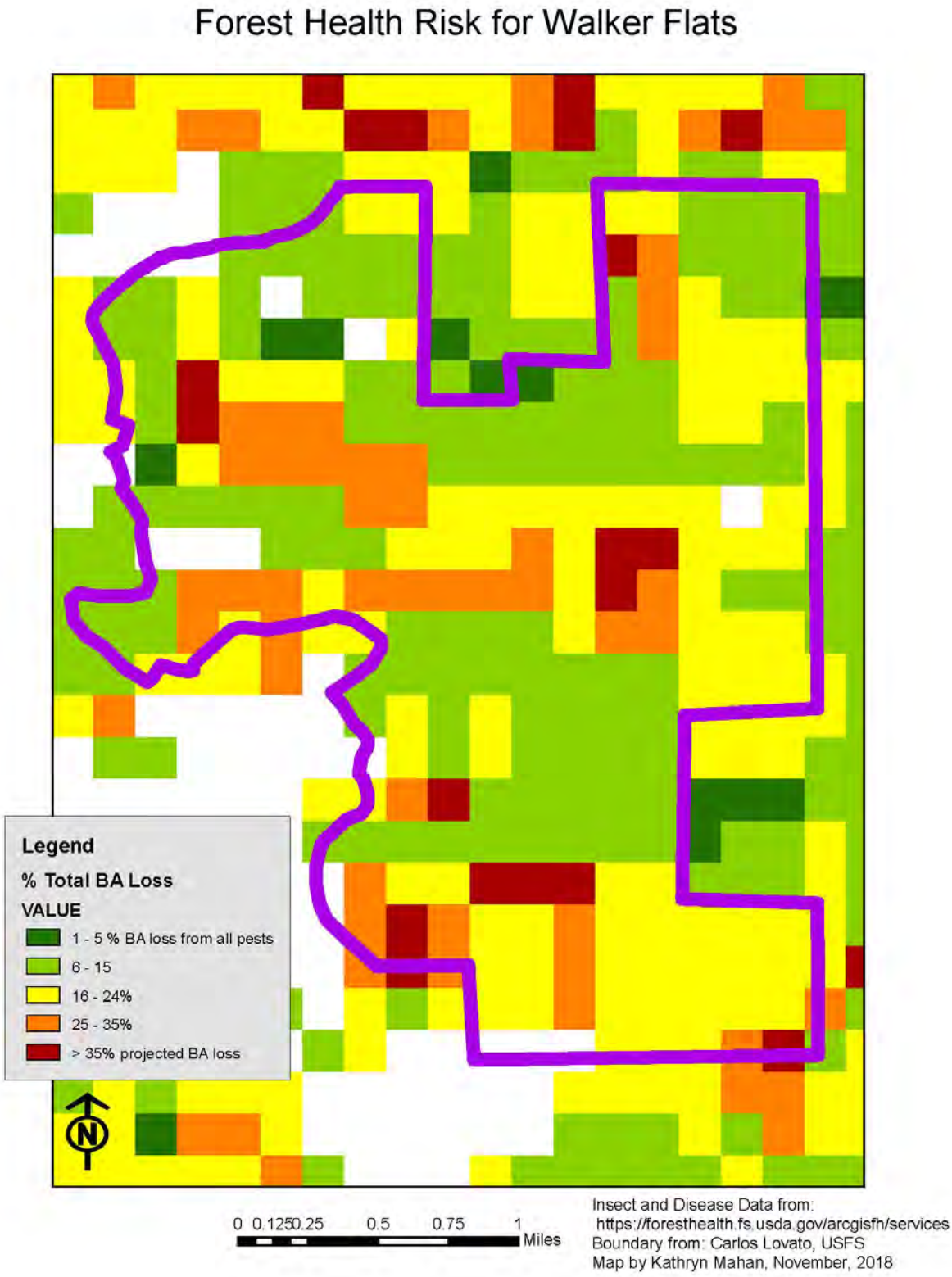


Figure 12. NIDRM projected basal area loss at Walker Flats.

Project Challenges & Limitations

Figure 13. Steep slopes on plot.

Primary challenges have been steep slopes for hiking and access. Slope in several areas exceeded 80% or more and was unsafe to traverse. See Figure 15 for a map of the project slopes.

Vehicles: We have one 4WD truck and during the summer, rented one 2WD SUV, which was not suitable for many of the roads in the area. Additional 4WD vehicles or ATVs are not available to us.

Figure 14. Variable terrain within the project.

Roads condition: Road condition was generally poor, both on the Mora County side and the USFS side of the fence. This meant an increase in time to access, as well as heavy wear and tear on our vehicles which did significantly slow down the work. Road condition in the area has resulted in two ruined tires and the need to do significant front suspension work on our 4WD unit. Further, road condition was highly influenced by weather, particularly moisture, another limiting factor to our access. Please see the photographs that follow for more detail, as this challenge will doubtless persist throughout the project for other contractors and the public.

Knowledge: The lack of good roads data prior to the beginning of our inventory was a major challenge.

Forest Closure and Fire Restrictions: Our ability to access roads with downed logs was also impacted by the forest closure and chainsaw operation restrictions in place in summer 2018.

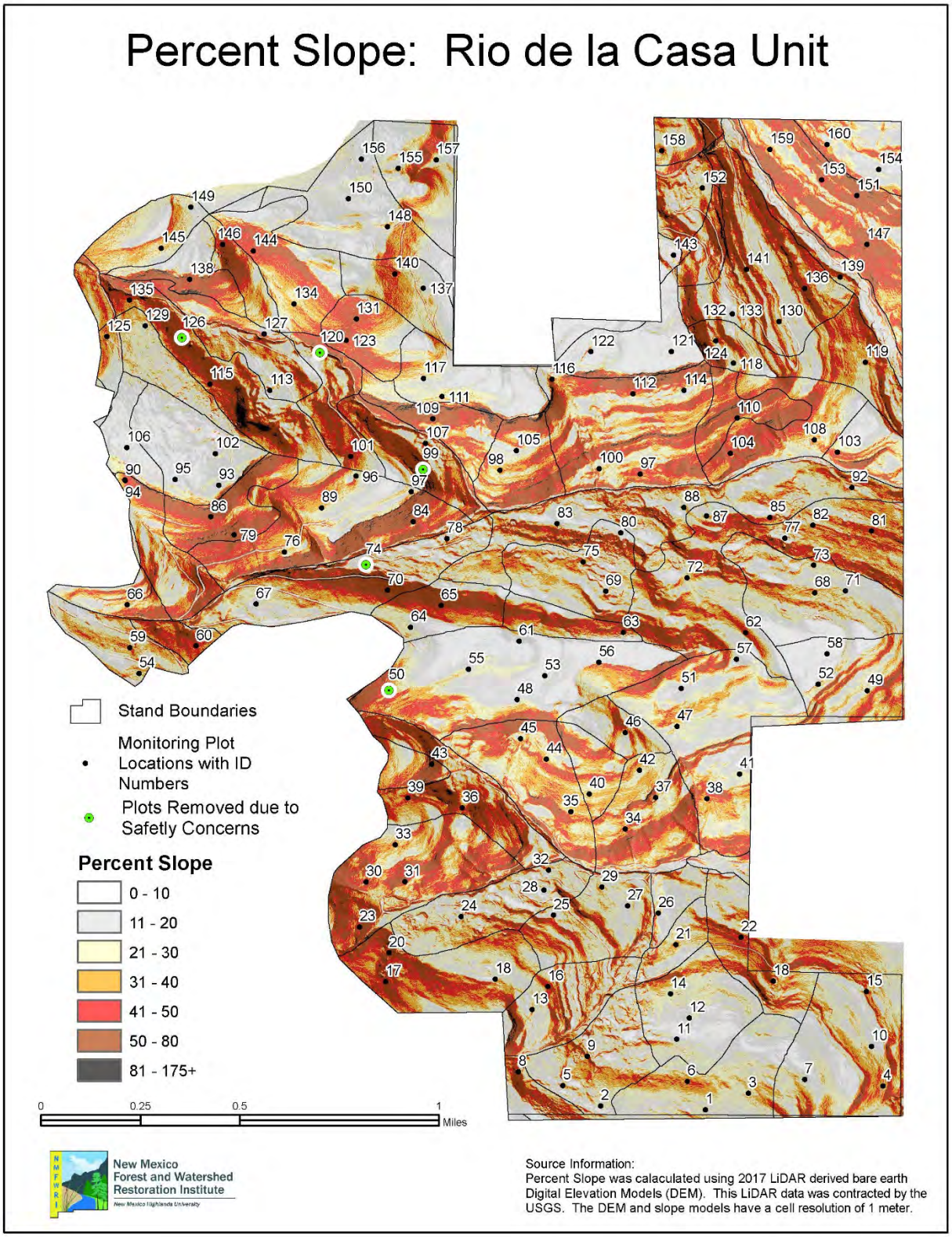


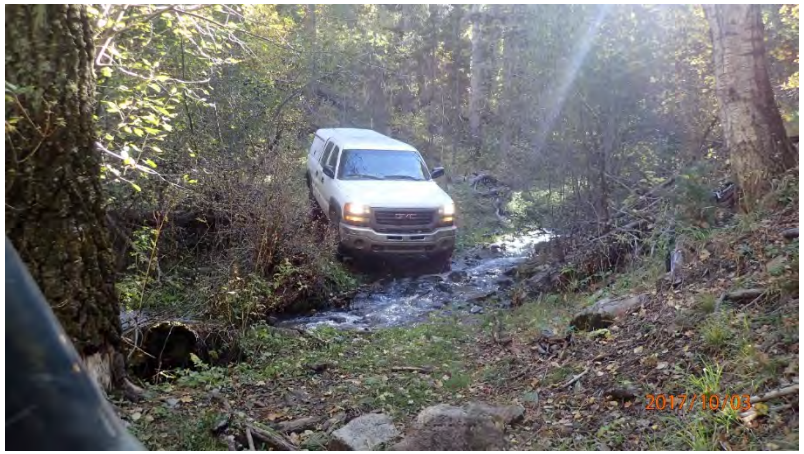
Figure 15. Slope for Walker Flats unit 2017-2018

Digging out on a closed road, Oct 2017

Road maintenance, April 2018

Changing a Tire, April 2018

Towing out the SUV, June 2018



We were told this was a “road.” It definitely wasn’t. But, once we started, it was far too steep to head back up. Oct 2017

Traveling in Snow, Dec 2017

Changing a tire on ice, Dec 2017

Road conditions during monsoons, Sept 2018

Monitoring Data

Methods

Note: These protocols are based on the standard procedures of the USFS's Common Stand Exam, DOI's FEAT/FIREMON Integrated, and recommendations for standards made by Derr et al in 2008 for Long-Term Monitoring of New Mexico's Collaborative Forest Restoration Program.

Crews, Navigation & Plot Setup

Plots are most efficiently accomplished with a **3-person crew** but can also be taken with 2 people. All crews need basic knowledge of monitoring methods and rationale, equipment, plant species and common tree pests and diseases.

2017 Professional Crew

- Ernesto Sandoval, monitoring and data technician
- Daniel Hernandez, monitoring and data technician
- Kathryn Mahan, ecological monitoring specialist

2018 Professional Crew

- Ernesto Sandoval, monitoring and data technician
- Carmen Briones, monitoring and data technician
- Raymundo Melendez, monitoring and data technician (hired Sept 2018)
- Kathryn Mahan, ecological monitoring specialist
- Sara Amina Sena, restoration program manager (hired Sept 2018)

2018 NMHU Summer Interns

- Anna Medina, monitoring technician
- Alex Perea-Angles, monitoring technician
- Leon Lujan, monitoring technician
- Raymundo Melendez, monitoring technician

Plots are established using a random point location with project-specific boundaries e.g. stand boundaries, treatment areas, vegetation types, etc. For the Upper Mora CFRP Project, the following distribution rationale (detailed rationale provided to USFS) was used based on stand boundaries provided by the USFS:

For Stands 1-50 acres, 1 plot per 10 acres (USFS standard)

For Stands 51+ acres:
51-70 ac --- 5 plots
71-90 ac --- 6 plots
91-110 ac --- 7 plots
111-200 ac --- 8-9 plots
201-400 ac --- 10 plots

Within the Rio de La Casa project area, monitoring plot locations were generated using a stratified random sampling design. Stand boundaries were provided by the USFS and were used to determine the number of stands per acre. Acreages were calculated within the stand boundaries and this value was used to determine the number of monitoring plots according to the rationale above. Using the GIS software package, ESRI ArcMap, a specified number of random points were generated based on the stand boundary acreage. The command that was used in ArcMaps was 'Create Random Points'. The stand boundary shapefile was used to constrain the location of and number of points. To prevent points from being too close together, points were generated with a minimum 100 meters distance between points.

In the NMFWRI office, maps and plot locations generated with ArcGIS utilities were loaded onto Trimble and Garmin GPS units. Hard-copy unit maps, driving maps and driving directions were created and sent with the field crew. Once in the project area, navigation to a plot was typically accomplished through paper maps and the Garmin GPS units. Paper maps were marked with Sharpies to indicate sequence of plot collection, dates, and teams at work; this information was stored with the datasheets and may help answer questions that arise later. NMFWRI crews use Garmin GPS units because they are user-friendly and can run on AA batteries which are easily replaced in the field. We use a Trimble GeoXT unit running TerraSync software to more accurately determine plot location and to collect updated plot location coordinates. These coordinates were later post-processed for greater location accuracy with GPS Pathfinder Software. Per our protocol, plots were moved one chain (66 ft) at a random azimuth from their original, intended location if they were found to be within 75 feet of a road.

A marker (typically a 1-foot piece of ½ inch rebar with a plastic mushroom cap) was installed at plot center. For any subsequent revisits, a good metal detector may be of use to locate the center stake. Copies of the previous plot photos will also be useful.

Plots were set up using 8-9 pin flags in addition to the center stake. Preferred colors included blue or orange. Crew members walked cardinal azimuths (N, E, S, W) from plot center and placed pin flags at 11.78ft (11' 9") and 37.24ft (37' 3") to give visual aids for the two circular, fixed-radius plots (1/10th ac and 1/100th ac) whose purposes are described below.

Figure 16. Example of capped rebar marker.

Photographs, Witness Trees & Other Plot data

A minimum of seven **photographs** were taken per plot. Typically, a white board labeled with erasable marker was used to tag each photo. The first photo taken at each plot was of the white board on the ground at plot center ("PC"). This first picture ensured the data technicians were able to read the plot name and number and correctly identify the photos that follow. Our cameras also recorded GPS coordinates and azimuth for every photo taken.

In addition to the "PC" photo, additional photos include:

- "C," taken from 75 feet along the North azimuth looking at a crew member holding the white board at plot center
- Brown's transect photo, "B_*degrees*" taken from the 75-foot mark of each fuels azimuth looking towards a crew member holding the white board at plot center
- "N," "E," "S," and "W" photos taken from plot center facing a crew member holding the white board 37.2' at each of the four cardinal azimuth flags. Additional photographs were sometimes taken, for example, to document disease or something unusual about the plot. These "extra" photos were always taken *after* the mandatory seven plot photos and noted on the data sheets.

The photo order was always recorded on the data sheets, for example, PC, C, N, B75, E, S, W. If these plots are revisited and **photos are being re-taken** from a previous year, it will be critical to bring along copies of the previous photographs to be sure the frames and landmarks match up.

