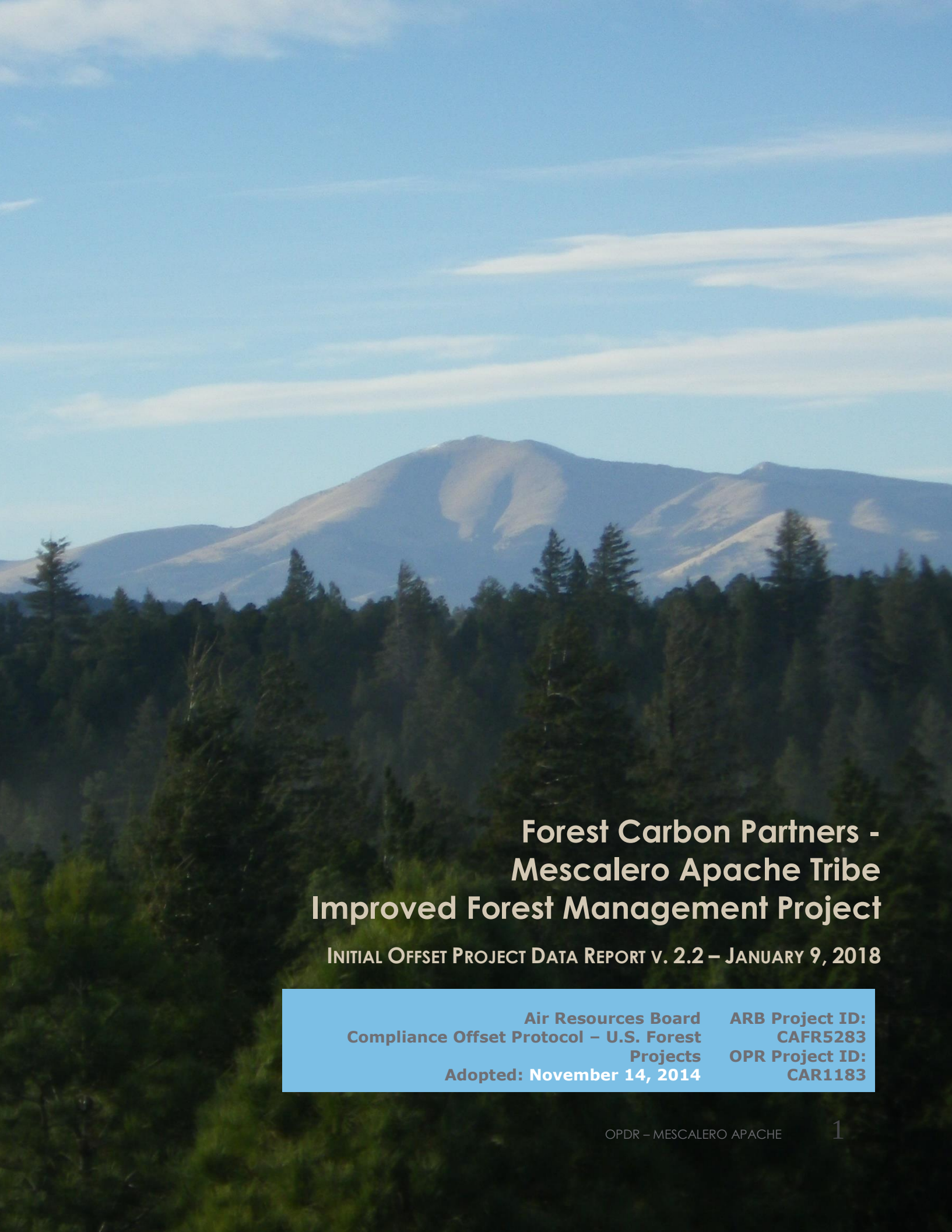

Forest Carbon Partners - Mescalero Apache Tribe Improved Forest Management Project

Initial Offset Project Data Report v. 2.2 – January 9, 2018

Air Resources Board
Compliance Offset Protocol – U.S. Forest Projects
Adopted: November 14, 2014

ARB Project ID: CAFR5283
OPR Project ID: CAR1183

Important Note

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Reporting Period:

The first reporting period for this Offset Project Data Report is from October 16, 2015, to August 15, 2016.

Protocol Version:

Air Resources Board Compliance Offset Protocol – U.S. Forest Projects
Adopted: November 14, 2014

Regulation Version:

Cal. Code Regs. tit. 17, § 95800-96022
(October 1, 2017)

ATTESTATION

I certify under penalty of perjury under the laws of the State of California the GHG reductions and/or GHG removal enhancements for Forest Carbon Partners - Mescalero Apache Tribe Improved Forest Management Project from October 16, 2015, to August 15, 2016, are measured in accordance with the Compliance Offset Protocol U.S. Forest Projects, November 14, 2014, and all information required to be submitted to ARB in the Offset Project Data Report is true, accurate, and complete.

Brian Shillinglaw **Date:** 1/9/18
Director, Investments & Operations

Note to Reader on Attachments to the OPDR
This version of the OPDR includes the necessary information required in attachments E (maps), G, H, I, K and L; thus, these attachments are not being provided separately. Attachments A, D, and F, as well as the shapefile of the Project Area boundary required as part of attachment E, are included as separate attachments to this document. Attachments B, C, and J are not applicable to this project.

Note to Reader Regarding Differences between OPDR and Listing Documents

There are differences between the listing documents and this OPDR. The differences are enumerated in the table on the following page.

Note to Reader Regarding Differences between the OPDR and Listing Documents:
There are differences between the listing documents and this OPDR. The changes between the listing documents and this version of the OPDR are enumerated in the following table.

Table 1. Listing Documents to OPDR Changes

Ln #	Item	Where Changed	Listing Documents	OPDR
1	Reporting Period and commencement date	OPDR 3	Listing Form pg. 1	Commencement date was changed to October 16, 2016. Reporting period was extended to August 15, 2016
2	Project Area	OPDR 11	Listing Form pg. 2	Project area changed to reflect more accurate delineation; maps and other project information modified to reflect revised project area
3	Assessment Areas	OPDR 20 & 47	Listing Form pg. 2 and 3	Acreages allocated to the Assessment Area changed as a result of revisions to the project area
4	Inventory	OPDR 27-28	Listing Form pg. 3	Plot size and spacing adjusted for topography and project area
5	Summary of onsite carbon stocks	OPDR 54-55	Listing Form pg. 6	Onsite carbon stock estimates changed as a result of revised project area and completion of inventory data collection
6	Baseline carbon stocks	OPDR 48-53	Listing Form pg. 7	Baseline carbon stock estimates changed as a result of FVS modeling and revised carbon calculations
7	Common practice value	OPDR 47	Listing Form pg. 7	Changed due to project area revisions
8	Legal Constraints	OPDR 22-23	Listing Form pg. 8	Updated legal constraints applicable to Mescalero tribal trust land
16	APD contact information	OPDR 3 (attestation page)	Listing Form pg. 1	Updated APD email address information and mailing address
17				

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1. Introduction

The Forest Carbon Partners – Mescalero Apache Tribe Improved Forest Management Project (hereafter Mescalero Apache Tribe Forest Carbon Project) is an Improved Forest Management (IFM) project on Mescalero Apache trust forest lands developed pursuant to the California Air Resources Board Compliance Offset Protocol – U.S. Forest Projects adopted November 14, 2014. Management of the property is designed to improve cultural and ecological values while at the same time generating income from sustainable forestry and carbon offsets, with the aim of restoring the forest to its historic state of well-spaced conifer stands with large-diameter trees and minimizing the threat of wildfire.

The Offset Project Operator is the Mescalero Apache Tribe, which has contracted with Forest Carbon Partners LP to be the Authorized Project Designee for the project. The project is located on land held in trust by the U.S. Department of the Interior Bureau of Indian Affairs (BIA) for the Mescalero Apache Tribe in New Mexico, United States. The Mescalero Apache Tribe carbon project is located on a portion of the Mescalero Apache Tribe's trust forest lands. No allotted trust lands or fee lands are included in the project.

2. Ownership

(Forest Offset Protocol §2.2, §9.1.1.1(3), Regulation §95974)

The 228,376 acre project is located on Mescalero Apache Reservation trust lands, meaning that the land is held in trust by the U.S. Department of the Interior Bureau of Indian Affairs for the Mescalero Apache Tribe. As such, the Mescalero Apache Tribe is the beneficial owner of the project area with the right to control management of the land, trees, and standing timber within the Project Area. The Mescalero Apache Tribe is also the Offset Project Operator (OPO) with the legal authority to implement the offset project.

As the OPO, the Mescalero Apache Tribe delegates responsibility to Forest Carbon Partners LP, a limited partnership managed by New Forests, as an Authorized Project Designee to perform and meet the requirements of listing, monitoring, reporting, record retention, verification, and credit issuance for the Mescalero Apache Tribe Forest Carbon Project.

3. Project Eligibility

3-A. Project Type

(Forest Offset Protocol §2.1, §2.1.2, §9.1.1.1(4&5))

The Mescalero Apache Tribe Forest Carbon Project is an Improved Forest Management Project as defined by Air Resources Board Compliance Offset Protocol – U.S. Forest Projects, adopted November 14, 2014. The project will generate CO_2 emission reductions by managing for increased carbon sequestration and stocking when compared to the project baseline. This will be accomplished by significantly reducing the amount of timber harvest in the project activity in comparison to the baseline scenario.

3-B. Project Location

I. Located in the United States

(Forest Offset Protocol §3.6)

The project takes place on land located in the United States and governed by the Mescalero Apache Tribal Council. Land surrounding the project area is governed by Otero County and Lincoln County of New Mexico, the state of New Mexico, and the United States of America.

Figure 1. Project location with reference to towns, roads and jurisdictional boundaries