A **witness tree** or trees (typically not more than two) was found and marked near plot center on every plot. The purpose of this tree is to assist with finding plot center and ideally was expected to survive any future thinning, fire, or other disturbance. For example, mature yellow-bark pines near plot center are easy to find and not likely to be thinned. Any healthy tree was preferred over sick trees, and in a minimum of instances, saplings or off-plot trees were used when no other options were available. The selected tree(s) were flagged twice around DBH with long-lasting flagging. This tree was noted as a "witness" in the overstory data table ("tree page"), and described on the Plot Description datasheet in the appropriate section. **Important characteristics** typically recorded included: azimuth from PC, distance from PC, species, status, height, DBH, color of flagging used, and any other notes (e.g. unusual crown shape). The position of the witness relative to the inner and outer circles was also indicated on the datasheets with an "x."

Figure 17. Example of flagged witness tree.

Photo order, hill slope (i.e. wherever slope is steepest)**, dominant aspect** (by circling N/E/S/W and by writing in the degrees)**, coordinates & units, elevation & units, date**, and **time begun** were recorded for each plot. **Comment fields** were available on all datasheets and observations such as species, land use impacts, fire history, challenges in taking plot, etc. were documented here. We stressed to our crews that no plot could be so unremarkable as to have a totally blank comments box.

Overstory

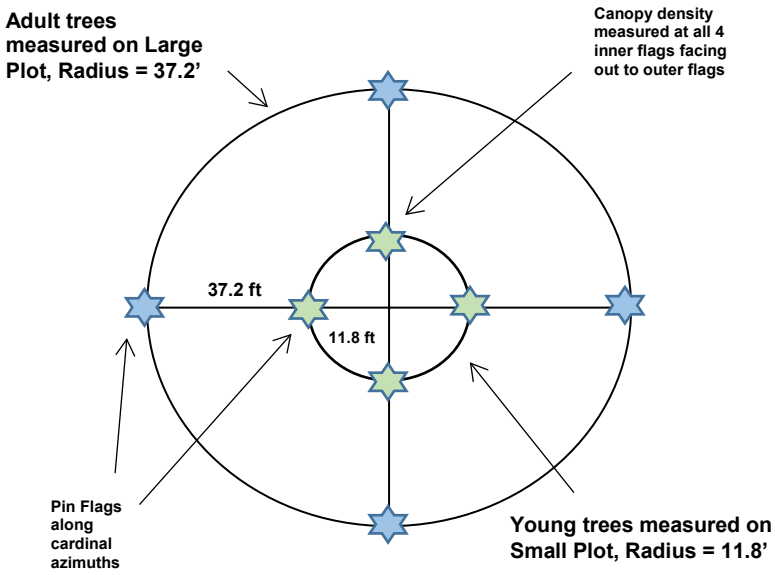
All **trees and snags** were measured within the 1/10th acre plot (37.24 ft. radius) circular, fixed area sample plot. We typically define a tree as ≥ 4.5 ft. and ≥ 1.0 in dbh or drc, although other cutoffs may be used depending on objectives. **For the Upper Mora CFRP, a tree was defined as as ≥ 4.5 ft. and ≤ 5.0 in dbh or drc.** Species, condition, dbh or drc, number of stems, total height, and live crown base height were recorded for each tree located within the plot. Most trees were measured at dbh with exception of those **multi-stem species with more than two stems at dbh** (i.e. *Quercus* spp., *Juniperus*

spp.). Other trees/large shrubs with multiple stems, such as mountain mahogany or chokecherry, cannot be processed if they are measured at drc since their conversion formulas are unavailable. Depending upon the project, other information may be collected including damage and severity, scorch height, snag decay class, crown ratio, and crown class. For this project, special attention was paid to tree health and mistletoe presence, per the request of the Santa Fe National Forest staff. Trees were recorded starting from the north azimuth line and moving clockwise, like spokes of a wheel from plot center. In dense stands, we found it helpful to flag the first tree measured to keep the crew oriented. If appropriate, this first tree may also have been used as the **witness tree**. The distinction between the two is that the witness tree is marked with *two* strips of flagging whereas the first tree would just have one.

Tree regeneration was measured on the nested 1/100th acre circular plot (11.78 ft. radius) and species, condition, and height class (>0-0.5 ft; >0.5-1.5ft; >1.5-2.5ft; >2.5-3.5ft.; >3.5-4.5ft) were recorded for each **seedling** or sprout. **Saplings** (>4.5ft but under the dbh/drc cutoff for trees (typically **≤** 1.0 inches but **for Upper Mora CFRP, ≤ 5.0 inches**) were also recorded in this way. **Shrubs** were measured on the same nested subplot and species, condition and height/diameter class are recorded for each stem just as with tree species; we recorded any cacti we found in this category as well due to their woody structure. The definition of a "shrub" may vary depending upon management objectives but typically means any woody species which is not a tree. Examples include rose, chokecherry, mountain mahogany, holly. Note that other cutoffs may be used for height and diameter classes depending upon objectives.

Trees and shrubs were recorded using their **USDA PLANTS code**, which is commonly a four letter code defined by the first two letters of the genus and first two letters of the species name (e.g. PIPO, ABCO, PIFL, PIED, JUDE, JUSC, QUGA, etc). Note that upon entry into a database, it is common for these codes to be followed by various numbers in order to differentiate between other species whose names would create the same code. These symbols can be found on the USDA PLANTS website, https://plants.usda.gov/

Canopy cover (density) is an average of four measurements from a spherical densiometer. These four measurements were taken facing out at the four small-plot pin flags along the perimeter of the nested subplot. In this way, each reading was spaced 90 degrees apart. Typically instructions for use of a densiometer can be found on the underside of the lid.

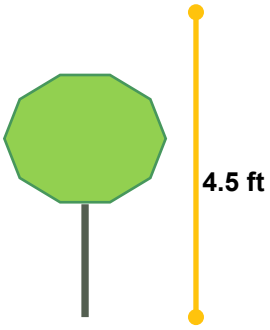


Tree Regen (Upper Mora):

< 4.5' tall (seedling)

OR

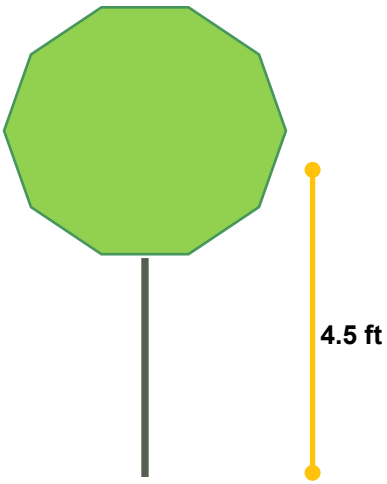
>4.5' but ≤5" dbh (sapling)



Adult trees (Upper Mora):

> 4.5' tall

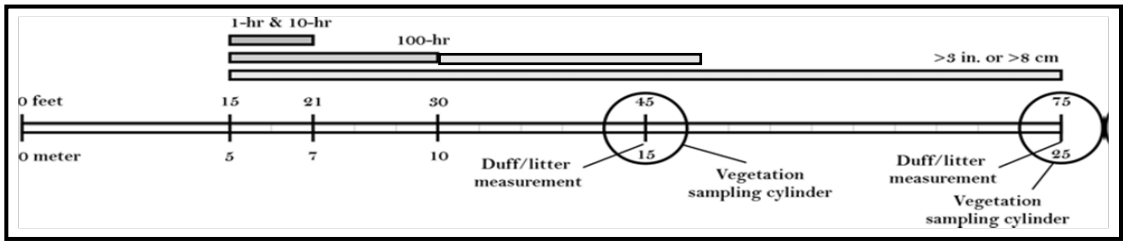
≥ 5" diameter



Fuels (Brown's)

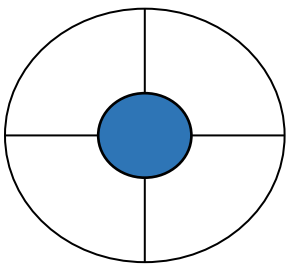
Dead woody biomass and forest floor depth were measured using a planar Brown's transect or transects. These transects may be at fixed or random azimuths. For the Upper Mora CFRP, we used one transect at a random azimuth. To select the random azimuth, one crew member spun a compass and another decided when to stop. A fiberglass tape was run from the plot center stake out 75 feet and fuels were measured from 15 to 75 feet to account for the expected foot traffic disturbance around plot center. Parameters measured include **1, 10, 100, and 1,000 hour fuels** ("time-lag fuels"). For more information, see Brown 1974 and subsequent guidelines. In our protocol, a piece of coarse woody debris (CWD) must be >3" in diameter and at least 3 feet long to count as a 1000-hour fuel; if it is >3" in diameter, but under 3 feet long, we counted it as a 100-hour fuel. Decay class (1 to 5), species, and sometimes length was collected for each 1000-hour fuel.

Percent cover and height of **herbaceous live and dead (HL, HD) material** percentage cover and height (up to 6 ft.) of **shrubby (woody) live (excluding boles of trees) and dead (SL, SD) material** were estimated using 6-foot diameter cylinders per Brown's planar intersect method at 45 and 75 ft (Brown 1974). **Litter and duff depths** were measured at 45 and 75 ft. The location, offset, and frequency of these measurements may be modified depending upon management objectives.



Understory

Vegetation and ground cover were estimated within the nested 1/100th acre plot ("small plot") for the Upper Mora CFRP; other project managers may request these measurements are conducted across the entire 1/10th acre area. Vegetation measurements included **aerial percent cover** of seedling/saplings (tree regen), shrubs (woody species which are not trees), graminoids (grasses and grass-like plants such as sedges, rushes), and forbs (flowering herbaceous plants which are not grass) and did not necessarily total 100%. Depending upon objectives and field crew skill levels, aerial percent cover may be further stratified by individual species greater than 1% cover; this typically was not done on this project. **Ground cover measurements** included percent cover of plant basal area (cacti is included in this category), boles (trunks of trees), litter, bare soil, rock, and gravel. Ground cover logically always totals 100%.



Data processing and reporting

For this project, we used **FFI software**, as well as Excel spreadsheets, to enter and analyze our data. FFI is able to export to FVS and FuelCalc. FFI software and User Guides are available for download here: https://www.frames.gov/partner-sites/ffi/software-and-manuals/

In order to process individual piñons, junipers and oaks with more than 2 stems or whose branch structure made access difficult and were therefore measured at root collar (DRC) instead of breast height (DBH), we used the **equations developed by Chojnacky and Roger** (1999).

All our results are typically reported to two significant digits, with exceptions for those metrics we know were measured with either more or less precision.

Sample reports can be found on our website: http://nmfwri.org/resources/restoration-information/cfrp/cfrp-long-term-monitoring/cfrp-long-term-monitoring

Disclaimer

NMFWRI provides this report and the data collected with the disclaimer that the information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived. It is the responsibility of the data user to use the data appropriately and within the limitations of monitoring data in general, and these data in particular. NMFWRI gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data. These data and related graphics are not legal documents and are not intended to be used as such. This includes but is not limited to using these data as the primary basis for the development of thinning prescriptions or especially timber sales. NMFWRI shall not be held liable for improper or incorrect use of the data described and/or contained in this report.

Monitoring Results

Please consult the USDA PLANTS symbols (page 6) for a list of codes used in the following sections.

Tree Component

Among these plots, the average number of trees per acre (TPA) was 134 (Figure 18). The seedlings per acre in this figure include both live and dead shrub and tree species. For all Live and sick tree species there was a total of 4520 seedlings per acre. Most tree species observed were ABCO, PIPO and PSME with a much more minor component of POTR as seen in Figure 19.

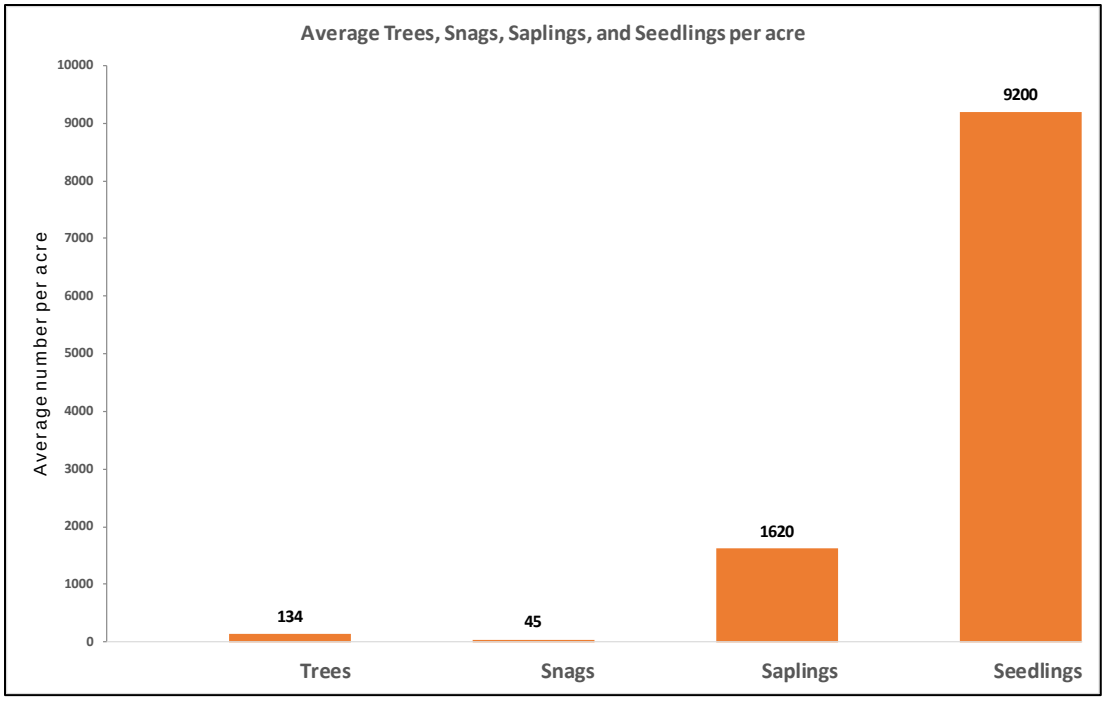


Figure 18. Average Trees, Snags, Saplings and Seedlings per acre for Walker Flats unit 2017-2018.