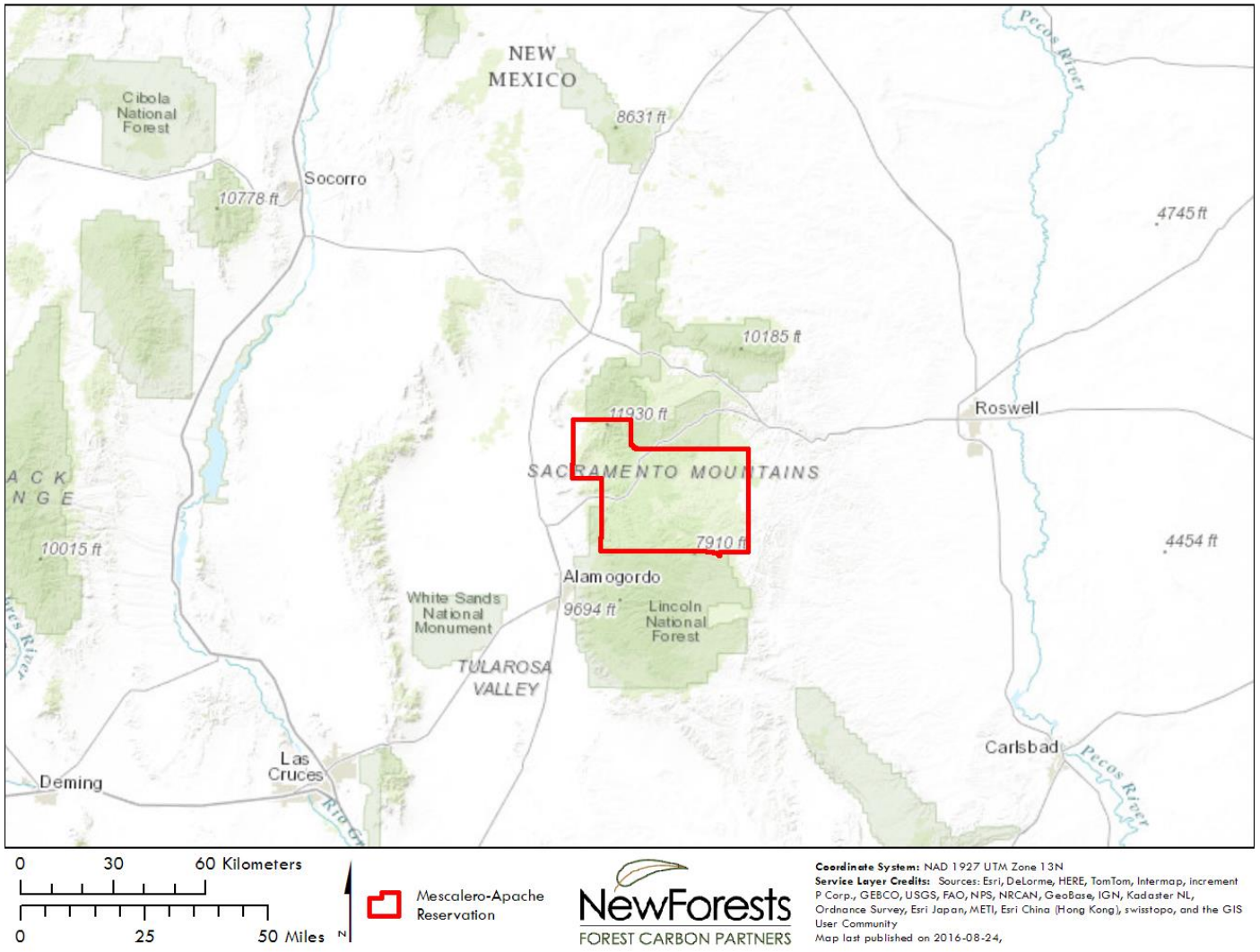
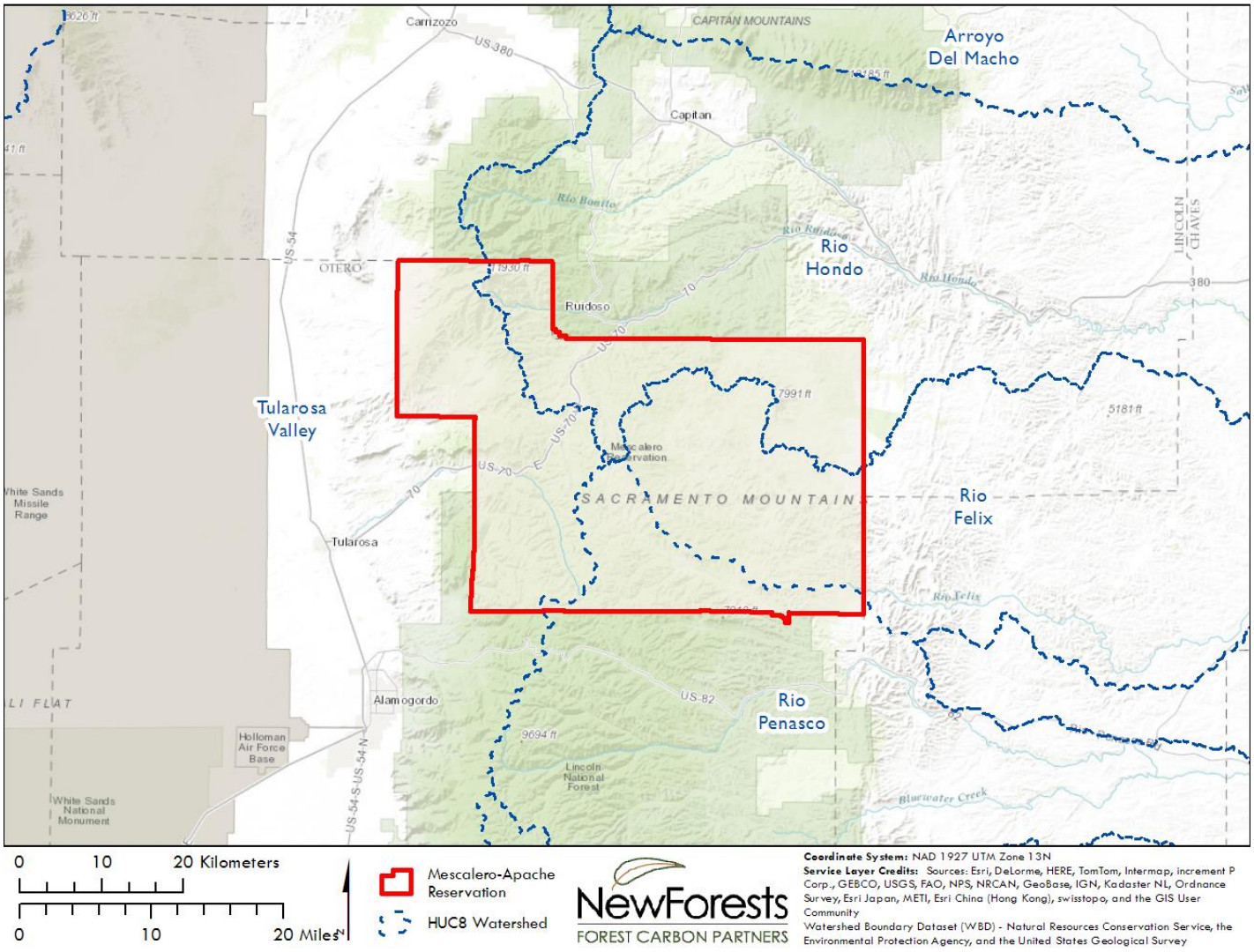


Figure 2. Project Area map shows the Mescalero Apache Reservation in relation to watercourses, watersheds, reservoirs, towns, and roads.



II. Located on Forested Land
(Forest Offset Protocol §2.1.2, §9.1.1.3(1))

The land is forested with greater than 10% canopy cover and is used by the Mescalero Apache Tribe for a mix of timber production, recreation, and other cultural uses. The project consists of commercial and productive timberland as classified by the BIA as having greater than 10% total crown cover, containing a majority of commercial species by basal area, and being accessible for timber harvesting (MAT FIA Report 2011). The project area has been in forest cover for the past 100 years or longer. Compliance with the 10% tree canopy cover requirement is demonstrated by the BIA's forest land classification system described briefly above, and by overlaying a shapefile of the project area on the most current available National Agriculture Imagery Program (NAIP) imagery (see Attachment F).

III. Land Ownership Category
(Forest Offset Protocol §3.6, §9.1.1.1(6), Regulation §95975(l))

The project is located on Indian Trust land owned by the Mescalero Apache Tribe (land that is owned by, or subject to, an ownership or possessory interest of an Indian Tribe). (See the BIA Title Status Report, Attachment A). For the purposes of the Protocol, tribal trust land is treated by the Protocol as private land for baseline determination.

IV. Any Previous Status as an Offset Project
(Forest Offset Protocol §2.1.2, §9.1.1.1(8))

None of the land within the Project Area has ever been listed or registered with an offset project registry or program, nor have greenhouse gas emission reductions or removal enhancements associated with the Project Area been credited or claimed for the purpose of greenhouse gas mitigation or reduction goals, either in a voluntary or regulatory context.

3-D Project Area

I. Geographic Boundaries
(Forest Offset Protocol §4, §9.1.1.1(15))

Delineation of Project Area

Since the Project area is defined by the property boundary wherever possible, the first step was to determine the property boundaries of the forest by obtaining a copy of the forest boundary shapefiles from the Mescalero Apache Tribe and Bureau of Indian Affairs. The Project Area consists entirely of commercial and productive timberland as classified by the BIA that contains a majority of commercial species by basal area and is accessible for timber harvesting (strata A, D and E). The Project Area was further defined by excluding stream channels and surface water, US and state highways, and paved and gravel roads as identified from a GIS layer from the Mescalero Apache Tribe.

A slope analysis was performed to exclude areas from the forested project area with excessive slope, which restricted foot access and likely limited timber harvesting opportunities. A Bilinear resample on the DEM layer (clip_dem1.tif) converted the 30x30-meter pixels to 90x90-meters (DEM_Resam_BIL). The DEM was then used to exclude the project area that exceeded 45 percent slopes. Contours were created, which were then converted to polygons. The project area that occurred within the area of slopes exceeding 45 percent was removed (Erase tool) from the eligible project area. Steep slopes were excluded by dropping stands that had greater than 45% slope as averaged across a 90m DEM raster layer.

In addition, stands less than 0.5 acres in size that were not assigned one of the cross-walked strata (see section V.1) were removed from the project area. Inoperable mountainous areas identified during the inventory were also delineated out of the project area. This included the stands surrounding Sierra Blanca Peak in the northwest portion of the property. For more information on the spatial analysis and specifications used to delineate the project area, please see "Spatial Data Analysis for Mescalero Apache Reservation".

The centroid of the project area is located at 33.17 degrees latitude and -105.65 degrees longitude.

General Location, Towns and Roads

The Mescalero Apache Tribe Forest Carbon Project is located within the Mescalero Apache Indian Reservation in Lincoln and Otero counties in south-central New Mexico. The Mescalero Apache Indian Reservation is bordered on the north and south by Lincoln National Forest and on the east and west by public and private lands (Little et al., 2001). The town of Mescalero is the closest population center. U.S. Highway 70 runs through the Project Area and connects to nearby towns and urban areas including Ruidoso, Tularosa, Alamogordo, and Roswell.

II. Topography & Climate

Figure 3. Rock outcrops overlook forested slopes across the Mescalero Apache Tribe Forest Carbon Project

The project is located on mountainous slopes in south-central New Mexico. The climate ranges from warm semi-arid to cold sub-humid depending on topography. A ridge in the Sacramento Range has a relatively steep west face and gently sloping east face. Low rainfall and warm temperatures limit timber growth below approximately 6,500 feet elevation. Higher elevation areas have alpine topography, with the Project Area following treeline to extend up the slopes of 12,003–foot Sierra Blanca Peak (Little et al., 2001).

Lower elevations tend to be fairly typical southwest semi-arid with vegetation limited by precipitation. At the higher elevations that contain coniferous forests, the climate is more sub-humid with average annual precipitation of 25 inches/year. Approximately 80% of this precipitation falls within the summer monsoon season, while winter precipitation is usually in the form of snow. Most of the reservation falls within USDA Plant Hardiness Zone 6b. The mean annual temperature is approximately 50 degrees Fahrenheit. Microclimates on eastern and western slopes and drainages lead to a variety of forest types across the landscape. South and west aspects tend to be drier and produce pinyon-juniper-pine species mixes, while north and east aspects range from mixed conifer to pure stands of ponderosa pine.

III. Existing Land Cover and Land Use

The Project Area is currently being managed for multiple uses by the Mescalero Apache Tribe, including timber harvest, recreation, and cultural uses. The existing land cover within the project area is forestland, and is further classified as timberland due to containing a majority of timber species and being able to produce a minimum volume of 15 cubic feet/acre/year. The primary forest vegetation types within the project area

boundary are mixed conifer and mixed pine forest, with the predominant species being Douglas-fir, white fir, and ponderosa pine. These vegetation types are primarily located at elevations above 7,000 feet.

The historical land uses of the project area and surrounding areas consisted of grazing, agriculture, hunting, timber harvesting, firewood collection, cultural and traditional uses, and recreation. The forest was managed intensively for timber in the 1980s, with harvests of 65 million board feet delivered to the mill. Mescalero Forest Products mill was opened in 1987, and had for technical upgrades in 2006, including upgrades to process smaller diameter trees. Since the mill closed in 2012, commercial harvesting has been light and fuels reduction has been the primary forest management activity. The Mescalero Apache Tribe has succeeded in working with the US Forest Service to do joint fuels reduction work on the boundary between the Lincoln National Forest and the reservation.

Current forest management includes small patch clearcuts to manage mistletoe – the Mescalero Apache Reservation is the site of some of the original mistletoe impact research – as well as individual-tree selection and fuel reduction. Although not constrained by regulation, most clearcuts are less than 30 acres in size. Regeneration success has been better in clearcuts, especially when rain and climate are favorable. The current Forest Management Plan (FMP) has been extended indefinitely, and the Mescalero Apache Tribe is in the process of developing a new FMP expected in 2017. These past and current land uses of timber harvest, fuels reduction, restoration, firewood collection, and recreation, as well as traditional and cultural uses are expected to continue into the future.

Figure 4. Open forests with large, widely spaced trees like the stand pictured are ecological restoration and fire hazard reduction objectives for the Mescalero Apache Tribe.

IV. Geology and Soils

The Mescalero Apache Tribe Forest Carbon Project is in the Sacramento Section of the Basin and Range Province. The Sacramento Mountains extend in a north-south orientation, culminating in the Sierra Blanca in the northwest. The area is characterized by sedimentary rocks cut through by drainage flows. Permian sediments cover most of the area, mainly San Andres Limestone, as well as sandstones and shales of the Yeso formation occurring as outcrops where they have been exposed by erosion. Quaternary alluvium may be found at the bottoms of the larger drainage ways (Little et al., 2001).

The forest area project overlays extensive Mollisol soils, as well as Alfisols and Inceptisols. Mollisols are usually fertile and have dark, relatively thick surface layers and high base status. Parent materials include limestone, shale, and andesite. Most soils across the reservation except for alluvial slopes contain significant amounts of rock fragments, which do not limit productivity but may affect reforestation. Depth to bedrock ranges from a few inches to a few feet, with shallower soils on ridgetops and upper slopes and deep soils in valleys and terraces (Little et al., 2001).

V. Forest Inventory Stratification

1. The Mescalero Apache Tribe Forest Carbon Project utilizes a detailed timber type stratification carried out by the Bureau of Indian Affairs (BIA). Within the larger strata designations of the BIA, there are additional designations at the stand level by forest type. These forest types were consolidated into three main groups based on the overstory stocking designation in the timber typing GIS database from the BIA. Douglas-fir and mixed conifer forest types generally make up the Mixed Conifer group, non-stocked timber and ponderosa pine forest types generally make up the Ponderosa Pine group, while the pine/mix strata is considered the Mixed Pine group (see tables below). For stands that did not have one of these cross-walked forest type designations but fell within the overarching commercial or productive timberland typing of the BIA, the stands were assigned the stratum of the largest neighboring stand; unassigned stands less than 0.5 acres in size were not given a strata and were removed from the project.

Table 2. Stratification

Strata	Grouped Forest Types
Mixed Conifer (MC)	Douglas-fir (DF); Spruce-Fir (SF); White Fir (WF); Aspen (A)
Mixed Pine (MP)	Pine Mixed
Ponderosa Pine (PP)	Ponderosa Pine (P); Pinyon and Juniper (PJ); Non-stocked Timber (NT)

The grouped BIA forest type classifications were applied to the inventory data as a post-stratification for use in sampling error calculations as well as for modeling silvicultural prescriptions.

Figure 5. Strata map

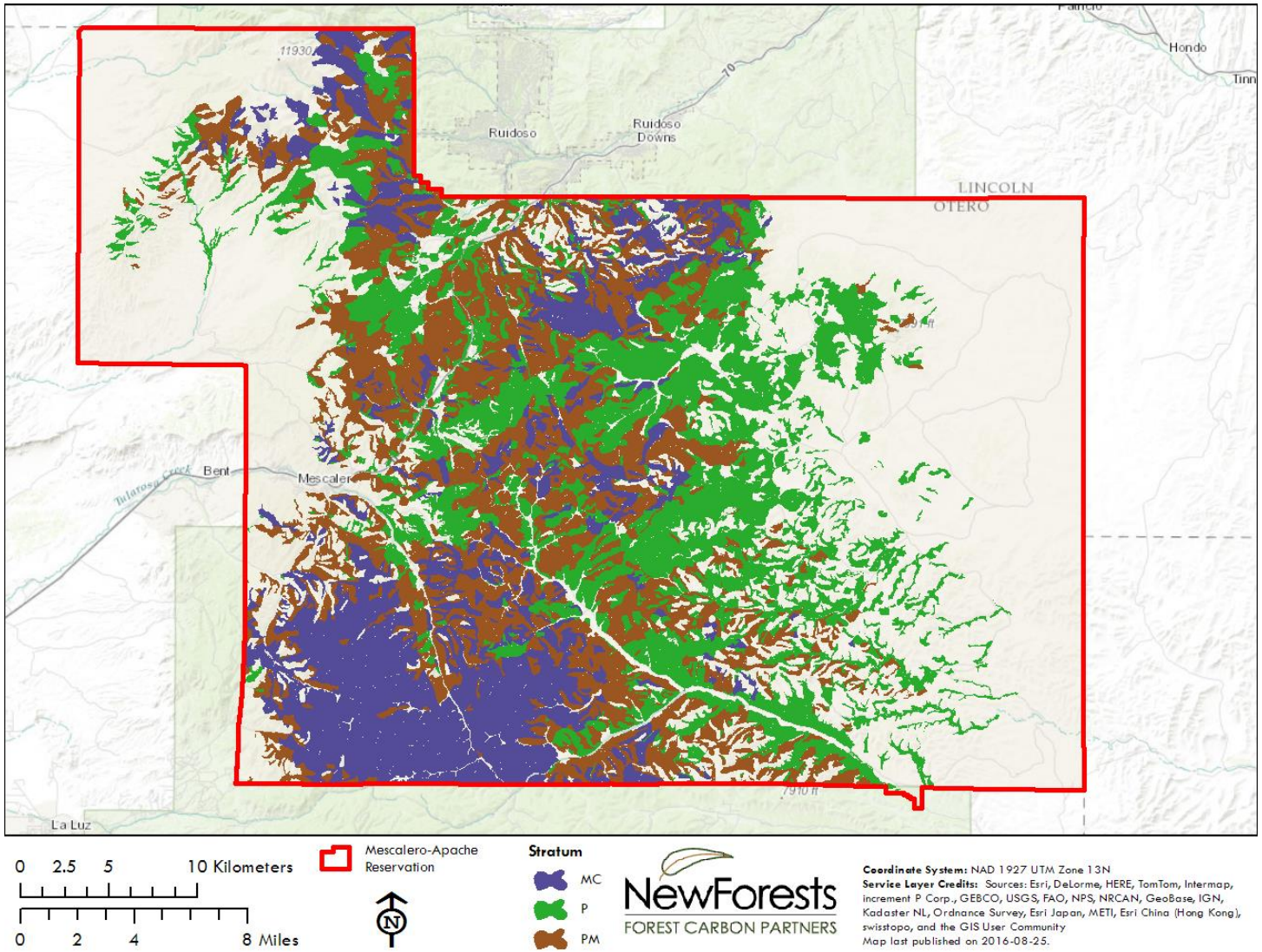


Table 3. Forest cover types, Mescalero Apache Reservation (table source: Little et al., 2001)

Table 1 Major Forest Cover Types

COVER TYPE	DESCRIPTION
Mixed Conifer	Forest areas in which less than 40% of the timber crown cover is ponderosa pine and the majority of the crown cover in timber species is in any combination of at least three of the following species: Douglas-fir, southwestern white pine, ponderosa pine, white fir, Engelmann spruce, blue spruce, quaking aspen, cork-bark fir or other incidental species (Douglas-fir, white fir or southwestern white pine must be present).
Pine Mixed	Forest areas in which 40 to 75% of the timber crown cover in timber species is ponderosa pine and the remainder of the timber crown cover is in any combination of the following species: Douglas-fir, southwestern white pine, ponderosa pine, white fir, Engelmann spruce, blue spruce, quaking aspen, cork-bark fir or other incidental species (Douglas-fir, white fir or southwestern white pine must be present).
Ponderosa Pine	Forest areas in which ponderosa pine is the predominant timber species and makes up at least 75% of the total crown cover of timber species.

VI. Assessment Areas

(Forest Offset Protocol §4, §9.1.1.1(16), Appendix F)

The project area is entirely within the Central New Mexico supersection, which contains only one assessment area: the Central New Mexico Pinyon/Juniper Woodland assessment area.

Due to relatively low forest growth rates, the Project Area is preliminarily classified as low site class. The project's assessment area is not broken down by site class, so site information is only being used to calibrate growth and yield modeling and adjust silvicultural prescriptions, and will not be used to determine the common practice value.

3-E. General Description of Forest Conditions

(Forest Offset Protocol §9.1.1.1(17))

I. Tree species composition; age class distribution; management history

The primary forest vegetation types within the project area boundary are mixed conifer and mixed pine forest, with the predominant species being Douglas-fir, white fir, and ponderosa pine. These vegetation types are primarily located at elevations above 7,000 feet. Elevation, slope and aspect are the primary factors affecting forest type and condition across the Project Area. Dominant species on the project include Douglas-fir, white fir, and ponderosa pine, which together comprise more than 60% of species composition by basal area, with more minor components of spruce, pinyon, juniper, and mixed hardwood species. Due to the history of uneven-aged management on the property, there is a mix of age classes represented. The Project Area displays a typical reverse j-curve distribution.

Historical management of the property includes commercial timber harvests, firewood harvests, and management for multiple non-timber forest products and cultural uses. The forest will continue to be managed for timber, firewood, non-timber forest products and cultural uses, but will seek to maintain carbon stocks at levels that are substantially higher than the baseline scenario and will therefore result in GHG reductions. If it is necessary to reduce carbon stocks over a 10-year period in order to improve the project area's resistance to wildfire, insects, or disease, the actions will be documented and will be supported by relevant published peer-reviewed research as required by the Protocol. Land pressures exist from timber harvesting and conversion of forest to agriculture and grazing. Pressures also exist from wildfires, pests, and diseases that threaten the health and productivity of the forest.

The species composition in the Project Area is predominantly mixed conifer and pine along with woodland species such as juniper and boxelder. All species encountered during the inventory were native species, meeting the native species requirement of the Protocol. The species composition table is derived from tree list output from FVS. Table 4 below shows the species distribution in the Project Area. No single species comprises more than 35.8% of the project basal area, and thus the project does not exceed the Species Diversity Index requirement.

Table 4. Species composition by basal area & native species proportion

Species		Basal Area Per Acre (ft^2)	Composition by Basal Area (%)	Native species	Percent by Native
Douglas-fir	Pseudotsuga menziesii	24.9	37.1%	Yes	37.1%
ponderosa pine	Pinus ponderosa	15.3	22.9%	Yes	22.9%
white fir	Abies concolor	8.6	12.8%	Yes	12.8%
alligator juniper	Juniperus deppeana	5.0	7.4%	Yes	7.4%

Gambel oak	Quercus gambelii	4.5	6.7%	Yes	6.7%
common or two-needle pinyon	Pinus edulis	2.7	4.0%	Yes	4.0%
southwestern white pine	Pinus strobiformis	2.7	4.0%	Yes	4.0%
Rocky Mountain juniper	Juniperus scopulorum	0.9	1.4%	Yes	1.4%
oneseed juniper	Juniperus monosperma	0.9	1.3%	Yes	1.3%
Unknown dead hardwood	Tree broadleaf	0.7	1.0%	Yes	1.0%
quaking aspen	Populus tremuloides	0.5	0.8%	Yes	0.8%
blue spruce	Picea pungens	0.2	0.2%	Yes	0.2%
Engelmann spruce	Picea engelmannii	0.1	0.2%	Yes	0.2%
corkbark fir	Abies lasiocarpa	0.1	0.1%	Yes	0.1%

3-F. Additionality – Legal Requirement Test

(Forest Offset Protocol §3.1, §3.1.1.2, §9.1.1.1(9), Regulation §95973(a))

The following laws and regulations are relevant when considering forest management on Native American trust lands:

1. National Indian Forest Resources Management Act (NIFRMA) of 1990, 25 USC 3101 et seq. and associated regulations (e.g. 25 CFR 163.11)

2. Federal Endangered Species Act.

I. NIFRMA

Forest management on Native American trust lands is implemented through the National Indian Forest Resources Management Act of 1990 (NIFRMA), 25 USC 3101. NIFRMA requires that all trust forest land be managed "in a perpetually productive state in accordance with the principles of sustained yield" (25 USC 3104(1)). NIFRMA is implemented through the drafting and adoption of Forest Management Plans (FMPs) by Native American governments in collaboration with the Bureau of Indian Affairs, which ensures that FMPs meet procedural requirements under NIFRMA. FMP metrics such as Annual Allowable Cut and Indicative Allowable Cut are "standards and objectives," i.e. metrics, that only serve to guide management towards "the development, maintenance and enhancement of Indian forest land in a perpetually productive state."

Harvest schedules delineated in FMPs may be rescinded and changed at any time at the discretion of a Tribal government. The statutory mandate of sustained yield can be met at substantially varying levels of inventory: for example, a Tribal government may in their discretion approve a Forest Management Plan that targets sustained yield of 10-year old pulp logs or 100-year old saw logs, with materially different effects on inventory and standing live biomass in the forest. For this reason, Forest Management Plans are not a legal constraint on forest management. Furthermore, the only legal constraint imposed by NIFRMA on trust land forest management is the requirement of sustained yield. Sustained yield is not defined by the law or associated regulations with reference to any particular wood product or time period. The baseline modeling for the Mescalero Apache Tribe Forest Carbon Project implements a sustained yield timber harvest.

New Forests is not aware of any reference in the BIA guidance issued to ARB, in NIFRMA or implementing regulations, or in case law applying NIFRMA and implementing regulations of any requirement of even flow. Because sustained yield only refers to perpetual productivity, the baseline modeled for this project, where sufficient regeneration is modeled in the baseline to ensure full site occupancy over a rotation, meets the requirement of sustained yield in NIFRMA.