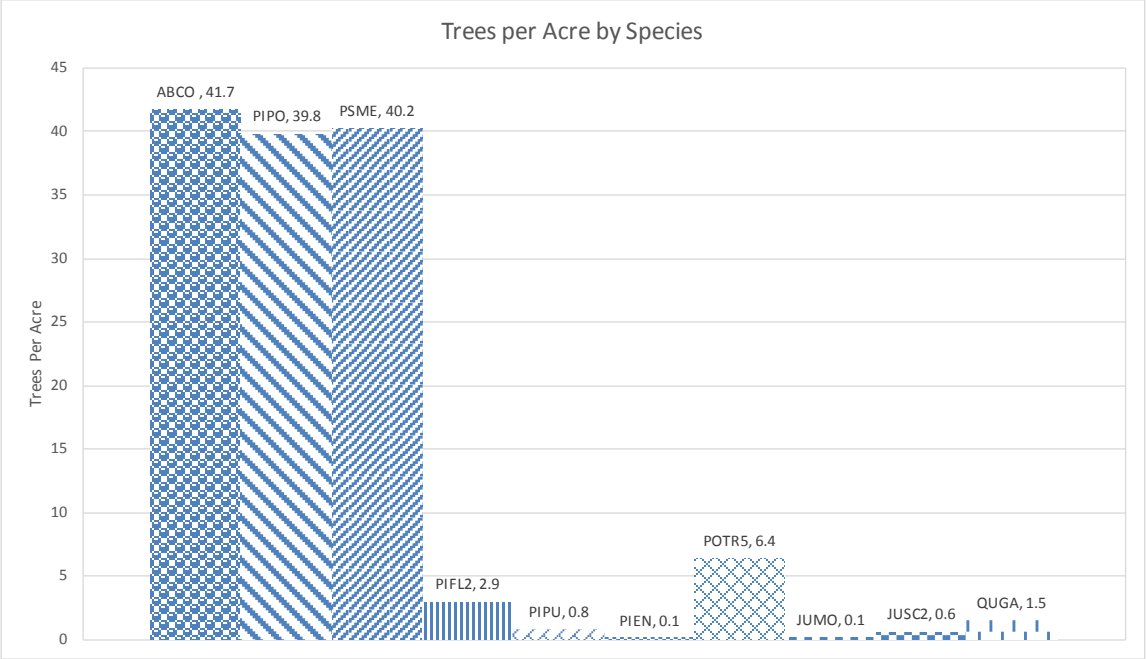


Figure 19. Trees per acre by species for Walker Flats unit 2017-2018

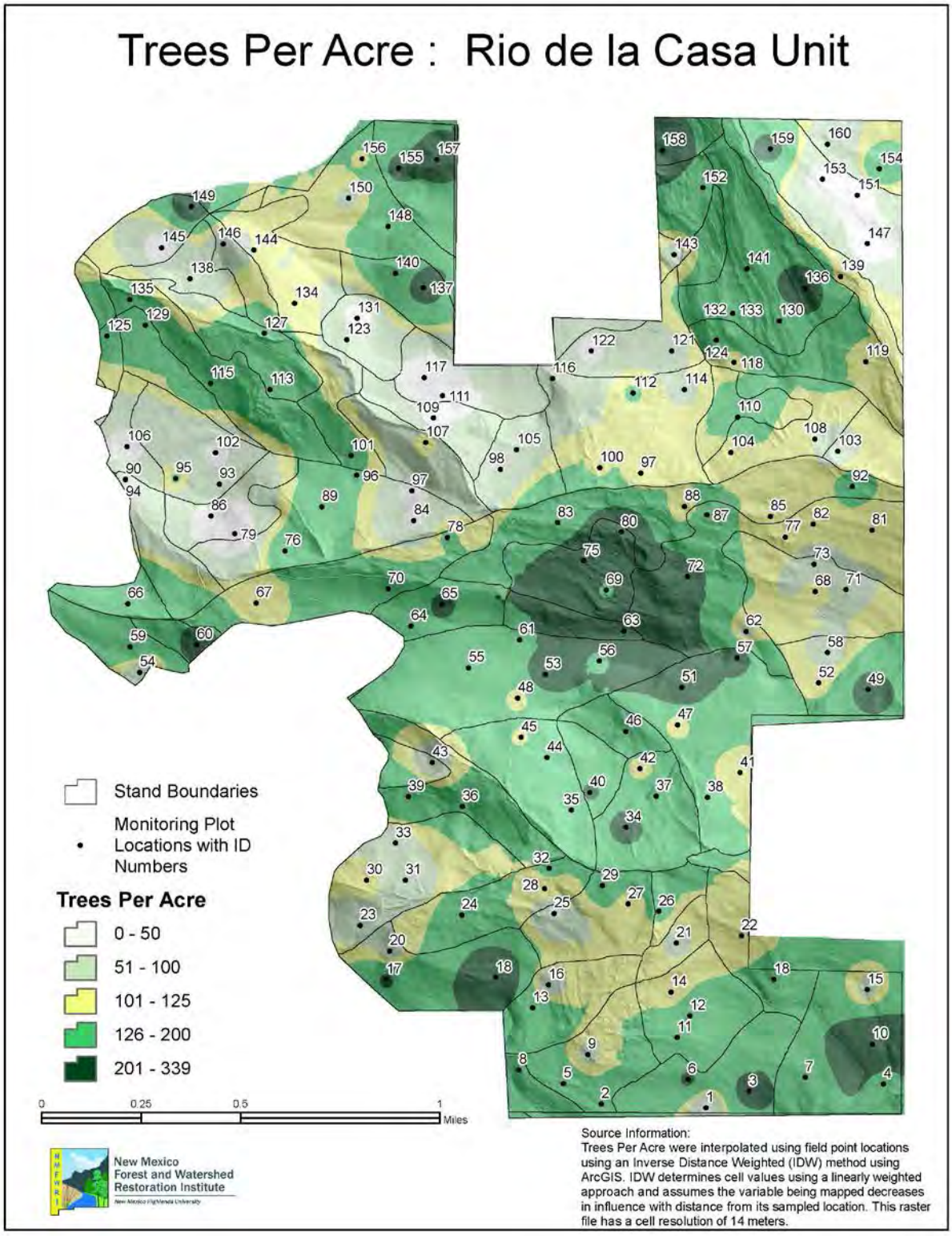


Figure 20. Trees per Acre for Walker Flats unit 2017-2018

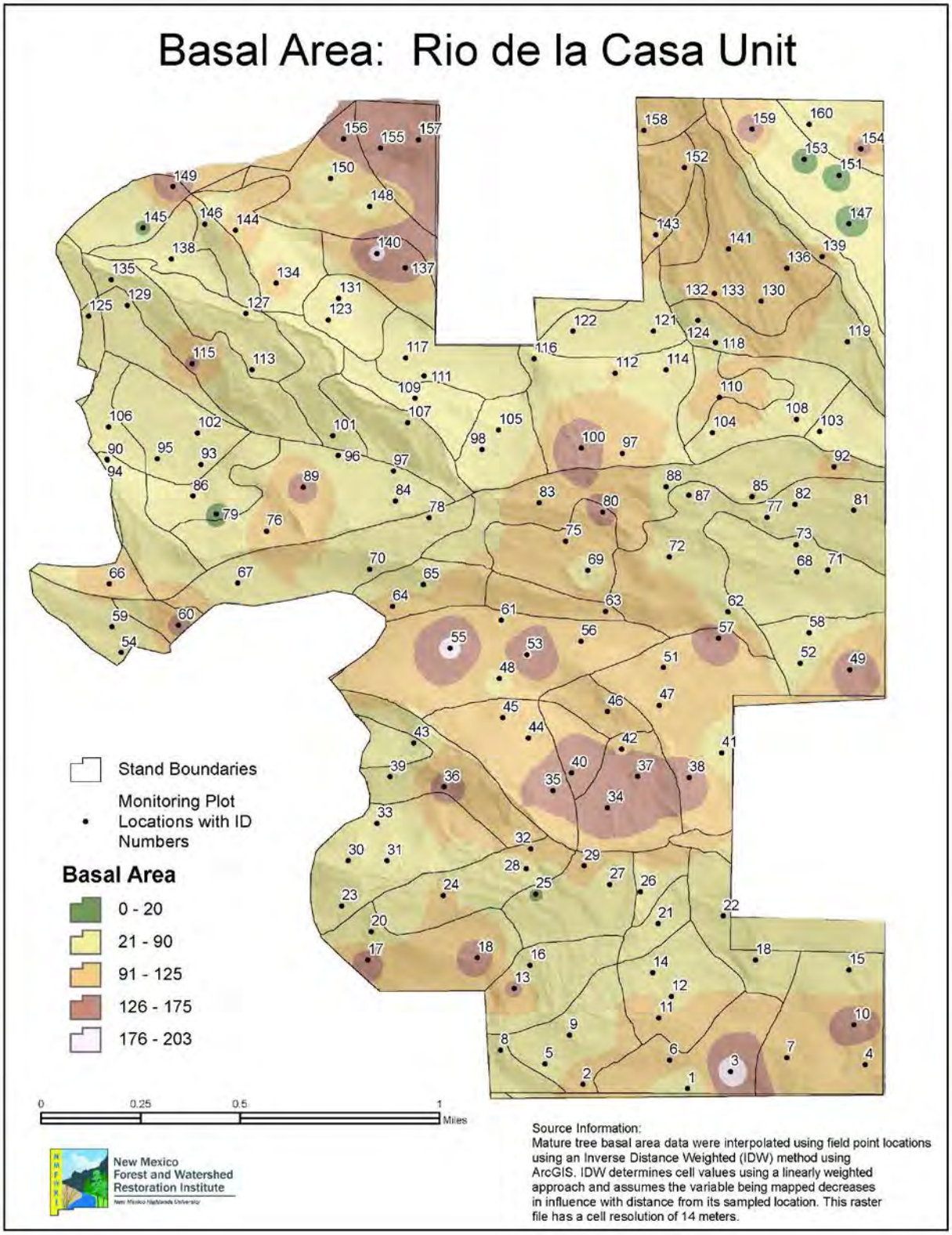


Figure 21. Basal Area per Acre for Walker Flats unit 2017-2018

A general note to observe is that some of the areas with the highest number of tree counts and highest Basal Area counts, are also where percent slope is high and where suitability for log landing and harvest equipment operability are rated as poorly suited.

The average basal area was 86 ft^2/acre (not shown on graph). Tree heights averaged 38 feet, live crown base height averaged 13 feet, and the quadratic mean diameter (QMD) was 11.1 inches (Figure 22). Average species distribution among trees was as follows: 41.7 white fir/acre, 39.8 ponderosa pine /acre, 40.2 Douglas-fir/acre, 2.9 limber pine/acre, 0.8 Colorado blue spruce/ acre, 0.1 Engelmann spruce/acre, 6.4 Aspen/acre, 1.5 Gambel oak/acre, 0.6 Rocky Mountain Juniper/acre and 0.1 oneseed juniper/acre (Table 8). Average height, QMD, and live crown base height (LiCrBHt) are displayed by species in Table 4, below.

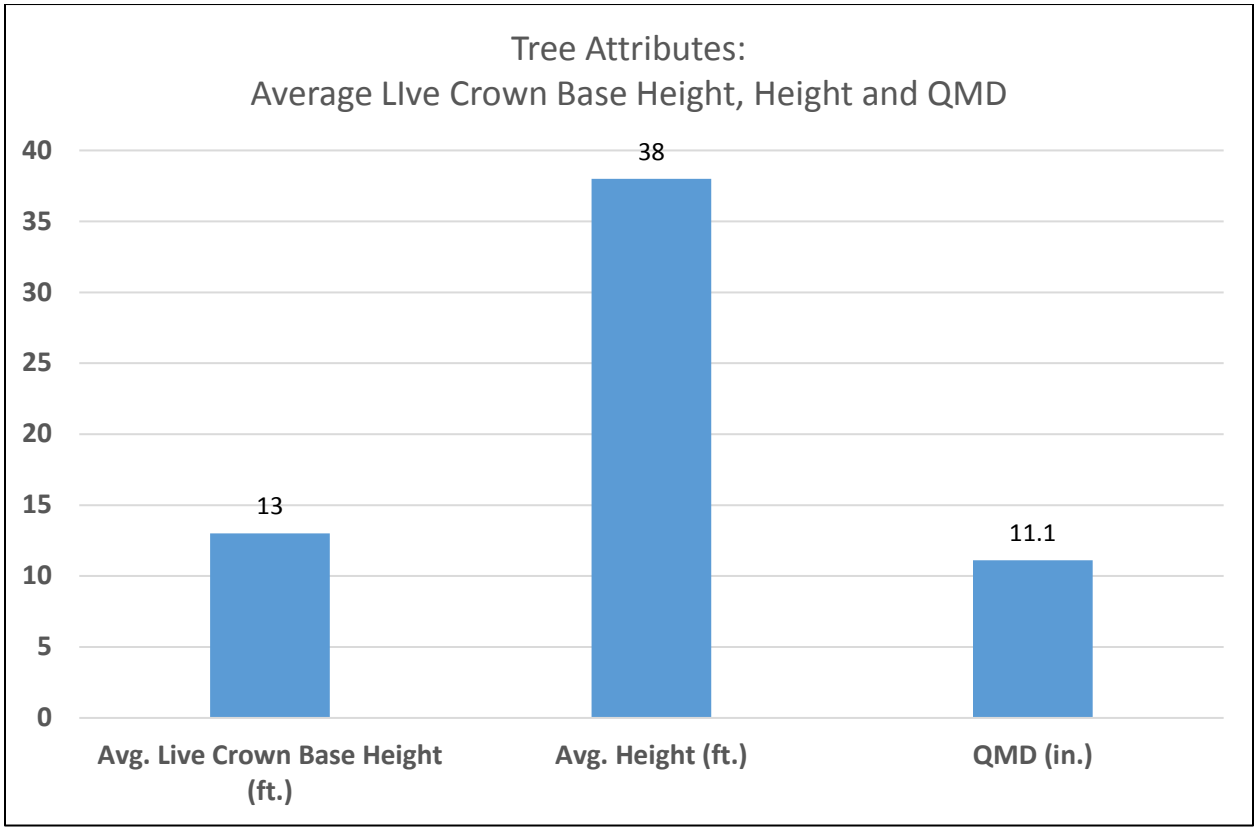


Figure 22. Average Live Crown Base Height, Average Height and QMD for Walker Flats unit 2017-2018

Table 4. Average QMD, Height and Live Crown Base Height.

SPECIES	Average QMD (in)	Average Height	Avg. Live Crown Base Height (ft.)
ABCO	10.2	36	7
JUMO	8.0	19	5
JUSC2	8.2	25	3
PIEN	12.8	68	6
PIFL2	9.2	34	11
PIPO	12.1	41	20
PIPU	10.0	41	10
POTR5	7.6	40	27
PSME	10.4	38	11
QUGA	6.4	19	5

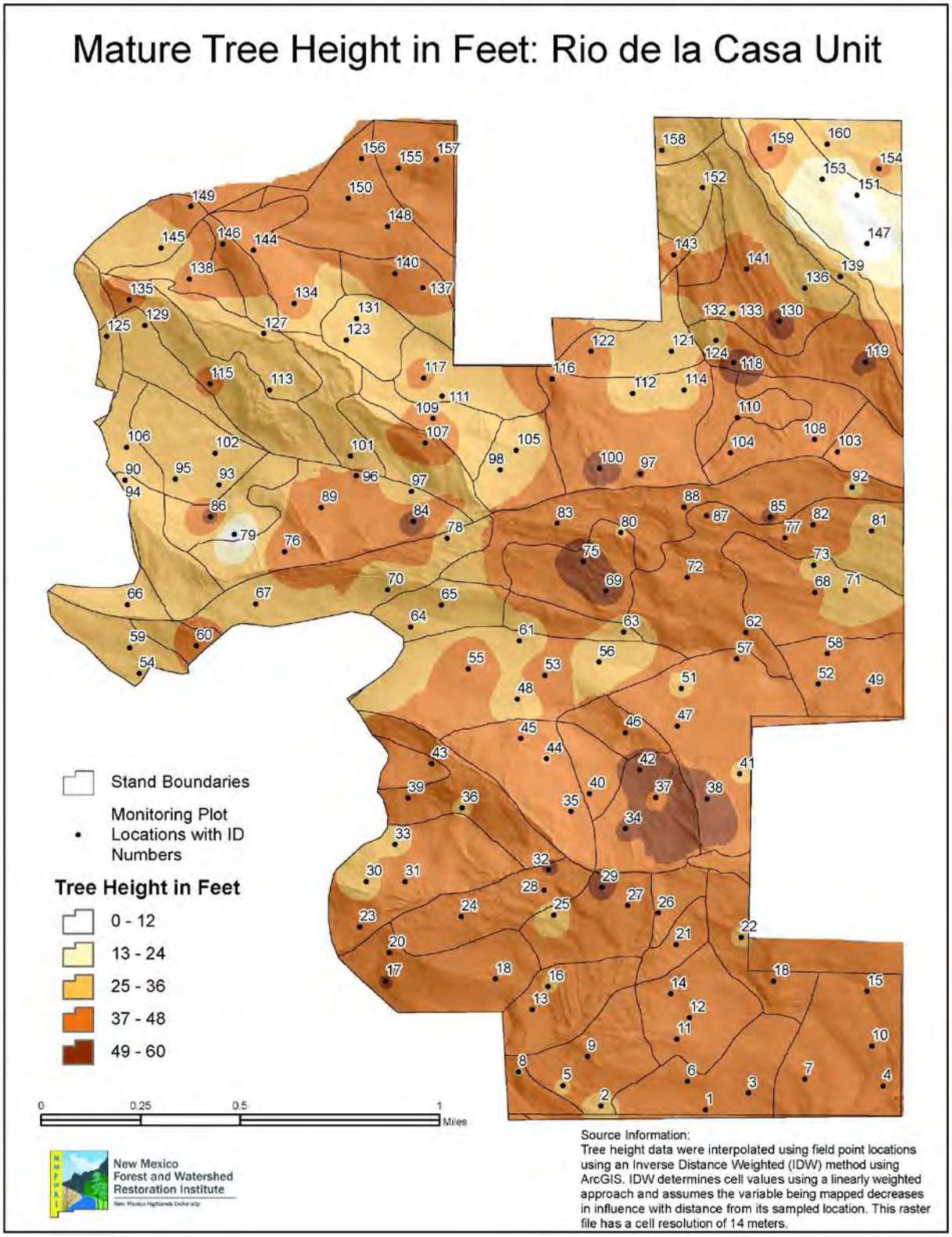


Figure 23. Tree Height for Walker Flats unit 2017-2018

Plots averaged 45 snags (standing dead trees) per acre. 45% of these snags were white fir (ABCO), 20% were Douglas-fir (PSME), 18% were ponderosa pine (PIPO), 16% were quaking aspen (POTR5), and 1% were Gambel oak (QUGA) (Figure 24). ABCO species dominated in the snags and so treatment techniques could consider this in prescriptions for treatment.