II. Federal Endangered Species Act

Please see attached (confidential) memoranda for more information on the application of the Federal Endangered Species Act on the Mescalero Apache Tribe Forest Carbon Project. A summary of the analysis is provided as follows.

In order to delineate Protected Activity Centers (PACs) for Mexican Spotted Owls (MSO) we first reviewed the 34 MSO PACs delineated by the Bureau of Indian Affairs (BIA) so that a consistent approach would be used. For each MSO site, the BIA PACs had two polygons associated; 1) a ~400-acre PAC, and 2) a ~100-acre Core. PACs were as compact (circular) as possible while still retaining the correct habitat characteristics. Each Core contained the mapped MSO site, although in some instances there were multiple nest/roost sites identified for the same owl and not all sites were included in the core. In some instances, small areas of unsuitable habitat were included in order to keep the PAC as compact as possible. In at least one instance, the MSO sites were outside both the Core and PAC for that owl, presumably because of the dynamic nature of animal movement and settlement. A new, additional PAC was created for that owl site. We utilized aerial imagery to refine the areas. The acres generated from this analysis were used as constraints for the baseline harvest schedule. No harvest is allowed in the core and outside the core there were basal restrictions of 55 sq. ft. per acre and as many 16" dbh trees or larger as feasible. The Core areas were assigned to the no harvest prescription and the PACs were assigned to the STS2 prescription.

III. Internal Voluntary Policies

Finally, please note that Mescalero Apache internal policies are not legal constraints on forest management. The Mescalero Apache Tribe can change internal policies related to forest management at any time in their discretion as a sovereign government. Thus, areas designated voluntarily as reserved from timber harvest by the Mescalero Apache Tribe are legally available for timber harvest: there is no constraint on timber harvest in such areas that can be enforced by any third party apart from federal law constraints that apply in all trust land areas (such as the Endangered Species Act). Mescalero Apache forest reserve areas and other voluntary constraints on forest management are therefore treated in the same fashion as any voluntary constraint on forest management adopted by a private landowner. In accordance with the Protocol, voluntary constraints are not modeled in the baseline harvest schedule.

3-G. Regulatory Compliance

(Forest Offset Protocol §3.7, Regulation §95973(b))

The project is not being implemented as the result of any law, statute, regulation, court order, or other legally binding mandate. The Forest Project and associated

Project Lands have met and been in compliance with all local, state, or federal regulatory requirements during the reporting period.

3-H. Use of Qualified Conservation Easements

(Forest Offset Protocol §3.5, §9.1.1.1(18))

The project will not employ a Qualified Conservation Easement.

3-I. Additionality – Performance Standard Test

(Forest Offset Protocol §3.1, §3.1.2.2)

In Improved Forest Management projects, project activities are considered additional to the extent they produce GHG reductions and/or GHG removal enhancements in excess of those that would have occurred under a conservative business-as-usual scenario, as defined by the baseline estimation requirements. This Improved Forest Management Project automatically satisfies the performance test according to Section 3.1.2.2 of the Protocol. Activities considered additional are described in above.

3-J. Broadcast Fertilization

(Forest Offset Protocol §2.1.2(3), §9.1.1.1(10))

The Mescalero Apache Tribe has not employed broadcast fertilization in the Project Area since the project commencement date and has no plans to employ broadcast fertilization at any future time in the Project Area.

3-K. Offset Project Commencement Date

(Forest Offset Protocol §3.2, §9.1.1.1(7))

The project commencement date is October 16, 2015, which is the date that project documents were submitted for listing via the Climate Action Reserve website.

The first reporting period for this project is the period from October 16, 2015 to August 15, 2016, reflecting the installation of an inventory in 2015 and subsequent seasons.

3-L. Demonstration of Sustainable Harvesting Practices

(Forest Offset Protocol 3.8.1, §9.1.1.1(13))

Since commercial harvesting will potentially be employed on the project area, it is necessary for the project to satisfy (at the time of commercial harvest) the Forest Offset Protocol §3.8.1 – Sustainable Harvesting Practices. Three options are given to satisfy this requirement:

1. The forest owner must be certified under the Forest Stewardship Council, Sustainable Forestry Initiative, or Tree Farm System certification systems.

2. The forest owner must adhere to a renewable long-term management plan that demonstrates harvest levels which can permanently be sustained over time and that is sanctioned and monitored by a state or federal agency.

3. The forest owner must employ uneven-aged silvicultural practices and canopy retention averaging at least 40% across the forest as measured on any 20 acres within the entire forestland owned by the forest owner.

Option 2 was chosen for this project. The renewable long-term management plan the Mescalero Apache Tribe will adhere to in managing the project area is the Mescalero Apache Indian Reservation Forest Management Plan 2001-2010, as approved by the BIA.

3-M. Natural Forest Management

I. Native Species

(Forest Offset Protocol §3.8.2, Table 3.2, §9.1.1.1(14.a))

Both before and after commercial timber harvest, project activities will seek to improve or maintain natural ecosystem processes, enhance native tree species, and adhere to the Natural Forest Management practices required by the Forest Offset Protocol. As stated in Table 3.2 of the Forest Offset Protocol, the project must consist of at least 95% native species. No non-native species were found during the 2015 inventory. Table 5 above provides the quantification required to show that at least 95% of the carbon in the standing live carbon pool is composed of native species. The project area clearly meets the native species requirement that the project consist of at least 95% native species based on the sum of carbon in the standing live carbon pool, due to the strong correlation between basal area and carbon stocks.

II. Composition of Native Species

(Forest Offset Protocol §3.8.2, Table 3.2, §9.1.1.1(14.a))

The Forest Offset Protocol requires that no single species comprise more than the percent basal area for standing live trees provided for the Species Diversity Index in the Assessment Area Data File. The Project Area meets this requirement. As shown above, the species with the greatest proportion of basal area is Douglas-fir at just under 36%.

III. Distribution of Age Classes

(Forest Offset Protocol §3.8.2, Table 3.2, §9.1.1.1(14.b))

The age class summary was created from the StandInit table in the FVS database. Stand age was based on the most current age data originating from the BIA CFI plot database. So, all BIA plots kept their age as provided. The newly established BAF plots were all set to age 99. An analysis of the BIA plots found no correlation between age and tree size. Since the majority of the BIA plots were set to age 99, all BAF plots were set to this age.

Table 5. Average Age

Strata	Strata Code	Average of Age
Mixed Conifer	MC	98.5
Ponderosa Pine	PP	89.7
Mixed Pine	MP	98.5

IV. Structural Elements (Standing and Lying Dead Wood)

(Forest Offset Protocol §3.8.2, Table 3.2, §9.1.1.1(14.c))

No salvage logging has occurred in the past year within the project area, nor has any active removal of down dead wood. Therefore, the project must maintain or demonstrate ongoing progress toward an average of at least:

- one (1) metric ton of carbon (C) in standing dead wood per acre; or
- 1% of standing live carbon stocks, in standing dead wood, whichever is higher.

The current standing dead wood stocks average 1.265 metric tons of carbon per acre, which is greater than 1% of standing live carbon stocks and greater than one (1) metric ton per acre. Since the carbon stocks in standing dead wood currently meet the minimum requirements, the project must maintain this carbon pool by continuing to recruit standing dead trees, or else demonstrate ongoing progress toward meeting the higher of the two targets throughout the life of the project.

3-N. Ongoing Management Activities

(Forest Offset Protocol §3.8.3)

The Forest Offset Protocol requires that standing live carbon stocking be maintained and/or increased during the life of the project unless the reduction meets one of the possible causes listed in Section 3.8.3 of the protocol. While standing live tree inventory declined due to drought in the past decade, the project activity modeling (described in Section 6 of this report) predicts that total standing live carbon stocks will gradually increase over the life of the Project. Overall stocks are not planned to decline below the level of standing live carbon stocks at the initiation of the project. Stocks will be maintained at a level that assures all credited standing live carbon stocks are permanently maintained. The forest will continue to be managed for timber, firewood, non-timber forest products and cultural uses, but will seek to maintain carbon stocks at levels that are substantially higher than the baseline and will thus result in GHG reductions. If it is necessary to reduce carbon stocks over a 10-year period in order to improve the project area's resistance to wildfire, insects, or disease, the actions will be documented and will be supported by relevant published peer-reviewed research as required by the Protocol. Stocks will be monitored over the life of the project by re-measuring the permanent plots and tracking disturbances, with appropriate changes made to the harvest schedule to ensure compliance with this requirement.

4. Inventory Methodology

4-A. GHG Assessment Boundary

(Forest Offset Protocol §5.2)

The carbon sources, sinks, and reservoirs accounted for in the project for quantifying project CO2e reductions and removals are listed in Exhibit 1 at the end of this document.

4-B. Inventory Design and Sampling Process

(Forest Offset Protocol §9.1.1.1(19), Appendix A.3)

The following inventory methodology has been used to quantify the required carbon pools for project registration:

I. Inventory Design

The plot design built on the BIA's existing Continuous Forest Inventory (CFI) design, last measured in 2012. To expand and calibrate the already existing 1/5-acre major plots distributed systematically across the project area on a pre-determined grid, a subset of existing CFI plots were re-measured, and a supplemental grid of systematic, randomized, variable-radius plots was also installed.

Table 6. Plot Design

Strata	2015 BAF Plots	2015 CFI Plots Re-Measure subset	2012 CFI Plots Re-Measure (initially installed 1982)	Total
MC	270	19	108	397
MP	132	9	122	263
PP	225	20	145	390
Total				**1,050**

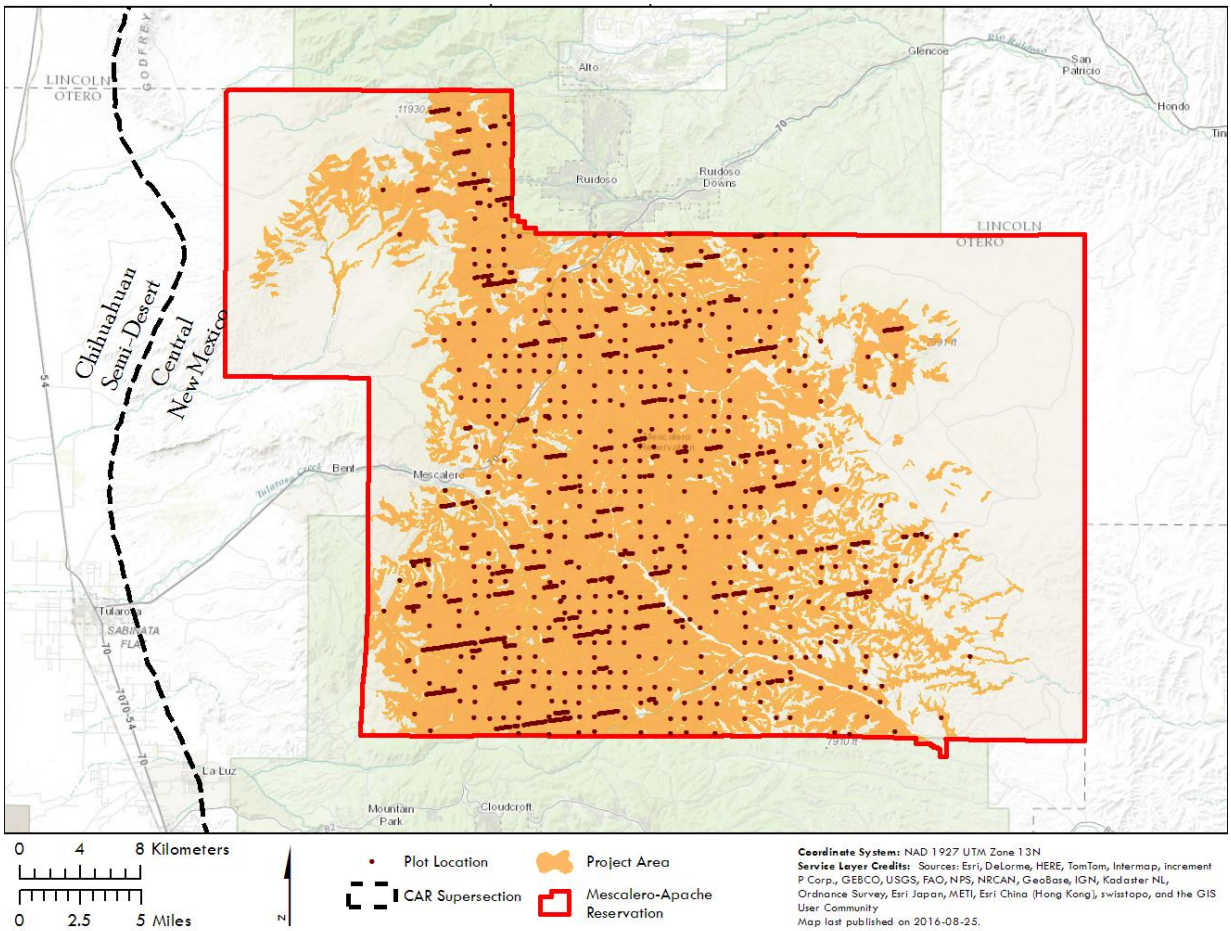
II. Plot Allocation and Inventory Layout

Plots were allocated on plot strings within each of the initial timber type groups. A custom plot allocation tool was used to allocate string grids within each timber type. The starting point of each string occurred at a random point within each string and, based on the distance between plots and between strings, was best fit within the timber type polygons. The tool was unable to allocate the exact sample size within each timber type, due to the arrangement of the polygons. Extra plots were systematically removed from timber types with excess plots until the desired sample size was reached. Plots were removed from the shortest plot strings, starting with one- and two-plot strings. The 50 CFI plots for re-measurement were selected based on their proximity to the plot strings. Selected CFI plots occurred within ±1,400 feet. The plot allocation by timber type is provided in the following table.

Table 7. Inventory Plot Allocation Summary

Timber type	n	# chains between plots	# chains between lines
DF_2	10	8	456
DF_3	7	6	200
MC_2	58	8	300
MC_3	195	8	151
P_1	11	6	500
P_2	99	8	375
P_3	42	8	400
PM_1	4	6	500
PM_2	51	8	500
PM_3	167	8	240

Figure 6. Inventory layout



4-C. Field Measurement and Plot Monumenting

(Forest Offset Protocol §9.1.1.1(19), Appendix A.3)

I. Plot Establishment

The inventory included the establishment of temporary plots, in addition to the re-measurement of established BIA CFI plots. The new plots consisted of 10 BAF points, with 1/20-acre sub plots to capture woodland species. Re-measurements were performed on previously established 1/5-acre fixed area CFI plots that had been monumented with rebar. When plots overlapped project boundaries that were discernable in the field (such as forest edges), the Walk Through and Fro Method (Flewelling 2013) measurements were taken in the field. These were then used to adjust the TPA value used in carbon quantification and modeling in order to account for project boundaries intersecting sample plot area. When boundaries were not discernable in the field (such as potential unmarked property boundaries or boundaries between strata), then the plot was measured as usual, treated as representative of the forest at the plot center point, and the Walk Through and Fro method was not applied.

On the 10 BAF plots, a 10-inch cabin spike was used to monument plot center. These spikes were painted with white paint and the plot number was written on a piece of flagging that was then tied on the spike. Four trees on plot were marked with their corresponding tree number using white paint at DBH. These trees were selected as being the first tree on plot after each cardinal direction. Borderline trees that were checked but determined out were marked with an X painted at the base of the tree. Trees on the BIA CFI plots had previously been tagged with tree tags. Tree numbers were not altered during re-measurement.

Plot level data were recorded for each of the BAF plots, but not on the CFI plots. Plot level data recorded included aspect, slope, condition class status, forest type, stand size class, regeneration status, and tree density. The details of the methodology are contained in the Inventory Manual found in Exhibit III. The manual was provided to the crew that installed the inventory.

Plot installation and check cruising was performed by Steigerwaldt Land Services. Check cruising was conducted on at least 5% of the plots according to the parameters in the inventory manual to ensure quality measurements and feedback to field crews during data collection. Timely on-site feedback of the issues found on each of the checked plots was provided to the cruisers. The corrected plot data were used in all modeling and analysis.

II. Tree Measurements

Tree measurements taken for both plot types included tree number, walk-through distance, walk-fro distance, present tree status, tree class code, species, diameter, defect, total height, angle of lean, height to break, length method, crown class, compacted crown ratio, cause of death, mortality year, and decay class. Standard timber cruising tools were used, including diameter tapes for measuring diameter at breast height (DBH) and laser range finders for measuring distances and tree heights. All live and dead trees that were 5 inches or larger were recorded as long as dead trees had an actual height of 15 or more feet and were not more than 45 degrees from vertical. Diameters for commercial species were measured to the nearest 1/10-inch at 4.5 feet above the duff layer (DBH), while woodland species had diameter

measurements completed at root collar (DRC). For multi-stemmed woodland species, with at least one qualifying stem (5 inches or larger), DRC was calculated as the square root of the sum of the squared stem diameters. All attached stems that are greater than or equal to 1 inch DRC and 1 foot tall were included in the multi-stem formula.

III. Ongoing Inventory Updates

CFI plots or a subset thereof will be re-measured at least once every 12 years. CFI plots will also be re-measured within three years of the close of a harvest or other significant natural disturbance. In the years between measurements, plots will be updated by using FVS to grow the inventory forward, following the project's modeling plan. All data will be stored on personal computers and back-up drives at Forest Carbon Partners' offices, on cloud-based storage and on digital media held by the Mescalero Apache Tribe.

4-D. Data Management System

(Forest Offset Protocol §9.1.1.1(19), Appendix A.3)

Field data were collected using field data recorders. The units are manufactured by F4 Tech and operate with Windows Mobile Operating Systems. The two specific models of computers used for this inventory were the Forge Echo O.S. 1.0.0 and Flint O.S. 1.0.1. Inventory data were recorded using TCruise Pocket Pro inventory software. Custom parameters were set in TCruise to collect the project specific data. Maximum and minimum values were set for most measurements, such as not allowing cruisers to enter DBH values greater than 100. At the end of each day, cruisers would download their TCruise files from their field computers to their desktop computer and email the data to the forester responsible to compiling and performing QA/QC for the inventory. TCruise files were then imported to the desktop software version of TCruise (.tcd) and exported to an Excel spreadsheet.

Field data were checked for quality during the inventory through plot audits. A total of 28 plots were audited during the inventory effort. Data collection items identified were communicated to the field staff following the compilation of audit results to ensure continued data integrity. Data and quality assurance checks were also carried out and recorded during post-processing once data were collected, including review of empty plots, dropped trees, and keypunch or calculation errors.

The data were analyzed in Microsoft Excel, Microsoft Access, and the Forest Vegetation Simulator (FVS) Central Rockies variant (Keyser and Dixon, 2008). This variant was used because of its regional applicability. A unique Access database was created for every strata/prescription/timing choice combination. All data, growth and yield simulation results, and carbon calculations remain stored on personal computers and back-up drives at Forest Carbon Partners' offices, as well as on private cloud storage maintained by Forest Carbon Partners and on digital media held by the Mescalero Apache Tribe.

A comparable data management system will be implemented for future inventory data collection and analysis. It is not feasible to anticipate in advance the data quality concerns that may arise with all future inventories. When inventory is re-measured, a re-measurement data quality system will be developed and documented specific to that inventory. These future re-measurement quality systems will address the following aspects of forest inventory data quality:

1. Documentation of inventory protocols, especially any changes to inventory protocols
2. Specification of the amount and method of field check cruising/plot auditing
3. Data entry method & quality checks, specific to data recorders or plot cards used
4. Checks that plot and tree data recorded falls into a reasonable range for the species and region. This may include min/max checks, height by diameter plots, etc.
5. Tracking of dropped plots, added plots, inaccessible plots, moved plots, empty plots, and other plots with anomalies.
6. Documentation of edits and corrections to inventory data
7. Checks that inventory data is compiled accurately, especially when handling inventory data from multiple cruises or measurement dates
8. Data storage and security

The re-measurement data quality systems developed for future inventories may be the same as the methods used in the initial inventory. Additional checks may be added based upon the concerns and risks unique to each future inventory. If future inventory is based upon LiDAR, remote sensing, or another method, then the re-measurement data quality plan will address the data quality concerns specific to that inventory method.

4-E. Carbon Quantification Methodology

(Forest Offset Protocol §9.1.1.1(20), Appendix A.3)

The live tree above-ground and below-ground portion of carbon was calculated using the approved species-specific FIA component ration method equations and methodology for cubic foot volume and biomass of tree bole, bark, branches, and roots as required by ARB (Woodall, Heath, Domke, & Nichols, 2011; FIA, 2009). The species codes in approved ARB volume equations differed somewhat from both the FVS regional species codes and the species codes used historically by the BIA. The following species codes were used throughout carbon quantification, including FVS modeling, volume equations, component ratio method biomass and carbon equations, and standing dead density deductions.

Table 8. Species Codes used for Carbon Quantification

Species	Latin name	ARB Species Code	ARB Species Code Notes	FVS CR code (if different)	Harmon 2011 DRF code used (if different)	Harmon 2011 DRF Code Notes
white fir	*Abies concolor*	15				Appendix D species
corkbark fir	*Abies lasiocarpa var. arizonica*	18			19	Corkbark fir not in Appendix B or D; used same species *Abies lasiocarpa* from Appendix D.
alligator juniper	*Juniperus deppeana*	63			57	Not in Appendix B or D; used *Juniperus spp*.
Rocky Mountain juniper	*Juniperus scopulorum*	66			57	Not in Appendix B or D; used *Juniperus spp*.
oneseed juniper	*Juniperus monosperma*	69				Appendix D species
Engelmann spruce	*Picea engelmannii*	93				Appendix D species
blue spruce	*Picea pungens*	96				Appendix D species
common pinyon	*Pinus edulis*	106				Appendix D species
southwestern white pine	*Pinus strobiformis*	114				Appendix D species
ponderosa pine	*Pinus ponderosa*	122				Appendix D species
Douglas-fir	*Pseudotsuga menziesii*	202				Appendix D species
Unknown dead conifer		299	Excluded; no approved volume equation	998	299	Table 6 hardwood/softwood
boxelder	*Acer negundo*	313		998		Appendix D species

Species	Latin name	ARB Species Code	ARB Species Code Notes	FVS CR code (if different)	Harmon 2011 DRF code used (if different)	Harmon 2011 DRF Code Notes
Rocky Mountain maple	*Acer glabrum*	321	Excluded; no approved volume equation	998		Appendix D species
bigtooth maple	*Acer grandidentatum*	322		998		Appendix D species
velvet ash (Rocky Mountain ash)	*Fraxinus velutina*	547		998	540	Not in Appendix B or D; used *Fraxinus spp*.
quaking aspen	*Populus tremuloides*	746				Appendix D species
Chokecherry	*Prunus virginiana*	763	Excluded; no approved volume equation	998		Appendix D species
oak (Quercus spp.)	*Quercus spp.*	814	Gambel oak was the only oak species found during inventory of Project Area, so all oaks identified only to genus level in the field are presumed to be Gambel oaks			Appendix D species
Gambel oak	*Quercus gambelii*	814				Appendix D species

Species	Latin name	ARB Species Code	ARB Species Code Notes	FVS CR code (if different)	Harmon 2011 DRF code used (if different)	Harmon 2011 DRF Code Notes
New Mexico locust	*Robinia neomexicana*	902	Excluded; no approved volume equation. There are inconsistencies in locust labels within the Coefficients Database. AZ_S_NM_S_config lists 901 as GLTR, which REF_SPECIES defines as SPCD (FIA code) of black locust ***Robinia pseudoacacia*** but SPECIES_SYMBOL of honeylocust *Gleditsia triacanthos.* Note that ***Robinia pseudoacacia*** is a timber species measured at DBH while ***Robinia neomexicana*** is a woodland species measured at DRC.	998		Appendix D species
Misc. Hardwoods		999 if live, 998 if dead	Excluded; no approved volume equation	999 if live, 998 if dead	998	Table 6 hardwood/softwood

Gross volume coefficients were selected according to ARB guidance by species and size from the Southern New Mexico tables of the ARB Coefficients Database. For damaged or broken-topped trees, VOLCFSND was reduced by field observations of percent of defect of the tree as well as estimated percent of biomass remaining below the break. Percent remaining below the break was calculated based on the "thirds method" of allocating biomass below a break developed by the Climate Action Reserve (Climate Action Reserve, 2014). For broken-topped trees, the percent remaining within each third of the tree was calculated as a ratio of the height remaining in that third divided by the estimated "phantom" height of an unbroken section. Total biomass remaining was calculated as the weighted average according to the proportions in the Climate Action Reserve Forest Quantification methodology. Calculations for live trees were conducted through a series of Access database queries. These queries were applied to the individual tree records at each 5-year time period for the 100-year projection period for each strata/prescription/timing choice combination. Databases for the baseline simulation have been provided as part of the verification process.