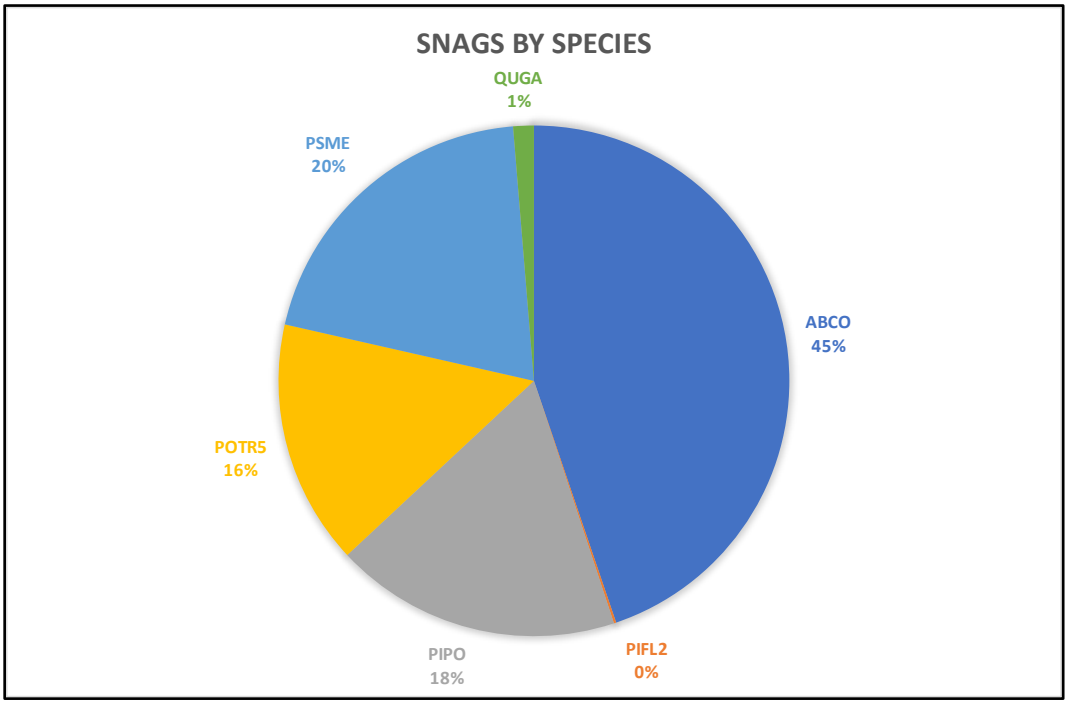


Figure 24. Snags by percent species composition for Walker Flats unit 2017-2018.

Figure 25. Snags on plots.

Note that some trees, such as those displaying diseases such as mistletoe, broom rust, severe injury or insect damage, or with high proportions of dead stems to live stems, were classified by the field crew as "sick," meaning they were not expected to recover/survive. Of these, 37% were white fir, 35% were ponderosa pine, and 28% were Douglas-fir.

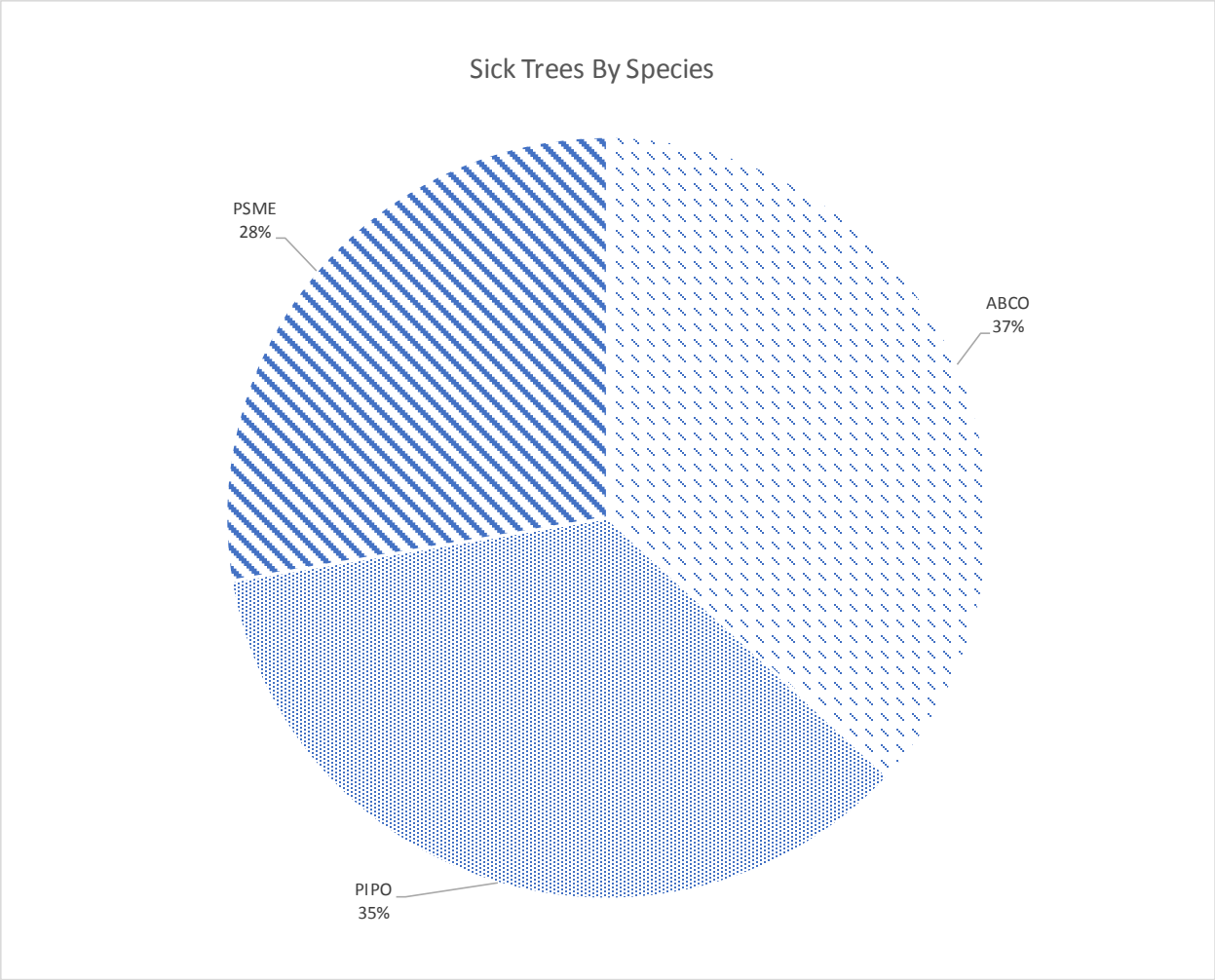


Figure 26. Sick trees by species for Walker Flats unit 2017-2018

JUMO, JUSC2, PIEN, PIFL2, PIPU, POTR5 and QUGA all had less than 10 sick trees total, whereas the majority of sick trees were classified as PSME, PIPO or ABCO.

These are the same species that dominated the presence of snags on the forest. Treatment prescriptions could be specific to removing the sick and snag trees of these species to reduce the amount of sick trees per acre for future forest resiliency. The damage type that was most frequent out of all sick code categories was mistletoe, as seen in Figure 27 below. Brooms rust was the next most common sick code category seen during plot inventory.

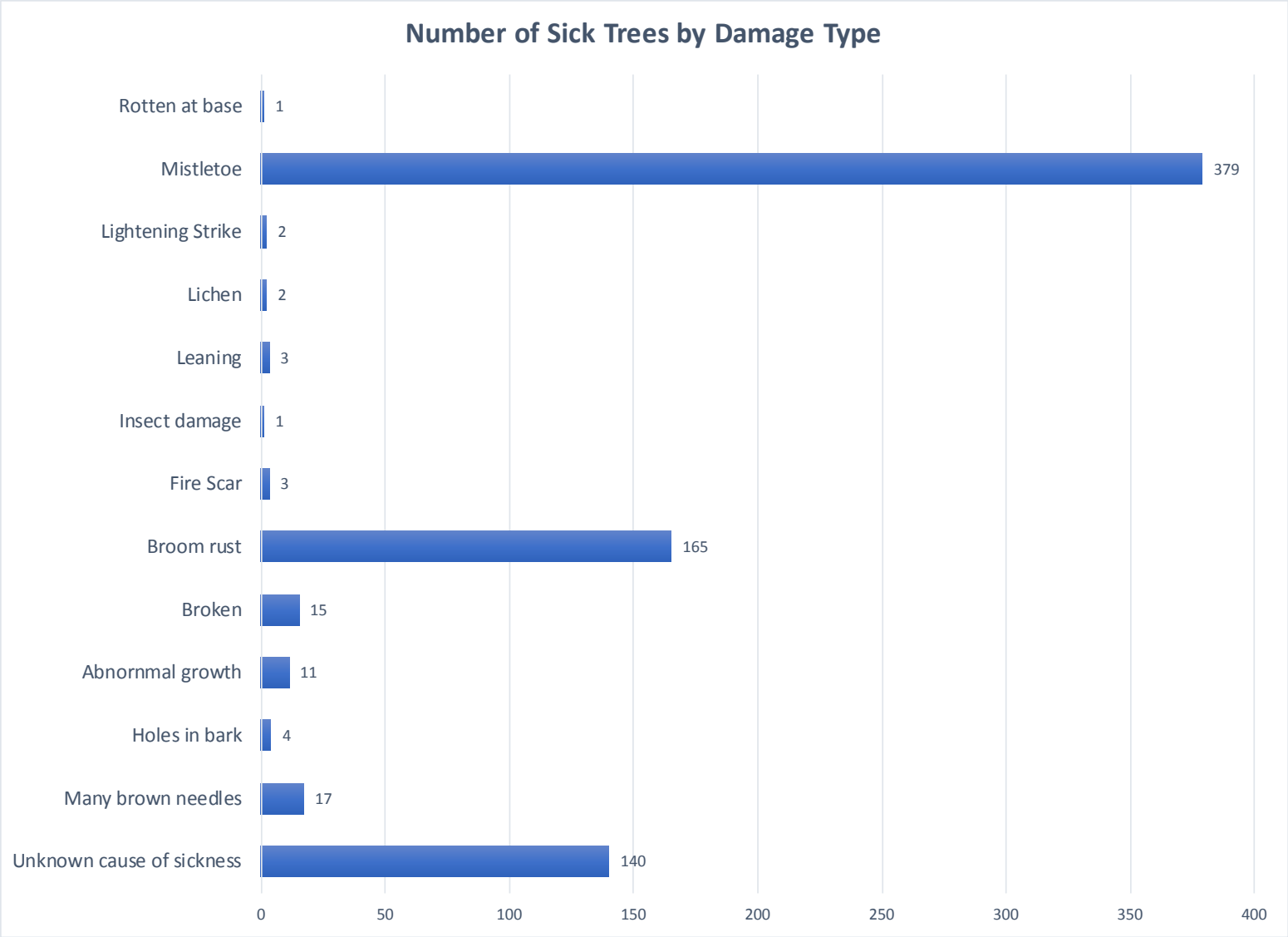


Figure 27.Absolute number of Sick Trees by damage type category for Walker Flats unit 2017-2018

Figure 28. Examples of Sickness or Damage Type at Walker Flats.