Above-ground standing dead wood was estimated following procedures outlined in ARB guidance (Air Resources Board, 2015) using the inventoried snag data for all standing dead trees greater than 5 inches DBH and 15 feet in height. Gross bole volumes were calculated volumetrically and net volumes were estimated by subtracting the trees' percent defect as estimated during the inventory from the total gross volume. For broken-topped trees, bole volume was reduced by the percent remaining below the break based on quantification methods from the Climate Action Reserve (see details in Live Trees section). Standing dead trees were adjusted by decay class with structural loss factors and density reduction factors (Domke, Woodall, & Smith, 2011; Harmon, Woodall, Fasth, Sexton, & Yatkov, 2011). All biomass estimates were converted to carbon by multiplying by 0.5 and to CO2e by multiplying by 3.664, which are the conversion factors specified in the Protocol.

Harvested wood products pools require an estimate of the average amount of carbon that remains stored in wood products over a 100-year period. This was done according to the steps outlined in Appendix C of the Protocol, which utilize the average DOE (2007) wood products factors for accounting for the long-term storage of wood products. The procedure begins with an estimate of the total harvested carbon that will be delivered to a mill to be turned into wood products (row 11 of the Offset Credit calculation worksheet). Next, the series of worksheets from Appendix C in the Protocol were used to determine the amount transferred to wood products, the amount stored in in-use wood products, and the amount stored in landfills. The carbon stored in wood products and landfills is summed to determine the total average annual carbon storage in wood products over 100 years.

For the calculation of secondary effects, the above- and below-ground carbon of all harvested live trees is determined using the same equations and methods for determining standing live tree carbon over time. This was done by running the same Access queries used for live trees on the FVS CutLists (TreeList output tables for all harvested live trees) for each strata/prescription/timing choice combination.

4-F. Inventory Update Process

(Forest Offset Protocol §9.1.1.1(19), Appendix A.3)

All planning and analyses, including inventory, growth, and yield modeling, and harvest scheduling required for this report had oversight by Dr. Timothy Robards of New Forests Inc., CF #2015. In addition, Robards oversaw all other elements of the OPDR; thus, this report has been prepared with the oversight of a professional forester as required in Section 9.1 of the Protocol.

Annual monitoring of the project is required to ensure up-to-date estimates of project carbon stocks and provide assurance that GHG reductions achieved by the project have not been reversed. A re-inventory will comply with the requirement that no field inventory data will be more than 12 years old; as such the Project Area and inventoried plots or clusters will be re-measured no later than 2027. Because the plots are permanently located, it is anticipated that the 12-year re-measurement will use the existing CFI plot locations as the basis for establishing project stocks in 2027.

For reporting stocks on an annual basis until the next inventory, when no harvesting is expected, the inventory update procedure will rely on growth projections from FVS. When inventory is re-measured, new inventory data will be incorporated into carbon quantification for re-measured plots. Plots will be re-measured consistently with the inventory manual used to establish the original inventory; any improvements or changes to inventory methods or calculations would be documented and justified in the change log. It is anticipated that updated data may be used for plots that have been re-measured, while other plots may be quantified based on modeled data. LiDAR or other remote sensing technology may be employed in future inventory work in addition to or as a substitute for ground-based plot measurements. At future re-measurements, an updated inventory database will be developed that specifies measurement date, replaces outdated data with re-measured data, or uses another appropriate system for inventory date tracking and data quality control. Older inventory data may be used to estimate growth and other modeling processes after it has been replaced by newer re-measurements. Carbon quantification of re-measured inventory data will include assessing the confidence deduction. If plot density is reduced at subsequent re-inventory, plots will be dropped systematically and/or randomly such that the inventory continues to meet sampling error requirements. Data management & QAQC systems implemented at future inventory measurement may be updated to ensure consistent high quality inventory data.

If any timber harvesting occurs in the Project Area, the timber harvest will be incorporated into the project model. Timber harvests in the Project Area shall be designed to treat plots the same as the surrounding stand. Effort will be made to limit knowledge of exact plot locations from the foresters designing and implementing timber harvests, so that the risk of bias is minimized during harvest planning. In addition, a post-harvest review of recently harvested areas shall be conducted by a professional forester; if a plot appears, based on professional judgment, to no longer be representative of the surrounding stand due to being treated differently than prescribed in the harvest plan, then the plot will be moved to a random distance and direction within a 2.5-acre area around the plot. Plots in areas affected by timber harvesting, other than salvage, will be re-inventoried within three years of completion of harvesting operations.

The primary natural phenomena with the potential to impact standing tree inventory are fire and disease. Mistletoe is the primary tree disease in the region. It has been monitored and managed on the Mescalero Apache Reservation since the 1950s. Fire, fuels, and disease management are central objectives of the Mescalero Apache Tribe. Fuel breaks, thinning, and other fire and disease management techniques are applied within the Project Area. These treatments will be monitored as part of normal inventory update procedures across the project area. Additionally, treatments will be incorporated into the project model if in a future Reporting Period they impact trees over 5" DBH on an area more than 5% of project acreage or if they result in a reversal under the Protocol. In that case, the impacted area will be re-inventoried within three years of completion of fuels management operations. The impact on standing carbon will be assessed using the methodology developed for a timber harvest, a disturbance, or similar method in order to determine the impact on standing carbon.

At the occasion of a disturbance event other than planned timber harvest, such as fire or windthrow, that appears to alter more than 5% of carbon stocks, 5% of project acreage, or result in a reversal under the Protocol (e.g., reduction is greater than annual growth if project is verified annually), then the plots in the affected area will be re-measured. If the disturbance appears to meet the specified threshold, but does not affect any of the permanent plots in the inventory, new plots will be established in the affected area in sufficient quantity and distribution to account for the disturbance. The newly measured plots will be installed consistent with the inventory manual used to establish the original inventory; any improvements or changes to inventory methods or calculations would be documented and justified in the change log. Once the plot data have been gathered, a new calculation of the Section 6 – Actual On-Site Carbon Stocks will be completed in order to revise the Section 7 – GHG Reductions and Removals as well as a new calculation of the confidence deduction. The effects of disturbances on the carbon stocks of the project area will be estimated by monitoring the acreage affected utilizing the average per-acre carbon stocks for the applicable strata. If the disturbance affects a significant portion of the strata acreage, then a new stratum will be delineated and the project stocks and confidence deduction calculated using the new strata.

Disturbance events will be monitored as part of normal management activities, as well as through an annual review of aerial imagery and local and state disturbance reports (e.g., fire maps) if available and applicable. Given the plot density, any disturbance that does not include a plot is assumed to have a diminutive effect on project carbon stocks. If, in the process of re-measuring plots after a significant disturbance, the plots cannot be relocated, new plots will be established in the same locations as the old plots. The replacement plot data will replace the old plot data for the purposes of calculating project carbon stocks.

4-G. FVS Modeling

(Forest Offset Protocol §9.1.1.1(21), Appendix A.3)

The Forest Vegetation Simulator (FVS) Central Rockies (CR)Variant (Keyser and Dixon, 2008) was used to model carbon stocks for the baseline scenario and also used to update carbon stocks from year to year for this Forest Project, as approved for use in the COP; see Appendix B: Modeling Carbon Stocks. FVS is an empirical forest growth model developed by the United States Forest Service (USFS) based on USFS Forest Inventory and Analysis plots within the variant region. It is an individual-tree, semi-

distance independent, growth and yield model that is calibrated for specific geographic areas (variants) of the United States that simulates a wide range of silvicultural treatments for major forest tree species, forest types, and stand conditions (Dixon 2002).

FVS runs were completed on combined data from BAF plots measured in 2015, CFI plots re-measured in 2015, and CFI plots measured in 2012 with regression updated height, diameter, and site index values. Initially, separate databases housed the CFI and BAF plot data. Following QA/QC efforts, the data were merged into one database.

I. FVS Calibration

The FVS modeling exercise did not utilize the calibration process previously used by the Bureau of Indian Affairs (BIA) during previous modeling efforts in 2011. Updates to the FVS settings in the current version of Suppose more accurately approximates growth without calibration. Stand behavior were adjusted by the use of Stand Density Index (SDI) settings, which were derived from the inventory dataset. Max SDI was calculated for the following species:

- White fir
- Rocky Mountain juniper
- Common pinyon
- Southwestern white pine
- Ponderosa pine
- Doulas-fir
- Quaking aspen
- Gambel oak

The Max SDI settings were rounded prior to entry into FVS via the "SDIMax" keyword.

II. Stand Table Projection Adjustments to 2012 CFI Data

The CFI data plots last visited in 2012 were projected forward to the beginning of the reporting period following the Stand Table Projection criteria specified in the Protocol. All of the project area is managed, and has been managed for many decades, using uneven-aged silvicultural methods. The data were divided into 8-inch diameter classes. As per B.1, the diameter classes started at 0 – 8" DBH. The number of observations was determined for each diameter class. Where there were fewer than 20 observations, the diameter class was combined with the next lowest class, as per B.1.

The stand table updates are applied to only the Fir and Pine species groups, which included ponderosa pine and southwest white pine (Pine group), and Douglas-fir, blue spruce, and white fir (Fir group). The other species groups (mixed hardwood, juniper & pinyon) did not have a sufficient diameter or height growth period (3 years) to derive a meaningful growth change estimate. This was due to their slow growth and generally smaller stature.

The Fir Group diameter growth analysis resulted in the following. The 24+ inch class had only 14 observations, less than the 20 minimum required, and so was combined with the 16-24 class to become the 16+ diameter class.

Table 9. Stand Table Projection DH Increment, Fir Group

DBH Classes	3-Year Increment (in)	Observations

5 – 8	0.32	146
8 – 16	0.37	260
16+	0.41	89
Total		495

The Pine Group diameter growth analysis resulted in the following. The 16+ inch class had only 12 observations, less than the 20 minimum required, and so was combined with the 8-16 class to become the 8+ diameter class.

Table 10. Stand Table Projection DBH Increment, Pine Group

DBH Classes	3-Year Increment (in)	Observations
5 - 8	0.54	50
8+	0.35	79
Total		129

Height was estimated via a DBH-height regression as specified by Protocol section B.1. The data used were the same as for the diameter growth increment. The Fir and Pine Groups were fit with simple linear regressions that resulted in p-values all below 0.05, overall F-Tests that were significant, and no lack-of-fit apparent in the residual plots. The other species did not have growth updates for the period for either height or DBH.

The DBH increments and height increments developed from CFI tree data gathered in 2015 (48 plots) were applied to the Fir and Pine group species outlined above. Diameter and height increments were only applied to trees with DBH >=5” when measured in 2012 since only trees >=5” were included in carbon quantification and the increments were derived from growth data of trees >=5”. These stand table updates were applied to trees last measured in 2012 prior to input into FVS.