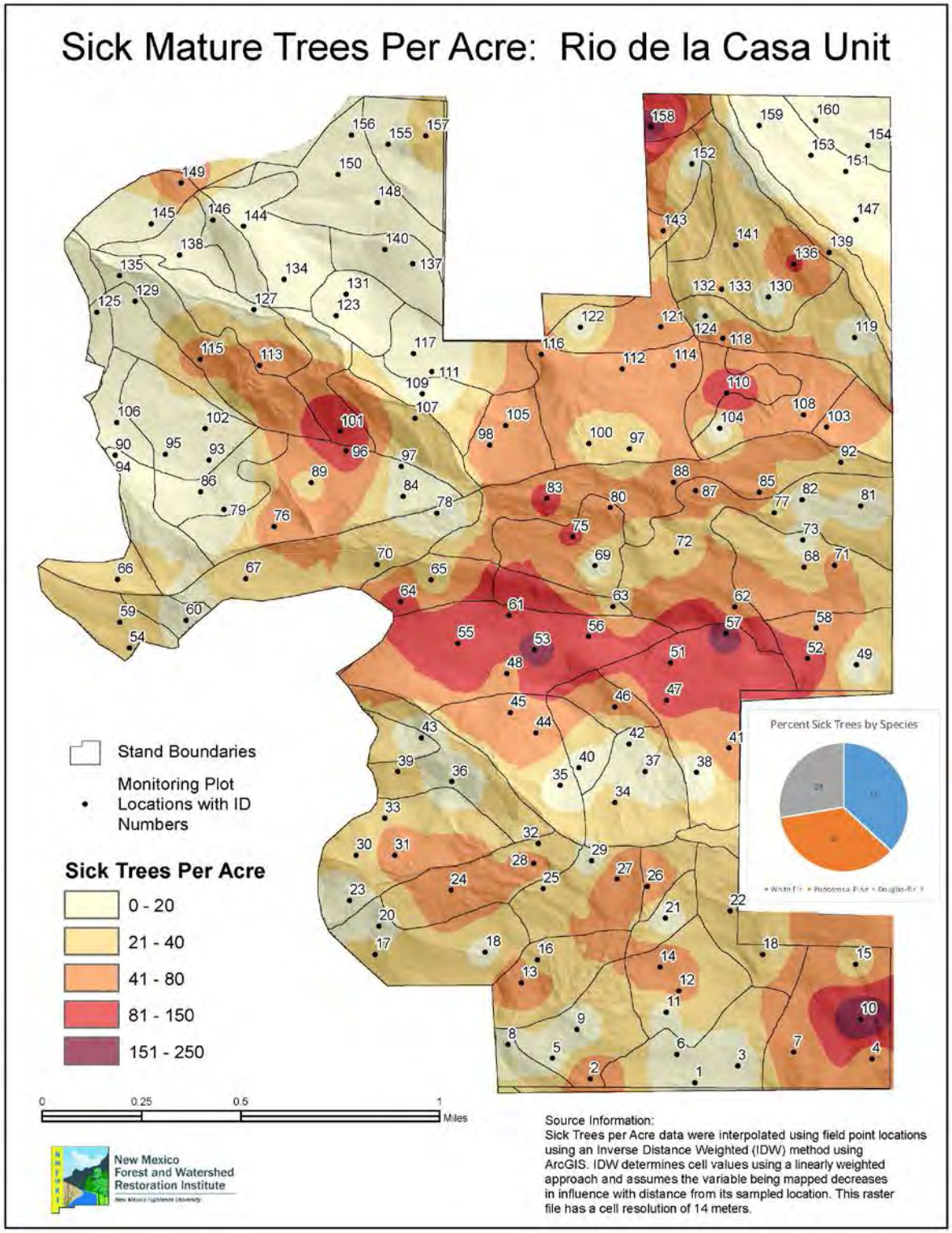


Figure 29. Mature sick trees for Walker Flats unit 2017-2018

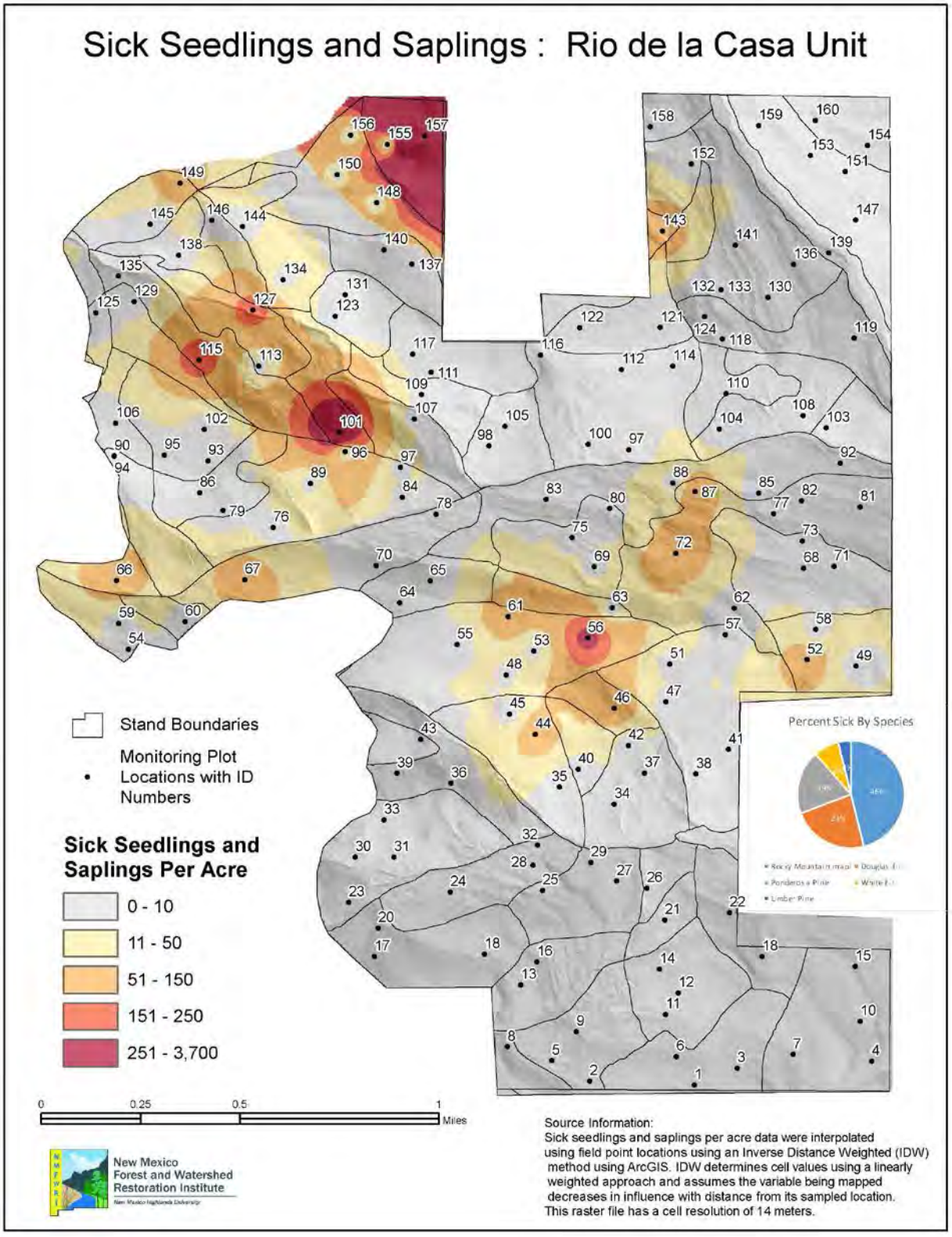


Figure 30. Sick seedlings and saplings for Walker Flats unit 2017-2018

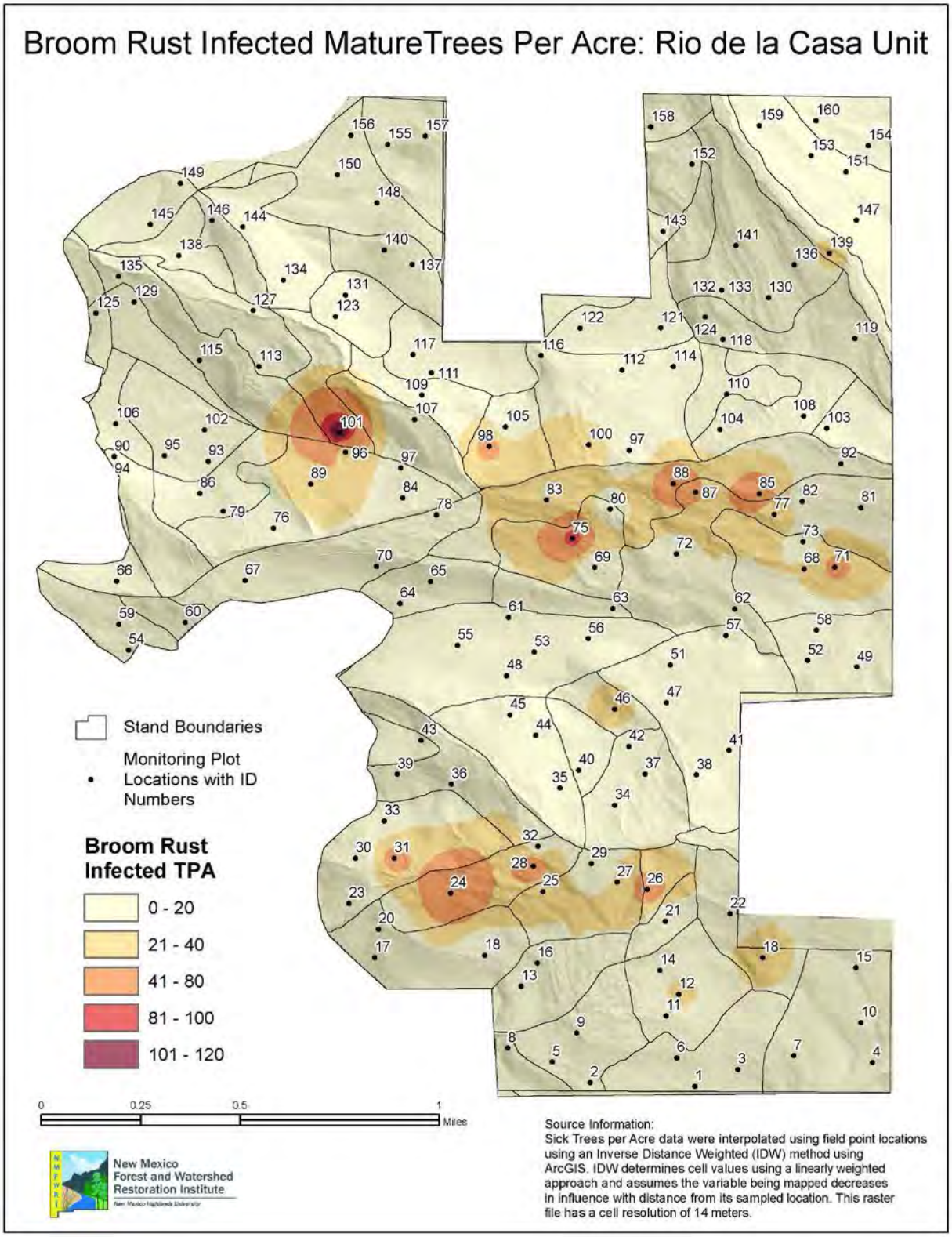


Figure 31. Trees with broom rust for Walker Flats unit 2017-2018

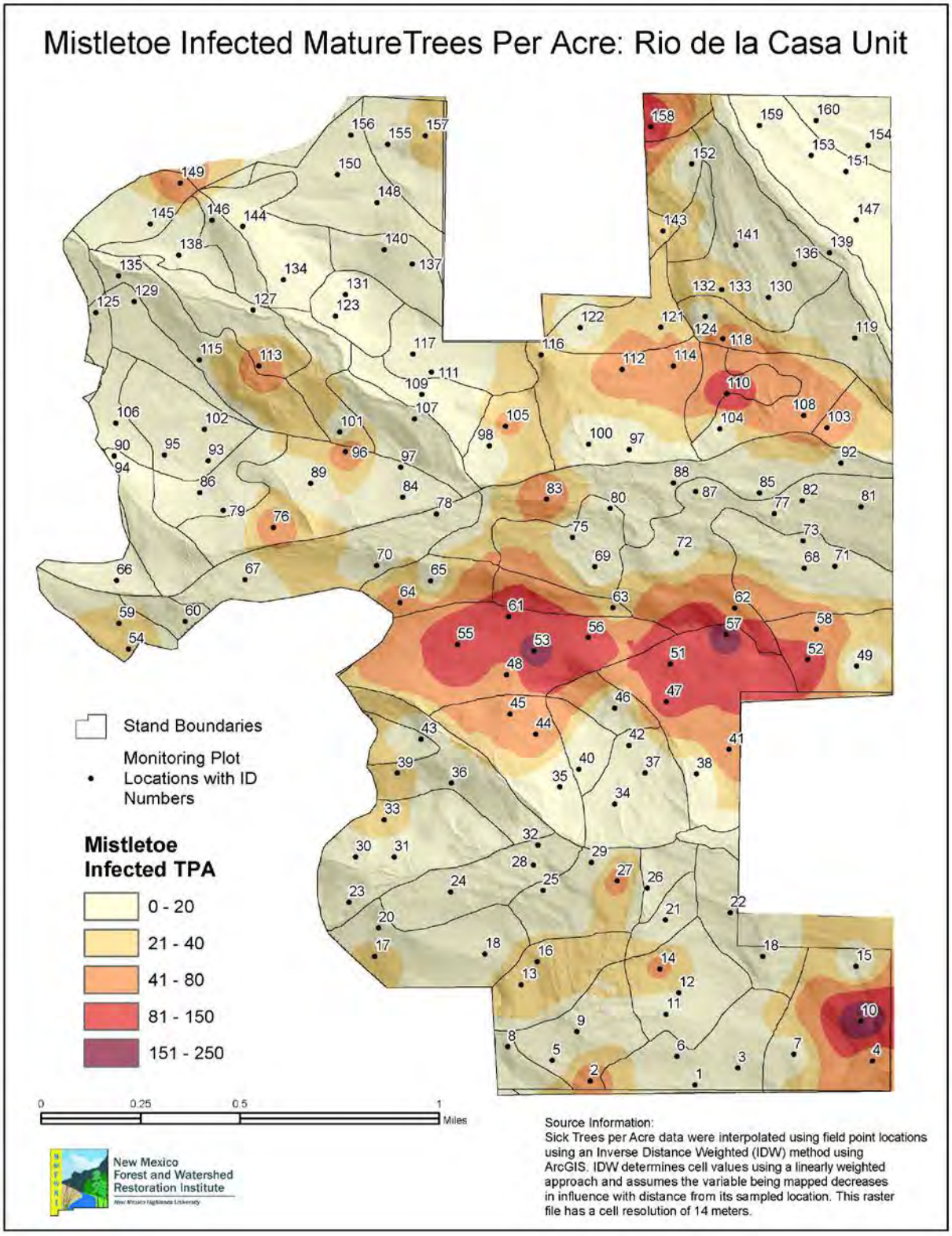


Figure 32.Trees with mistletoe at Walker Flats unit 2017-2018

The plots had an average of 9200 live and dead seedlings per acre (tree and shrub species). Of these, Gambel oak (QUGA) was encountered at 3600 individuals per acre, mountain lover (PAMY) at 2900 individuals per acre, white fir (ABCO) at 860 individuals per acre, quaking aspen (POTR5) at 696 individuals per acre, and other tree and shrub species as shown in Figure 33.

Of the 9200 total live and dead seedlings for all shrubs and tree species, 4520 are specifically tree seedlings that are live and sick.

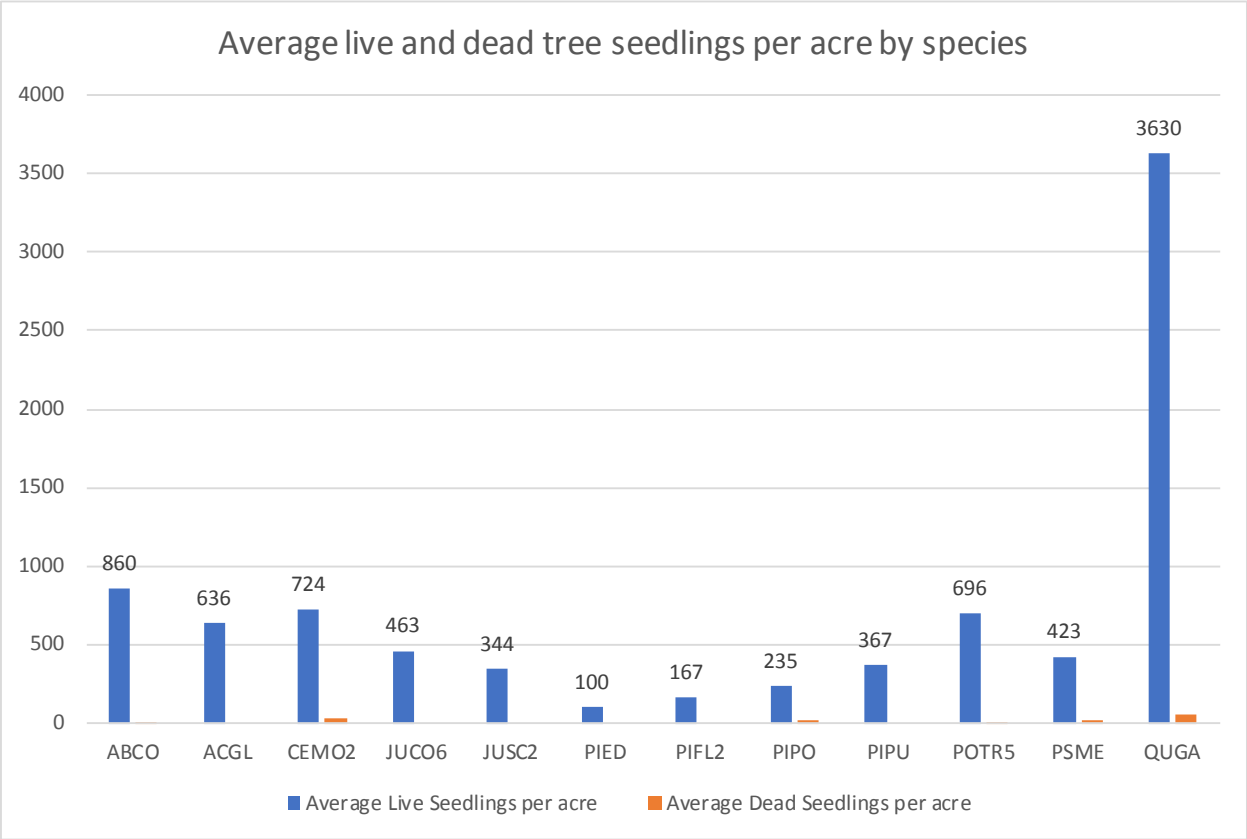


Figure 33. Average Live and Dead seedlings per acre for tree species for Walker Flats unit 2017-2018

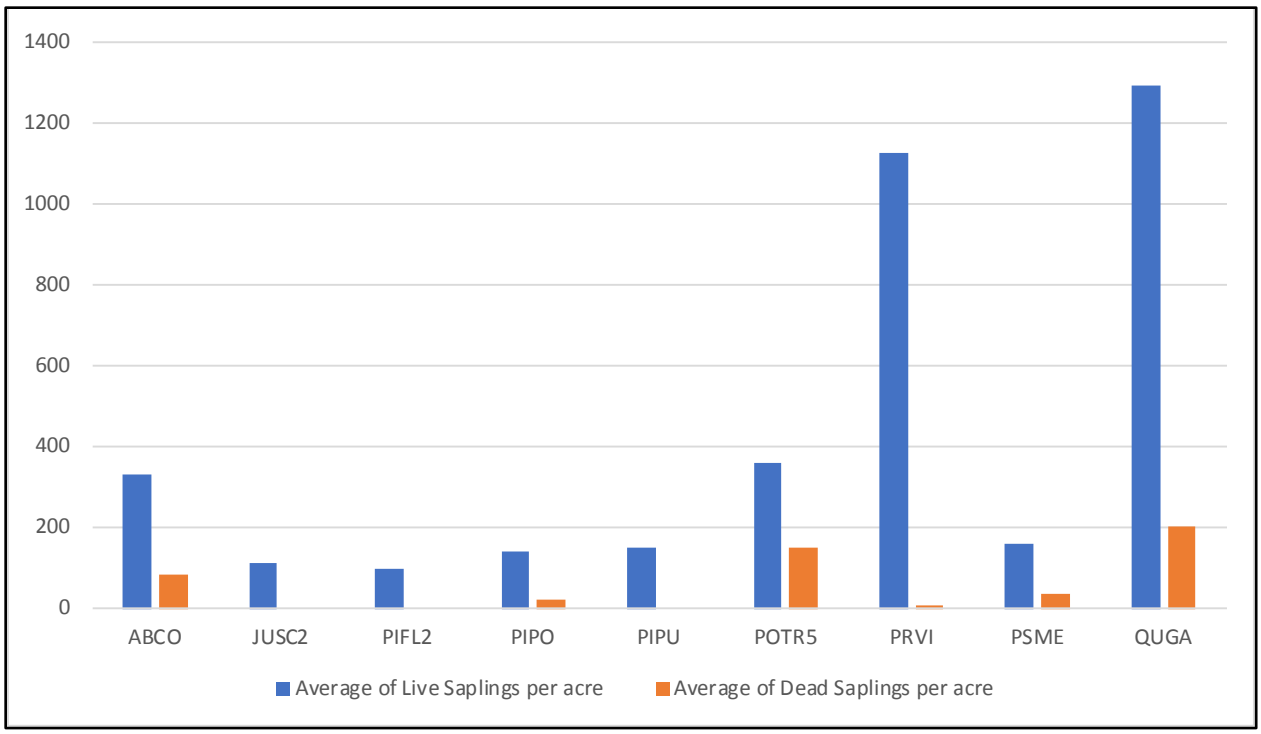


Figure 34.Tree Saplings per acre for all tree species for Walker Flats unit 2017-2018

Understory shrub/vine seedlings included serviceberry (AMAL2) and western white clematis (CLLI2) at 200 and 1400 seedlings per acre. All shrub saplings and seedling counts are shown in Figure 35 below. The most dominant shrub was ROWO followed by MARE11 and RICE. All other shrub species played a much more minor role in overall composition diversity.

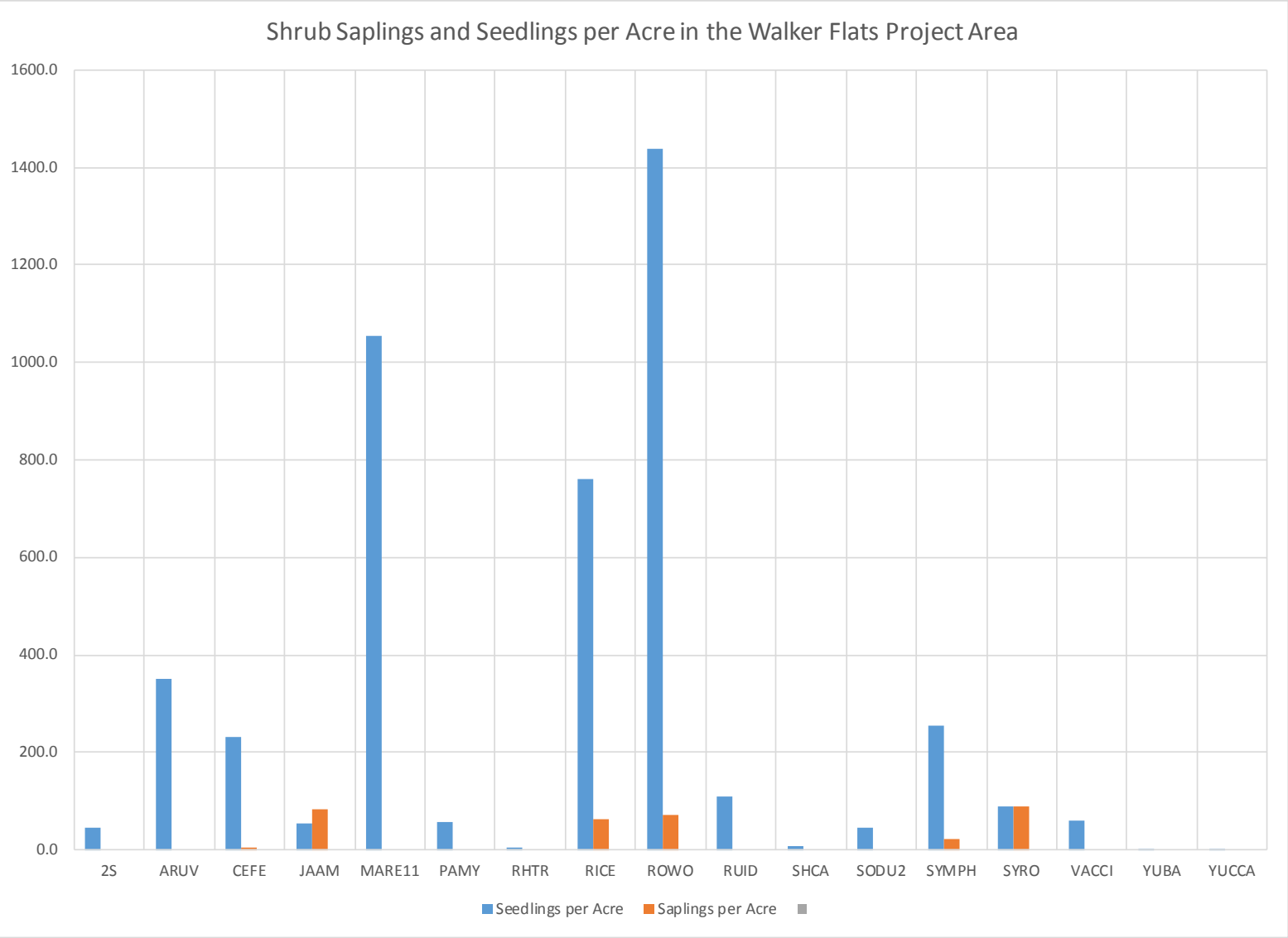


Figure 35. Shrub Saplings and Seedlings per acre in the Walker Flats Project Area

The NEPA Planning Project proposal states that "present vegetation in the area consists of overgrown and overstocked small diameter ponderosa pine and mixed conifers (Douglas fir and white fir)."[11] It also asserts that "the majority of trees are small averaging less than 16 inches in diameter. Very few large fire resistant pine trees exist in these stands." [12] This is consistent with the findings in the stand tables, found in Table 5 through Table 8, below.

Table 5 shows that our woodland species including JUMO, JUSC2 and QUGA play a minor role in the composition of the Walker Flats forest even though they are present. The dominant tree species are ABCO, followed by PIPO and PSME, with 31, 30 and 30 percent TPA for all plots. The majority of these trees were in pole size classes or smaller diameter size classes for mature trees. Table 6 shows that the majority of the size class measured on site was in the 6 inch diameter size class, with 31 percent of all trees measured falling into this size class. In comparison, for the 18 inch size class and above, only 1 percent or less of the inventory measured trees in these larger size classes.

[11] (Adelante RC&D), page 1
[12] (Adelante RC&D), page 2

Table 5. Summary table for all plots for Walker Flats unit 2017-2018

Upper Mora CFRP - Walker Flats			**2018**	
Summary Table for all Plots		**Number of Sample Trees on plot**	**Trees per acre**	**Basal area per acre**
Plot Total		**2757**	**179**	**110**
Growing Stock				
	Sick (S)	580	38	25
	Living (L)	1487	97	61
Sum of Growing Stock		**2067**	**134**	**86**
Dead	Dead (D)	690	45	24
Sum of Dead		**690**	**45**	**24**
Plot Total: Sum of Growing Stock & Dead		**2757**	**179**	**110**

Table 6. Individual plot summaries for all plots for Walker Flats unit 2017-2018

Upper Mora CFRP - Walker Flats						2018			
Individual Plot Summary Table									
		Growing Stock					Growing Stock		
Macro Plot Name	Total number of sample trees on plot	Number of growing stock sample trees on plot	Trees per Acre	Basal Area per Acre	Macro Plot Name	Total number of sample trees on plot	Number of growing stock sample trees on plot	Trees per Acre	Basal Area per Acre
RC_01	27	4	40	33.5	RC_25	26	4	40	12.0
RC_02	17	14	140	117.1	RC_26	23	13	130	90.0
RC_03	26	23	230	204.1	RC_27	21	12	120	56.7
RC_04	22	18	180	99.2	RC_28	13	12	120	66.4
RC_05	26	16	160	70.6	RC_29	14	14	140	122.6
RC_06	31	21	210	106.8	RC_30	12	11	110	91.1
RC_07	22	18	180	103.6	RC_31	6	6	60	78.9
RC_08	17	13	130	41.8	RC_32	19	13	130	117.1
RC_09	18	9	90	69.5	RC_33	10	8	80	38.6
RC_10	41	33	330	155.5	RC_34	24	23	230	161.2
RC_100	14	12	120	172.0	RC_35	15	13	130	132.8
RC_101	17	14	140	57.2	RC_36	18	15	150	141.9
RC_102	4	4	40	27.9	RC_37	15	15	150	131.1
RC_103	9	8	80	47.0	RC_38	15	13	130	152.4
RC_104	10	10	100	85.8	RC_39	31	19	190	81.5
RC_105	7	7	70	45.6	RC_40	24	21	210	163.6
RC_106	3	3	30	28.8	RC_41	10	10	100	47.6
RC_107	18	12	120	53.4	RC_42	12	11	110	124.0
RC_108	13	10	100	91.8	RC_43	9	7	70	63.8
RC_109	5	4	40	38.6	RC_44	19	17	170	98.6
RC_11	18	14	140	110.2	RC_45	12	12	120	89.5
RC_110	19	18	180	117.0	RC_46	24	17	170	103.0
RC_111	5	3	30	20.9	RC_47	12	11	110	96.1
RC_112	15	13	130	91.5	RC_48	11	11	110	71.8
RC_113	21	20	200	69.0	RC_49	25	24	240	154.3
RC_114	9	9	90	61.4	RC_51	30	27	270	102.6
RC_115	23	16	160	129.2	RC_52	14	12	120	84.9
RC_116	8	8	80	67.1	RC_53	29	24	240	179.0
RC_117	3	2	20	29.2	RC_54	9	8	80	42.9
RC_118	13	11	110	81.1	RC_55	19	19	190	188.3
RC_119	15	12	120	79.3	RC_56	20	19	190	110.8
RC_12	28	15	150	82.0	RC_57	29	23	230	173.8
RC_121	10	7	70	55.4	RC_58	25	7	70	43.3
RC_122	6	4	40	52.9	RC_59	22	19	190	56.3
RC_123	10	9	90	50.9	RC_60	47	24	240	132.3
RC_124	22	13	130	80.2	RC_61	23	19	190	86.0
RC_125	14	13	130	43.7	RC_62	11	9	90	49.5
RC_127	16	16	160	55.0	RC_63	37	34	340	119.3
RC_129	21	16	160	59.1	RC_64	31	20	200	100.5
RC_13	30	19	190	135.6	RC_65	37	21	210	88.0
RC_130	22	17	170	103.5	RC_66	24	19	190	116.2
RC_131	2	2	20	25.0	RC_67	13	11	110	76.5
RC_132	22	21	210	93.1	RC_68	11	11	110	85.7
RC_133	28	18	180	116.7	RC_69	28	19	190	70.6
RC_134	13	11	110	102.2	RC_70	25	14	140	59.6
RC_135	28	14	140	65.4	RC_71	9	9	90	46.9
RC_136	30	27	270	113.7	RC_72	25	22	220	89.0
RC_137	26	24	240	133.7	RC_73	8	7	70	65.9
RC_138	8	7	70	86.2	RC_75	45	32	320	101.8
RC_139	12	12	120	103.5	RC_76	20	16	160	121.9
RC_14	17	11	110	86.6	RC_77	18	12	120	56.2
RC_140	21	17	170	185.9	RC_78	13	13	130	57.7
RC_141	23	18	180	96.5	RC_79	0	0	0	0.0
RC_142	10	10	100	77.1	RC_80	47	28	280	135.0
RC_143	9	9	90	112.0	RC_81	11	11	110	72.5
RC_144	11	10	100	105.0	RC_82	14	11	110	76.2
RC_145	1	1	10	12.3	RC_83	21	17	170	123.6
RC_146	12	8	80	57.4	RC_84	8	4	40	61.5
RC_147	0	0	0	0.0	RC_85	14	10	100	92.1
RC_148	15	14	140	77.7	RC_86	4	4	40	75.3
RC_149	51	26	260	159.4	RC_87	36	16	160	50.9
RC_15	23	9	90	34.0	RC_88	12	10	100	86.4
RC_150	9	9	90	59.0	RC_89	19	17	170	144.0
RC_151	0	0	0	0.0	RC_90	4	3	30	14.3
RC_152	22	19	190	112.3	RC_91	6	3	30	24.1
RC_153	2	2	20	6.5	RC_92	21	15	150	108.0
RC_154	19	18	180	138.4	RC_93	10	5	50	41.6
RC_155	31	22	220	173.0	RC_94	14	9	90	47.4
RC_156	12	12	120	141.7	RC_95	15	13	130	56.4
RC_157	28	22	220	162.0	RC_96	17	13	130	70.7
RC_158	29	24	240	91.8	RC_97	11	10	100	95.3
RC_159	28	22	220	138.7	RC_98	9	6	60	27.0
RC_16	9	7	70	39.1					
RC_160	12	8	80	40.2					
RC_17	26	21	210	146.9					
RC_18	22	15	150	70.5					
RC_19	41	32	320	145.8					
RC_20	24	8	80	51.3					
RC_21	14	9	90	65.3					
RC_22	27	10	100	43.3					
RC_23	11	8	80	53.4					
RC_24	19	15	150	92.0					
Total			**Total number of sample trees on plot**	**Number of growing stock sample trees on plot**	**Average for all Plots**				
					TPA	**BA/AC**			
			2757	**2067**	**134.2**	**85.9**			