Figure 7. Fir Group Height-DBH regression

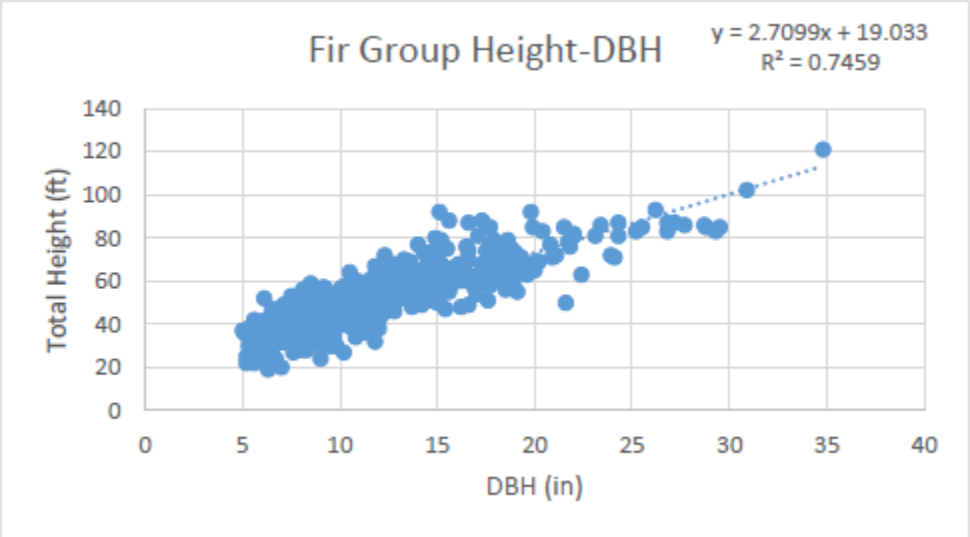
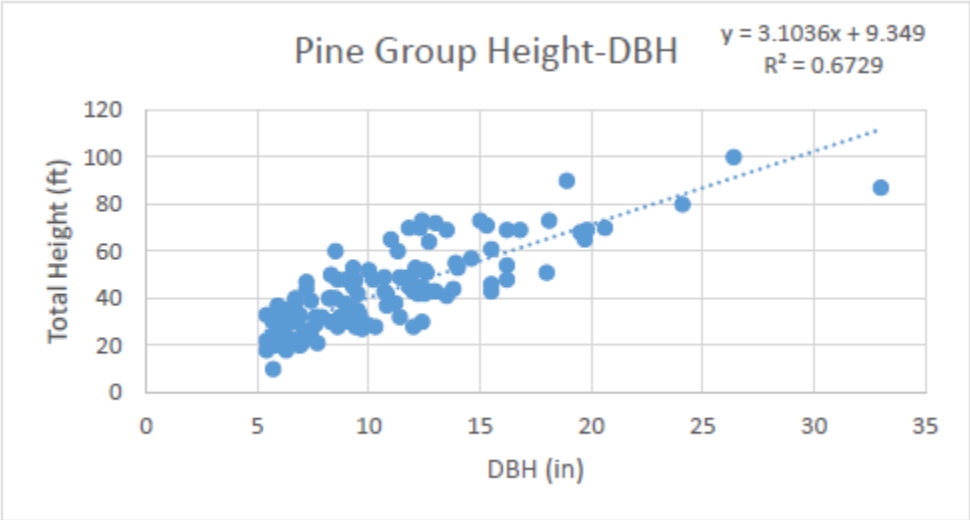


Figure 8. Pine Group Height-DBH regression



III. Site Index

Site index calculations were based off the most recent plot measurements within the BIA CFI database for plots within the project area and followed the FVS CR variant recommendations. Plots were applied site index for either Douglas-fir or ponderosa pine.

We applied equations from Minor (1964) to calculate site index for ponderosa pine and found the results to be identical to the values calculated by the BIA, with the exception of 15 records/pots. Thirteen of the 15 plots had site values (Minor, 1964 calculated) greater than 120, in which the BIA set site index to the upper bound of the CR variant ponderosa pine site index range (100 years). Two of the 15 values were calculated as negative site index (both of the plots had site age 11 years). The BIA set the site index for these two plots to 70 and 90. Overall, the BIA site index values for ponderosa pine appeared to follow the CR variant recommended equations. So, all BIA-derived ponderosa pine site index values were accepted and remain in the FVS database.

Douglas-fir site index was calculated using the Edminster (1991) equation. We found site values calculated from Edminster (1991) to be different from that provided by the BIA (being consistently higher). The calculated values were tested against the lookup table provided in Edminster (1991), and found our calculated values to be consistent with that published. We applied the calculated site index values derived from Edminster (1991) oppose to the values provided by the BIA.

Eleven of the 443 plots either did not contain site index measurements or had site index calculated from species other than Douglas-fir or ponderosa pine. These plots were assigned the average site index values for the chosen species within the modeling stratum (group) they were located in. Additionally, the average site index values were applied to all BAF plots by group. The species chosen to represent the strata are based on species dominance within the group. Prescriptions were run on the three project strata individually: Mixed Conifer, Ponderosa Pine, and Mixed Pine.

IV. Silvicultural Prescriptions

Silvicultural prescriptions modeled in FVS were based upon common practice for the region as well as the goals and practices of the Mescalero Apache Tribe. New Mexico Forest Practice Guidelines' Best Management Practices (Paul, 2008) and BIA forest management documents (Little, 2001) for the Mescalero Apache Tribe describe both even- and uneven-aged management systems, including patch cut (clear cut), selection, use of intermediate thinnings, and prescribed burning. The GROW prescription models forest growth without active management. CC_1 models active and intensive timber harvest, with several timing options (A, B, C, etc.) to reflect staggered rotations across the property. Single-tree selection prescriptions were based upon models developed previously by the Mescalero Apache Tribe to promote relatively more open (STS1) and more dense (STS2) forest types.

Regeneration was modeled using both sprouting and planting settings. When sprouting is on, all species in the FVS default sprouting list sprout per FVS settings. All other woodlands species that do not sprout required natural planting to estimate regeneration patterns. The regeneration table below reports the TPA settings for the woodland species through planting. A 95% mortality rate was applied to the planting figures.

Table 11. Silvicultural prescriptions modeled for baseline and project activity

Rx ID	GROW	CC_1	STS1	STS2
Timber Type	all timber types	all timber types	all timber types	all timber types
Rx Description	Let Grow	Patch (Clearcut) period 2, 3, 4 or 5; thin regen stand up to age 50 yrs following first cut; CC again at age 60	Q-factor: 1.2 Diameter class width: 4 inches Maximum tree size: 30 inches 20 year cutting cycle BA stocking target: 40 ft2/ac Legacy tree TPA: 1	Higher density STS for high elevation and north facing slopes. 20 year cutting cycle.
Minimum Commercial Harvest Volume	-	0 for CC (except trees< 3"); 1.5 MBF/ac for thin and 30 BA residual	1.5 MBF/ac	1.5 MBF/ac
Residual Stocking	-	0 ft2/ac	BA Stocking: 40 ft2/ac Legacy trees: 1/ac	BA Stocking: 55 ft2/ac Legacy trees: 1/ac, thin from below, <16"
Species Retention Preferences	-	Ponderosa pine & Douglas-fir, white fir & southwestern white pine	Ponderosa pine & Douglas-fir, white fir & southwestern white pine	Ponderosa pine & Douglas-fir, white fir & southwestern white pine
Sprouting (on/off)	On	On	On	On

Rx ID	GROW	CC_1	STS1	STS2
Keywords	NOTRIPLE, SDIMAX (for spp. in list provided by Tim), **SPROUTING (ON)**	NOTRIPLE, SDIMAX (for spp. in list provided by Tim), **SPROUTING (ON)**, MINHARV = 1,500 bdft (for thin only), RESETAGE, SpecPref (for thin only), Adjust Mortality	NOTRIPLE, SDIMAX (for spp. in list provided by Tim), S**PROUTING (ON)**, MINHARV = 1,500 bdft (for thin only), SpecPref, Adjust Mortality	NOTRIPLE, SDIMAX (for spp. in list provided by Tim), S**PROUTING (ON)**, MINHARV = 1,500 bdft (for thin only), SpecPref, Adjust Mortality
Notes		Run A = CC starting in period 1 (2015); Run B = CC starting in period 3 (2025); Run C = CC starting in period 5 (2035)	One run per Strata	One run per Strata
Revisions		Sprouting on, Mortality settings = 5% survival for Rocky Mountain Juniper and Common Pinyon, 99% mortality for all sprouting woodland spp. 5 years after CC treatment, periods B and C do not reset age, so Thinning could occur before CC. These periods also cut up through age 50 due to the fact that harvests can only happen mid-decade.	Drop CC. Revise planting to occur 5 years after each cut, Use natural keyword for regen. Turned sprouting on. Sprouting on, Mortality settings = 5% survival for Rocky Mountain Juniper and Common Pinyon, 99% mortality for all sprouting woodland spp. 5 years after treatment	Drop CC. Revise planting to occur 5 years after each cut, Use natural keyword for regen. Turned sprouting on. Sprouting on, Mortality settings = 5% survival for Rocky Mountain Juniper and Common Pinyon, 99% mortality for all sprouting woodland spp. 5 years after treatment

Table 12. FVS regeneration settings by species

	Timber Species		Woodland Species	
Strata/Species	**CC**	**STS**	**CC**	**STS**
MC	150	10	40	3
15	56	3		
66			19	1
106			21	2
114	8	1		
122	11	1		
202	75	5		
MP	150	10	40	3
15				
66			11	1
106			29	2
114	15	1		
122	30	2		
202	105	7		
PP	150	10	40	3
15				
66			5	1
106			35	2
114	2	0		
122	105	7		
202	43	3		

5. Baseline Carbon Stocks – Improved Forest Management Projects

5-A. Legal Constraints

(Forest Offset Protocol §6.2.1.2, §9.1.1.3(4))

The baseline model for the carbon project reflects all applicable legal constraints, as described in sections 3-F and 3-G above. In addition, while the Mescalero Apache Reservation is not subject to the jurisdiction of New Mexico state law, we have considered New Mexico state better management practices ("BMPs") as common harvest procedure in the region. To be very conservative, certain (non-required) New Mexico BMPs have been applied to baseline scenario modeling (Paul, 2008). Table 13 summarizes how these BMPs have been applied in project baseline modeling.

Table 13. New Mexico BMPs Applied to Baseline Modeling

Constraint	Law or Reference	Silvicultural Method	Retention strategy
Streamside management areas: no harvest within 50 feet (slope distance) of the ordinary high water mark, unless alternate practices approved (i.e. for restoration purposes)	NMAC 19.20.4.9, section G, page 27	LetGrow	n/a
Seed all exposed soil such as skid roads and landings	NMAC 19.20.4.9, section E, page 24	regen treatment settings (in all except LetGrow)	natural regeneration and/or plant appropriate species

5-B. Financial Constraints

(Forest Offset Protocol §6.2.1.3, §9.1.1.3(5))

Option two in Section 6.2.1.3 was selected for demonstrating that the proposed baseline is financially feasible by demonstrating that harvesting similar to that proposed in the baseline has occurred on at least one other similar property within the Project's Assessment area in the past 15 years.

We used forest activity information from the adjacent Lincoln National Forest to demonstrate activities similar to the proposed baseline growth and harvesting regime have taken place within the Forest Project's Assessment Area within the past 15 years. We selected areas from a GIS shapefile of Lincoln National Forest activities that were accomplished since the year 2000 and were within 20 miles of the Mescalero Apache Tribe Forest Carbon Project. The activities selected represent a diverse mix of management activities that are appropriate for landscape-level management, and are thus similar to the baseline prescriptions that will be modeled for the project area. We

used the selected activity areas to create a layer of percent slope. Percent slope was also calculated for the project area in order to compare the mean slopes and ensure that the average slope in the comparison property did not exceed the average slope of the Project Area by more than 10% (Table 1). To compare species composition, we used data from the Forest Inventory and Analysis (FIA) Program of the US Forest Service for the state of New Mexico. FIA plot locations were brought into a geographic information system software based on the plot latitude and longitude. Plots within the project area and the Lincoln National Forest activity areas were used to calculate trees per acre by species group to ensure that the species composition of the comparison property does not vary by more than 20% of the species composition of the Project Area (Table 2). Since county and local zoning is not applicable on tribal trust lands, nor is it applicable on national forest lands, the zoning status of the comparison property is similar to the zoning status of the Project Area. In conclusion, the comparison property provides evidence that financially feasible timber harvest activities have taken place on other similar properties and that the proposed baseline for the project is thus financially feasible.

Table 14. Financial Feasibility - Slope Comparison

Lincoln National Forest Projects completed 2013 within 20 miles of Mescalero Apache Tribe Forest Carbon Project Mean Percent Slope	Mescalero Apache Tribe Forest Carbon Project Mean Percent Slope
25.32 %	25.29 %

Table 15. Financial Feasibility - Species Composition Comparison.

		Mescalero Apache Tribe Forest Carbon Project		Lincoln National Forest Projects completed 2013 within 20 miles of Mescalero Apache Tribe Forest Carbon Project		
Species Group	Species Group Code	Trees per Acre	Percent of Total	Trees per acre	Percent of Total	**Percent Difference**
Douglas-fir	10	59.47	13%	43.52	8%	**5%**
Ponderosa and Jeffrey pines	11	34.93	8%	37.56	7%	**1%**
True fir	12	35.58	8%	2.54	0%	**7%**
Woodland softwoods	23	94.25	20%	212.08	38%	**-18%**
Other western softwoods	24	6.63	1%	17.77	3%	**-2%**
Woodland hardwoods	48	230.71	50%	242.29	44%	**6%**

	Grand Total	461.56	100%	555.77	100%	**0%**

5-C. Estimate Baseline Onsite Carbon Stocks

(Forest Offset Protocol §6.2.1, §9.1.1.1(21, 22, 25), §9.1.1.3(2, 3), Appendix B)

Step 1: Determining the Common Practice (CP) Carbon Stocks for the Project's Assessment Area.