Table 7. Woodland species stand table for all plots for Walker Flats unit 2017-2018

Woodland Species		**Saplings**			**Pole**			**Mature Trees**											***Total by Species***	***Percent Species for all G-Stock***
Diameter Class		***0***	***2***	***4***	***6***	***8***	***10***	***12***	***14***	***16***	***18***	***20***	***22***	***24***	***26***	***28***	***30***	***32+***		
JUMO	COUNT	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	***1.0***	
One-seed juniper	TPA	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.1***	***0%***
	BA/AC	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.0***	***0%***
	AVE HT. (HL)	0.00	0.00	0.00	0.00	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
JUSC2	COUNT	0	0	0	4	3	2	0	1	0	0	0	0	0	0	0	0	0	***10.0***	
Rocky Mnt juniper	TPA	0.00	0.00	0.00	0.26	0.19	0.13	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.6***	***0%***
	BA/AC	0.00	0.00	0.00	0.05	0.07	0.08	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.3***	***0%***
	AVE HT. (HL)	0.00	0.00	0.00	21	23	31	0.00	34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
QUGA	COUNT	0	0	0	16	4	2	1	0	0	0	0	0	0	0	0	0	0	***23.0***	
Gambel oak	TPA	0.00	0.00	0.00	1.04	0.26	0.13	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***1.5***	***1%***
	BA/AC	0.00	0.00	0.00	0.18	0.08	0.07	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.4***	***0%***
	AVE HT. (HL)	0.00	0.00	0.00	18	21	26	42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Woodland Species Sub-total	***COUNT***	***0***	***0***	***0***	***20***	***8***	***4***	***1***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***34.0***	
	TPA	***0.00***	***0.00***	***0.00***	***1.30***	***0.52***	***0.26***	***0.06***	***0.06***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***2.2***	***2%***
	BA/AC	***0.00***	***0.00***	***0.00***	***0.23***	***0.17***	***0.15***	***0.05***	***0.06***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.7***	***1%***
	AVE HT. (HL)	***0.00***	***0.00***	***0.00***	***19***	***22***	***29***	***42***	***34***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***		
Summary by Size Class for	***TPA***		***0.00***			***2.08***							***0.13***						***2.2***	
Woodland Species	***TPA %***		***0.00%***			***94.12%***							***5.9%***						***100%***	
	BA/AC		***0.00***			***0.54***							***0.11***						***0.7***	
	BA/AC %		***0.00%***			***83.61%***							***16.4%***						***100%***	
	QUADRATIC MEAN DIAMETER		***0.00***			***6.93***							***12.3***						***7.4***	
	AVE HT. (HL)		***0.00***			***22***							***37***						***25***	

Table 8. Forestland species stand table for all plots for Walker Flats unit 2017-2018

Forestland Species		Saplings			Pole			Mature Trees											Total by Species & Covertype	Percent Species for all G-Stock
Diameter Class		*0*	*2*	*4*	*6*	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*	*28*	*30*	*32*		
ABCO	COUNT	0	0	0	186	157	115	71	52	28	13	8	6	1	4	0	1	0	***642.0***	
White fir	TPA	0.00	0.00	0.00	12.08	10.19	7.47	4.61	3.38	1.82	0.84	0.52	0.39	0.06	0.26	0.00	0.06	0.00	***41.7***	***31%***
	BA/AC	0.00	0.00	0.00	2.27	3.45	4.01	3.56	3.57	2.47	1.49	1.12	1.05	0.19	0.97	0.00	0.32	0.00	***24.5***	***28%***
	AVE HT. (HL)	0.00	0.00	0.00	28.13	33.90	38.77	44.07	47.73	50.77	48.10	58.08	52.07	36.00	57.54	0.00	78.00	0.00		
PIPO	COUNT	0	0	0	77	115	118	100	83	58	29	17	10	3	1	1	0	1	***613.0***	
Ponderosa pine	TPA	0.00	0.00	0.00	5.00	7.47	7.66	6.49	5.39	3.77	1.88	1.10	0.65	0.19	0.06	0.06	0.00	0.06	***39.8***	***30%***
	BA/AC	0.00	0.00	0.00	0.98	2.60	4.14	5.05	5.65	5.23	3.33	2.37	1.67	0.60	0.25	0.27	0.00	0.37	***32.5***	***38%***
	AVE HT. (HL)	0.00	0.00	0.00	28.61	35.97	42.70	46.52	49.78	52.32	54.61	58.52	57.76	61.36	53.00	83.00	0.00	67.00		
PSME	COUNT	0	0	0	156	143	130	71	62	30	15	5	2	3	1	0	0	1	***619.0***	
Douglas-fir	TPA	0.00	0.00	0.00	10.13	9.29	8.44	4.61	4.03	1.95	0.97	0.32	0.13	0.19	0.06	0.00	0.00	0.06	***40.2***	***30%***
	BA/AC	0.00	0.00	0.00	1.92	3.22	4.48	3.60	4.27	2.66	1.66	0.72	0.31	0.61	0.22	0.00	0.00	0.42	***24.1***	***28%***
	AVE HT. (HL)	0.00	0.00	0.00	27.27	35.25	40.65	46.22	49.56	48.50	54.46	50.37	73.54	62.76	44.00	0.00	0.00	45.00		
PIFL2	COUNT	0	0	0	16	6	10	4	6	2	1	0	0	0	0	0	0	0	***45.0***	
Limber pine	TPA	0.00	0.00	0.00	1.04	0.39	0.65	0.26	0.39	0.13	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***2.9***	***2%***
	BA/AC	0.00	0.00	0.00	0.22	0.13	0.32	0.20	0.37	0.18	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***1.5***	***2%***
	AVE HT. (HL)	0.00	0.00	0.00	28.25	30.80	35.88	44.91	43.20	49.11	42.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
PIPU	COUNT	0	0	0	4	1	3	1	1	2	0	0	0	0	0	0	0	0	***12.0***	
Colorado blue spruce	TPA	0.00	0.00	0.00	0.26	0.06	0.19	0.06	0.06	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.8***	***1%***
	BA/AC	0.00	0.00	0.00	0.06	0.02	0.09	0.06	0.07	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.5***	***1%***
	AVE HT. (HL)	0.00	0.00	0.00	33.29	38.00	39.90	65.00	46.00	52.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
PIEN	COUNT	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	***1.0***	
Engleman spruce	TPA	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.1***	***0%***
	BA/AC	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***0.1***	***0%***
	AVE HT. (HL)	0.00	0.00	0.00	0.00	0.00	0.00	68.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
POTR5	COUNT	0	0	0	50	30	11	4	0	3	0	0	0	0	0	0	0	0	***98.0***	
Aspen	TPA	0.00	0.00	0.00	3.25	1.95	0.71	0.26	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***6.4***	***5%***
	BA/AC	0.00	0.00	0.00	0.63	0.65	0.36	0.21	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	***2.1***	***2%***
	AVE HT. (HL)	0.00	0.00	0.00	38.55	42.60	38.17	43.63	0.00	61.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Forestland Species	***COUNT***	***0***	***0***	***0***	***489***	***452***	***387***	***252***	***204***	***123***	***58***	***30***	***18***	***7***	***6***	***1***	***1***	***2***	***2030.0***	
Sub-total	***TPA***	***0.00***	***0.00***	***0.00***	***31.75***	***29.35***	***25.13***	***16.36***	***13.25***	***7.99***	***3.77***	***1.95***	***1.17***	***0.45***	***0.39***	***0.06***	***0.06***	***0.13***	***132***	***98%***
	BA/AC	***0.00***	***0.00***	***0.00***	***6.08***	***10.07***	***13.40***	***12.74***	***13.94***	***10.98***	***6.60***	***4.21***	***3.04***	***1.40***	***1.44***	***0.27***	***0.32***	***0.79***	***85***	***99%***
	AVE HT. (HL)	***0.00***	***0.00***	***0.00***	***29***	***35***	***41***	***46***	***49***	***51***	***53***	***57***	***57***	***59***	***55***	***83***	***78***	***55***		
Summary by Size	***TPA***		***0.0***			***86.2***							***45.6***						***132***	
Class for Forestland	***TPA %***		***0.0%***			***65.4%***							***34.6%***						***100.0%***	
Species	***BA/AC***		***0.0***			***29.6***							***55.7***						***85.3***	
	BA/AC %		***0.0%***			***34.7%***							***65.3%***						***100.0%***	
	QUADRATIC MEAN DIA.		***NA***			***7.93***							***14.97***						***10.9***	
	AVE HT. (HL)		***0.00***			***36***							***51***						***46***	

Understory and Forest Floor Components

As described above, percent ground cover was estimated at each plot within the 1/100th acre subplot. Tree canopy was measured with a densiometer. Where total percent cover exceeds 100%, this is usually due to the presence of litter beneath other vegetation. Average cover values were as follows: 69% tree canopy cover, 22% seedling/sapling cover, 19% shrub cover, 25% graminoid and forb cover, 61% litter cover, 10% rock and gravel cover, and 3.8% bare soil. See Table 9. As expected, cover values varied by plot; for example, individual plot measurements of tree canopy cover ranged from 9% to 97%.

The Adelante NEPA Planning Proposal states that "overstocked conditions have resulted in… heavy shading and competition for moisture resulting in the elimination of most of the herbaceous on the forest floor."[13] The field crew findings included a wide variety of understory vegetation, but overall ground cover percentages on plots are low.

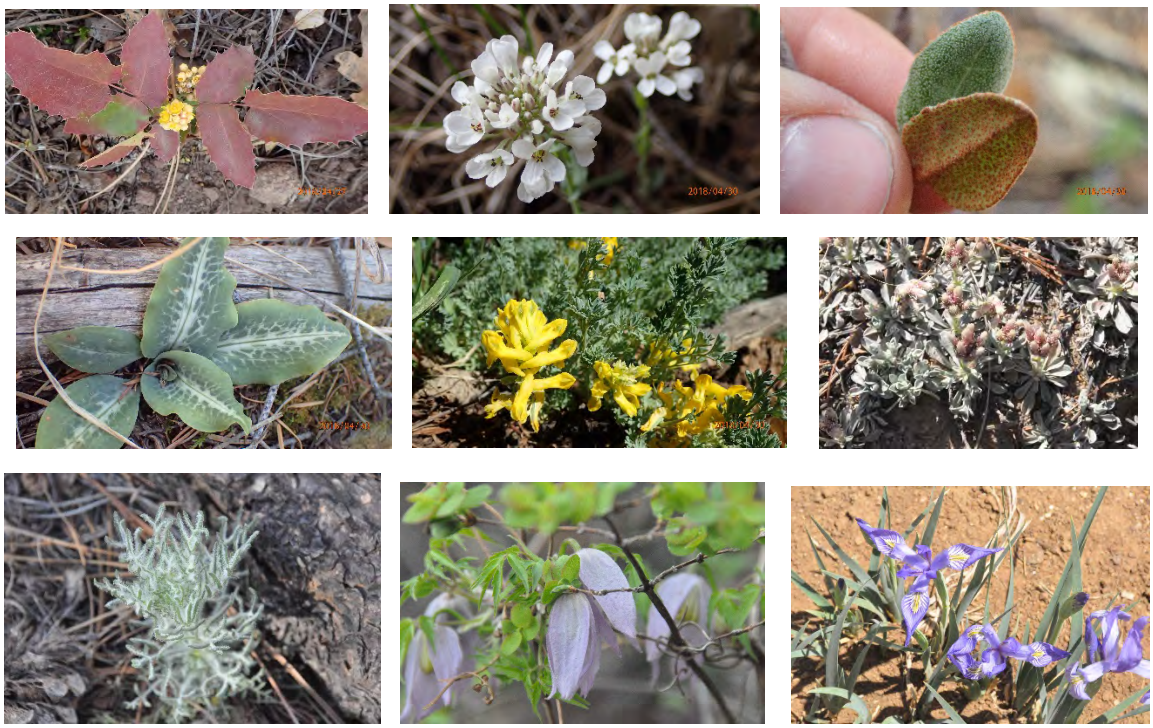


Figure 36. Examples of understory vegetation at Walker Flats, 2017-2018.

Table 9.Tree canopy, understory and ground cover for Walker Flats unit 2017-2018.

Rio de la Casa (CFRP)	**Aerial cover**			
Tree Canopy	**Seedlings/Saplings**	**Shrub cover**	**Graminoid Cover**	**Forb Cover**
69%	22%	19%	15%	10%

Ground cover					
Plant Basal	**Bole**	**Litter**	**Bare Soil**	**Rock**	**Gravel**
14%	12%	61%	3.8%	8.9%	1.2%

[13] (Adelante RC&D), page 2

Additional cover data was collected using the planar intercept method as revised by Brown (1974) for the sampling of down woody debris (DWD) and ladder fuels, which was described in the Field Methods section. Recall that this data is broken down into four categories: herbaceous dead (HD), herbaceous live (HL), woody standing dead (SD), and woody standing live (SL). The average total percent cover for all plots was 11.4%. Average HD cover was 4.3%, average HL cover was 12.9%, SD cover was 5.0%, and SL was 23.5%. See Table 10, below.

Table 10. Planar intercept cover and fuels.

Fuel	Average Height (ft.)	Average Biomass (tons per acre)	Average Cover (%)	Total Biomass (tons per acre)
HD	0.7	0.1	4.3	14.0
HL	0.7	0.3	12.9	35.0
SD	2.0	0.6	5.0	58.8
SL	2.8	2.0	23.5	301.7
Grand Total	1.6	0.8	11.4	409.4

Surface fuels were measured at all plots using Brown's transects. Average tons/acre for all fuels (1, 10, 100, and 1000-hour wood fuels as well as litter and duff) was 33.8. Total wood fuels were measured at 30.41 tons/acre with fine wood fuels (1 to 100 hour fuels) measured at an average of 4.61 tons/acre and coarse wood fuels (1000-hour fuels) at 8.29 tons/acre. Duff was measured at 13.81 tons/acre and an average depth 1.38 inches; litter was measured at 7.09 tons/acre and an average depth of 1.42 inches. See Table 11.

According to the Adelante NEPA Planning Proposal, "conditions [are] conducive to catastrophic stand replacing fires."[14]The forest stand data collected supports this statement.

Table 11. Surface fuels for all plots.

Fuel	Average Tons/Acre
1-hr	0.27
10-hr	2.19
100-hr	2.15
1-100-hr	4.61
1000-hr sound	5.68
1000-hr rotten	2.61
1-1000-hr	12.90
Duff	13.81
Litter	7.09
Total Fine Wood Fuels	4.61
Total Wood Fuels	30.41
Total Surface Fules	33.80
Fuel	**Depth (inches)**
Duff	1.38
Litter	1.42

[14] (Adelante RC&D), page 2

Decay classes of logs (1000-hour fuels) were recorded (Figure 37). Both snags and logs provide wildlife habitat and are an important part of a restored landscape. The large amount of decayed logs onsite are adding to the fuel loads available for catastrophic fires. A good balance is needed between a prescription to reduce sick and snag trees while maintaining the wildlife benefit that this tree type can offer special species.

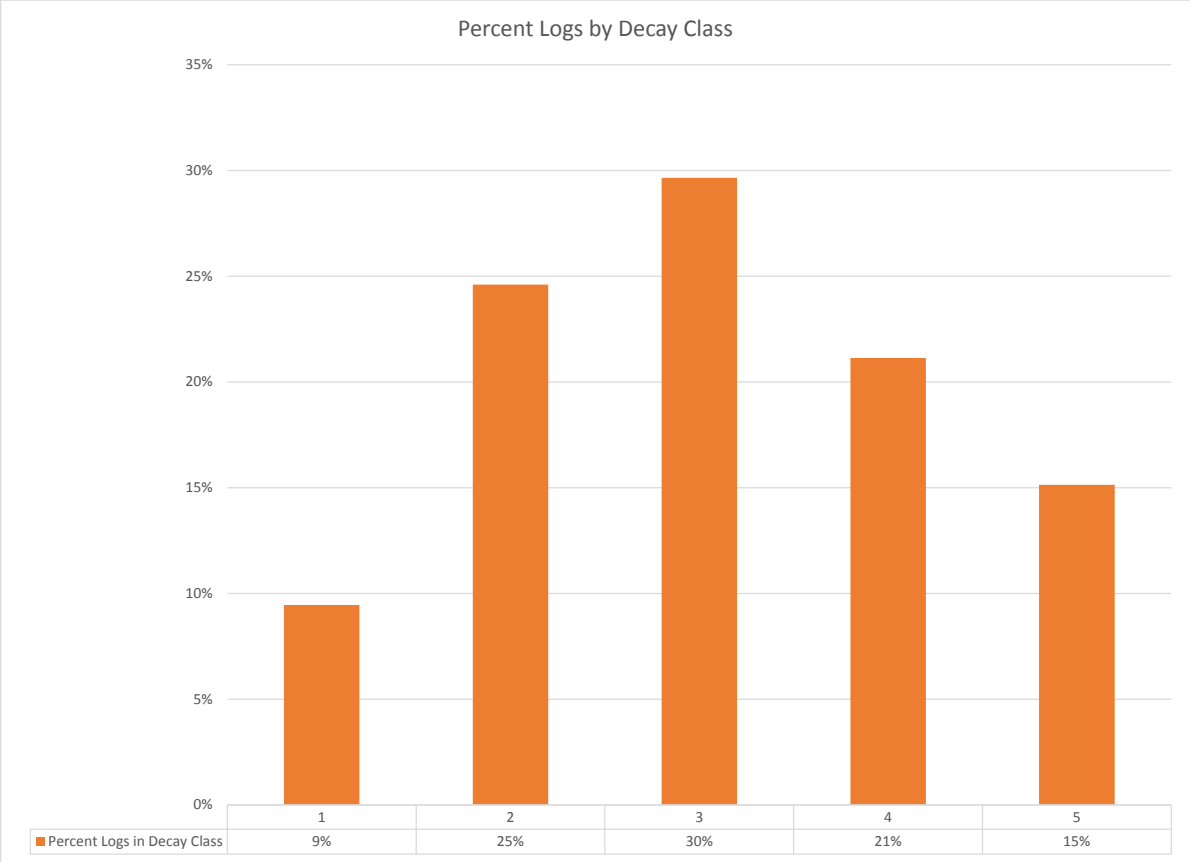


Figure 37. Logs (1000-hour fuels) by decay class for Walker Flats unit 2017-2018.

Plot photos

Plot 22, facing south

Plot 26, facing plot center

Plot 94, facing north

Plot 9, facing south

Plot 16, facing north

Plot 20, Brown's transect (295 degrees)

Plot 10, facing E.

Plot 14, Brown's transect (124 degrees).

Plot 17, facing plot center (south).

Plot 23, facing W.

Plot 105, facing N.

Plot 147, facing E.

Plot 55, facing south

Plot 131, Brown's transect (20 degrees)

Plot 95, facing east

Plot 10, Brown's transect (30 degrees)

Plot 1, facing south

Plot 160, facing south.

Figure 38. Photographs from Walker Flats plots.

Summary

Field crew notes included comments on the patchiness of the stand, as well as on small-scale topographic relief and accompanying drainages, and noted the steep, rocky and variable terrain of the project.

Some plots had high fuel loads (logs stacking up to five feet on one plot), as well as high prevalence of snags. In some areas, evidence of severe mistletoe and rust was present on all snags, suggesting the infestation has been destructive and persistent. Overall disease in the project was among the highest the crew had seen in four years of work around the state. Spittle bugs were common on Gambel oak, powdery mildew was common on aspen regeneration, and deformity of trees of all ages was found throughout the project area. Windthrow was also common across plots.

Understory cover and composition was highly variable. Fire scars were rare on standing trees outside of previously treated areas, and only one log was encountered with evidence of fire. Evidence of human influence was present almost everywhere, even in areas with extremely difficult access. This evidence was primarily ATV roads, trash (most commonly chainsaw oil bottles, vehicle parts, and beer cans), and a very high volume of beheaded white firs (presumably harvested for Christmas trees). The crew observed the highest volume of other vehicles (pickups with beds full of white fir saplings) during "Christmas tree" season in 2017; they did not at any time find permit tags on white fir stumps.The following table and figures represent the summarized data.

Table 12. Data summary for all plots in the Walker Flats unit, 2017-2018.

Metric	Average (if applicable)	Range of values on individual plots
Trees per acre	134	0-340
Dominant tree (numerically)	white fir	---
Basal area (ft^2/acre)	86	0-204
QMD (inches)	11.1	5 - 34.5 (DBH on individual trees)
Average tree height (ft)	38	4.9 - 97
Height of tallest tree (ft)	97 (ponderosa pine)	----
Average LiCrBHt (ft)	13	0 - 68
Seedlings per acre (tree spp)	4520	----
Dominant seedling (numerically)	Gambel oak	----
Saplings per acre (tree spp)	1100	----
Dominant sapling (numerically)	Gambel oak	-----
Shrubs per acre (in seedling ht class)	4560	0.6 - 1440
Dominant Shrub (seedlings numerically)	Woods' rose	-----
Shrubs per acre (in sapling dia class)	331	3.9 – 90.3
Dominant Shrub (sapling numerically)	roundleaf snowberry	-----
Sick trees per acre	38	0 – 200
Dominant sick tree (numerically)	white fir	----
Snags per acre	45	0 - 250
Dominant snag (numerically)	white fir	----
Average slope (%)	34%	6-90%
Dominant aspect	North (37%)	North, South, East
Tree Canopy cover (%)	69%	9 – 97%
Grass and forb cover (%)	25%	0 - 85%
Logs per acre (1000-hour fuels)	21.2	0 – 89.9
Average total tons of surface fuel per acre	33.8	2.4 – 167.9

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Appendix I: GPS coordinates for collected points

Plot_ID	Latitude	Longitude	Easting	Northing
RC_01	36.002507	-105.429298	461310	3984310
RC_02	36.002633	-105.433994	460886	3984330
RC_03	36.003122	-105.427383	461482	3984380
RC_04	36.003403	-105.421345	462027	3984410
RC_05	36.003369	-105.435699	460733	3984410
RC_06	36.003538	-105.430119	461236	3984430
RC_07	36.003633	-105.42486	461710	3984430
RC_08	36.003866	-105.437704	460553	3984470
RC_09	36.004432	-105.434609	460832	3984530
RC_10	36.00485	-105.421858	461981	3984570
RC_100	36.025826	-105.434197	460879	3986900
RC_101	36.026224	-105.445352	459875	3986950
RC_102	36.026309	-105.451425	459328	3986960
RC_103	36.026465	-105.423514	461842	3986970
RC_104	36.026408	-105.428313	461410	3986960
RC_105	36.026465	-105.437921	460544	3986970
RC_106	36.026514	-105.455404	458969	3986990
RC_107	36.026714	-105.442002	460177	3987000
RC_108	36.026905	-105.424552	461749	3987020
RC_109	36.027607	-105.441677	460206	3987100
RC_11	36.005072	-105.430608	461193	3984600
RC_110	36.027688	-105.428009	461438	3987100
RC_111	36.028425	-105.441257	460245	3987190
RC_112	36.028559	-105.432703	461015	3987200
RC_113	36.02862	-105.448995	459548	3987220
RC_114	36.028685	-105.430406	461222	3987220
RC_115	36.02883	-105.451672	459307	3987240
RC_116	36.029078	-105.436335	460689	3987260
RC_117	36.02908	-105.442092	460170	3987260
RC_118	36.029682	-105.428189	461423	3987330
RC_119	36.029737	-105.422277	461955	3987330
RC_12	36.005854	-105.430046	461244	3984680
RC_121	36.030093	-105.430986	461171	3987370
RC_122	36.030078	-105.434593	460846	3987370
RC_123	36.030455	-105.445572	459857	3987420
RC_124	36.030494	-105.428992	461351	3987420
RC_125	36.030542	-105.456322	458888	3987430

RC_127	36.030666	-105.449267	459524	3987440
RC_129	36.030951	-105.454599	459044	3987480
RC_13	36.006127	-105.437101	460608	3984720
RC_130	36.031208	-105.426157	461607	3987490
RC_131	36.031238	-105.44512	459898	3987500
RC_132	36.03148	-105.428252	461418	3987520
RC_133	36.031475	-105.428248	461418	3987520
RC_134	36.031774	-105.447923	459646	3987570
RC_135	36.031876	-105.455314	458980	3987580
RC_136	36.032415	-105.425005	461711	3987630
RC_137	36.032366	-105.442134	460168	3987630
RC_138	36.032644	-105.452619	459223	3987660
RC_139	36.032834	-105.423423	461854	3987670
RC_14	36.006719	-105.430884	461169	3984780
RC_140	36.032874	-105.443402	460054	3987690
RC_141	36.033098	-105.427631	461475	3987700
RC_143	36.033606	-105.430894	461181	3987760
RC_144	36.033698	-105.449758	459482	3987780
RC_145	36.033768	-105.453897	459109	3987790
RC_146	36.03392	-105.451132	459358	3987800
RC_147	36.034035	-105.422225	461962	3987810
RC_148	36.034592	-105.443743	460024	3987880
RC_149	36.035279	-105.452574	459229	3987960
RC_15	36.006843	-105.422094	461961	3984790
RC_150	36.035607	-105.445509	459865	3987990
RC_151	36.035804	-105.422692	461921	3988000
RC_152	36.03605	-105.42962	461297	3988030
RC_153	36.036376	-105.424264	461780	3988070
RC_154	36.036761	-105.421713	462010	3988110
RC_155	36.036719	-105.443272	460067	3988110
RC_156	36.037051	-105.444923	459919	3988150
RC_157	36.037037	-105.441575	460220	3988150
RC_158	36.0374	-105.43146	461132	3988180
RC_159	36.037471	-105.426603	461569	3988190
RC_16	36.006967	-105.436395	460672	3984810
RC_160	36.037655	-105.424044	461800	3988210
RC_17	36.00713	-105.443677	460016	3984830
RC_18	36.0072	-105.426277	461584	3984830
RC_19	36.007232	-105.438749	460460	3984840
RC_20	36.008169	-105.443519	460031	3984950

RC_21	36.008513	-105.430663	461189	3984980
RC_22	36.00879	-105.427744	461453	3985010
RC_23	36.009104	-105.444852	459911	3985050
RC_24	36.009497	-105.440297	460322	3985090
RC_25	36.009566	-105.436149	460696	3985100
RC_26	36.009662	-105.431464	461118	3985110
RC_27	36.009921	-105.432832	460995	3985140
RC_28	36.010478	-105.43659	460656	3985200
RC_29	36.010598	-105.433984	460891	3985210
RC_30	36.010746	-105.444565	459938	3985230
RC_31	36.010759	-105.442833	460094	3985230
RC_32	36.011208	-105.436378	460676	3985280
RC_33	36.012105	-105.44328	460054	3985380
RC_34	36.01272	-105.432945	460986	3985450
RC_35	36.013335	-105.435406	460764	3985520
RC_36	36.013456	-105.440277	460326	3985530
RC_37	36.013863	-105.431598	461108	3985570
RC_38	36.013831	-105.429291	461316	3985570
RC_39	36.01381	-105.44271	460106	3985570
RC_40	36.013986	-105.434572	460840	3985590
RC_41	36.014732	-105.427838	461447	3985670
RC_42	36.014858	-105.432331	461042	3985680
RC_43	36.015049	-105.441648	460203	3985710
RC_44	36.01525	-105.436507	460666	3985730
RC_45	36.015983	-105.43767	460562	3985810
RC_46	36.01622	-105.432969	460985	3985830
RC_47	36.016458	-105.430644	461195	3985860
RC_48	36.017409	-105.437825	460548	3985970
RC_49	36.017785	-105.422115	461964	3986000
RC_51	36.017837	-105.430476	461211	3986010
RC_52	36.018013	-105.42433	461765	3986030
RC_53	36.018281	-105.436596	460660	3986060
RC_54	36.018298	-105.454789	459020	3986070
RC_54	36.018292	-105.454799	459019	3986070
RC_55	36.018511	-105.440029	460350	3986090
RC_56	36.018776	-105.434168	460879	3986120
RC_57	36.018916	-105.427997	461435	3986130
RC_58	36.019119	-105.423932	461801	3986150
RC_59	36.019227	-105.455222	458982	3986180
RC_60	36.019305	-105.452243	459250	3986180

RC_61	36.01954	-105.437759	460555	3986200
RC_62	36.019879	-105.427597	461471	3986240
RC_63	36.019873	-105.433078	460977	3986240
RC_64	36.020022	-105.44262	460118	3986260
RC_65	36.020819	-105.441259	460241	3986350
RC_66	36.020791	-105.455341	458972	3986350
RC_67	36.02084	-105.449573	459492	3986350
RC_68	36.021343	-105.424501	461751	3986400
RC_69	36.021361	-105.433883	460906	3986400
RC_70	36.021371	-105.443672	460024	3986410
RC_71	36.021418	-105.423118	461876	3986410
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RC_73	36.022342	-105.424551	461747	3986510
RC_75	36.022421	-105.43489	460815	3986520
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RC_77	36.023326	-105.425859	461630	3986620
RC_78	36.02326	-105.441006	460265	3986620
RC_79	36.023358	-105.450563	459404	3986630
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RC_83	36.023813	-105.436077	460709	3986680
RC_83	36.023811	-105.4361	460707	3986680
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RC_90	36.025312	-105.455462	458963	3986850
RC_91	36.024959	-105.442621	460120	3986810
RC_92	36.025183	-105.422859	461901	3986820
RC_93	36.025159	-105.451259	459342	3986830
RC_94	36.025332	-105.455473	458962	3986850
RC_95	36.025358	-105.45322	459165	3986860
RC_96	36.025512	-105.445099	459897	3986870
RC_97	36.025633	-105.432359	461045	3986880
RC_98	36.025757	-105.438651	460478	3986890