The project is located entirely within the Central New Mexico supersection. This supersection has only one assessment area irrespective of site class. The 228,376 acre project area is Central New Mexico Pinyon/Juniper woodland, which has a common practice of zero (0) tonnes per acre under the 2014 version of the Protocol.

Step 2: Determining if the Project Area's Initial Carbon Stocks (ICS) are above or below the Common Practice (CP). Based on the initial forest carbon inventory for the Project Area, the carbon stocks of the above-ground live tree component are calculated to be 35.61 tonnes CO2e per acre. The ICS is greater than the CP, therefore the minimum baseline level (MBL) is equal to the CP, which is zero tonnes per acre CO2e in the above-ground live tree component. Note: When ICS is above CP, it is not necessary to estimate the High Stocking Reference (HSR) or Weighted Average Above-Ground live carbon stocks per acre for all Forest Owner and affiliate landholdings within the same logical management unit (WCS).

Step 3: Determine Baseline Above-Ground Standing Live Carbon Stocks. The baseline above-ground standing live carbon stocks were determined by modeling above-ground standing live carbon stocks through a series of growth and harvesting scenarios over 100 years and averaging the model results over the 100-year timeframe, so that the baseline is expressed as a single (average) value for above-ground standing live carbon stocks per acre in every year. The baseline simulation incorporates all legal and financial constraints as discussed in Sections 5-A and 5-B. Consideration was given to financial, legal, and regulatory constraints by assigning acres constrained for various reasons to certain silvicultural prescriptions as described in this document and attachments.

The following table shows the acreage allocation to each prescription by stratum in the baseline. In the project scenario, all acres were allocated to the let-grow prescription.

Table 16. Baseline Acreage Allocation by Prescription and Strata

Strata	Prescription	Acres
MC	Let Grow (Grow)	9,980
	Patch clearcuts (CC_1)	45,072
	Single Tree Selection (STS)	5,292
	Subtotal	60,343
MP	Let Grow (Grow)	8,740
	Patch clearcuts (CC_1)	70,627
	Single Tree Selection (STS)	5,463
	Subtotal	84,830
PP	Let Grow (Grow)	4,766
	Patch clearcuts (CC_1)	77,167
	Single Tree Selection (STS)	1,269
	Subtotal	83,203
Total		228,375

The following figures and tables show the final baseline modeling and resulting average onsite and harvested pools. The first tables and figure displays the total onsite CO2e tonnes per period for the baseline harvest schedule. The pattern over time is largely a function of the periodicity of the harvests modeled. The harvest schedule meets all legal, physical, and financial feasibility tests and is a likely scenario under a no-carbon-project scenario. The horizontal lines in the second figure are the annual averages across the planning period, which are used in the carbon credit calculations. Modeling the baseline stocking with legal and financial constraints yields an average onsite above ground standing live tree stocking of 4,658,886 total tonnes of CO2e for the 100 year baseline modeling scenario, or 20.40 tonnes CO2e per acre, which is above the CP value and thus does not fall below the MBL as required by the Protocol.

Table 17. Carbon (CO2e) Reported from the Baseline Harvest Schedule

Year	AG Live Tree	BG Live Tree	Standing Dead	Cut-All	Cut-Merch
2015	8,131,867	1,825,258	1,058,832	6,150,457	3,671,653
2025	3,988,111	893,165	1,058,832	2,724,276	1,694,890
2035	2,214,813	496,392	1,058,832	71,068	39,294
2045	2,714,894	609,076	1,058,832	50,378	27,121
2055	3,567,079	799,889	1,058,832	112,490	62,322

2065	4,916,833	1,106,003	1,058,832	133,086	73,275
2075	6,885,425	1,555,483	1,058,832	2,932,007	1,662,045
2085	5,736,997	1,289,210	1,058,832	2,456,343	1,416,388
2095	4,040,692	901,567	1,058,832	17,830	10,420
2105	4,331,749	966,364	1,058,832	-	-
2115	4,719,287	1,053,862	1,058,832	-	-

Figure 9. Onsite Carbon Pools in Baseline Model

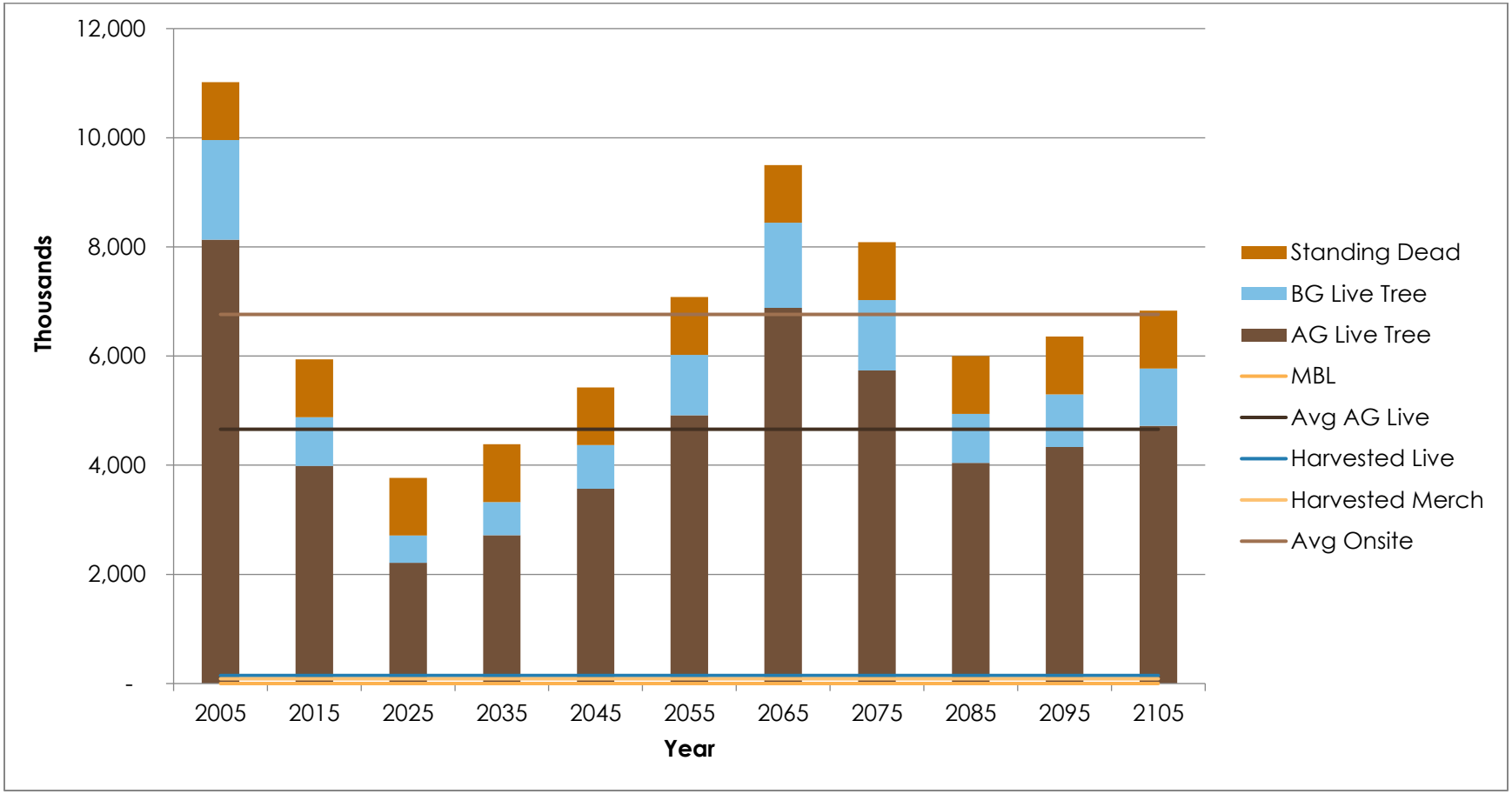
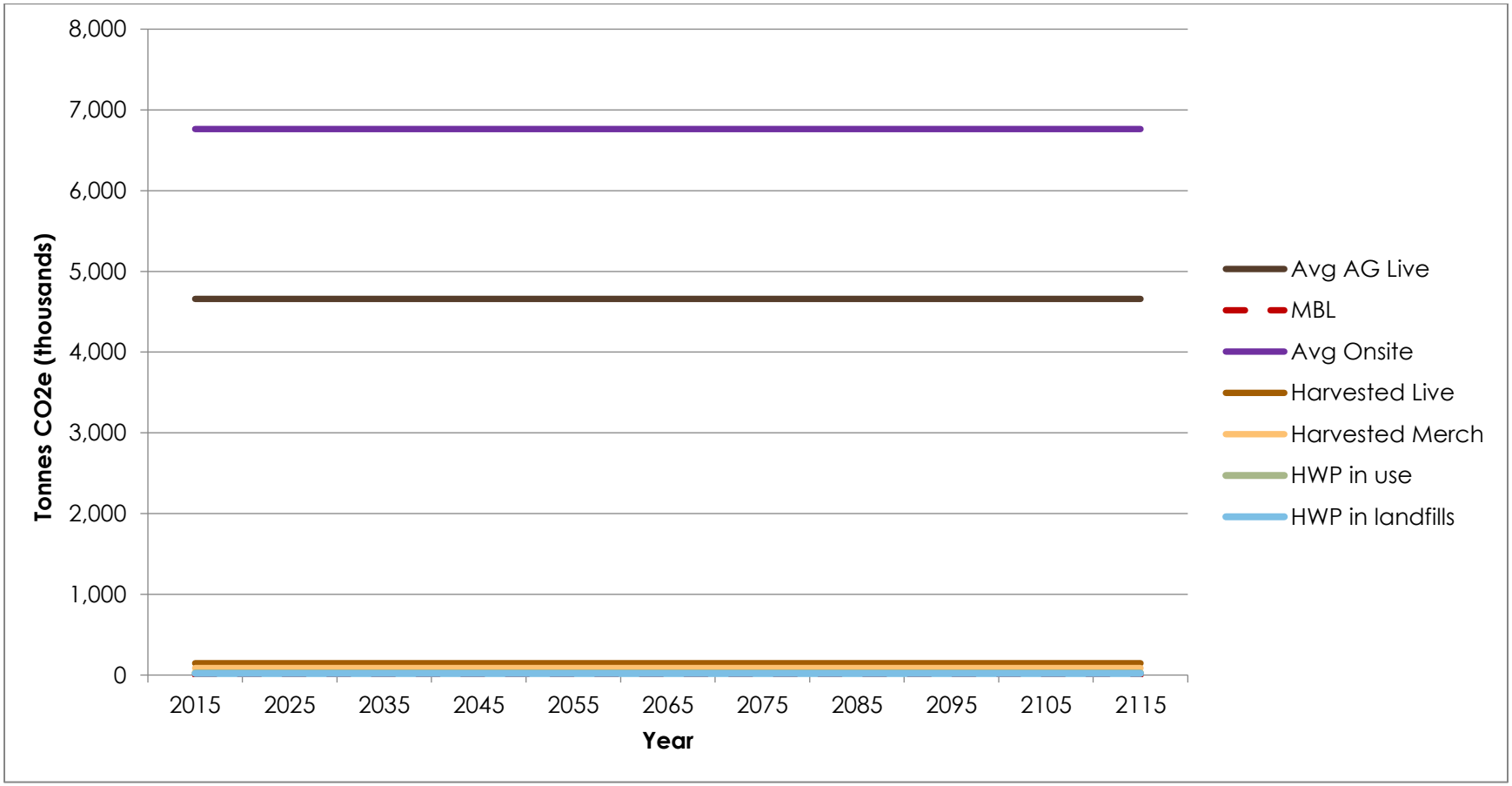


Figure 10. Hundred-year averages for baseline carbon pools



Step 4: Determine the Baseline for All Carbon Pools. There are no optional carbon pools in this project. Standing live (IFM-1), standing dead (IFM-3), and in-use forest products carbon (IFM-7) are required pools. Forest products carbon stored in landfills (IFM-8) is also required when baseline harvesting exceeds project harvesting. In order to determine the amount of carbon stored in harvested wood products (HWP) the cut trees are further divided into Harvested Live and Harvested Merch. Harvested Live is defined as the carbon in all portions of live trees removed from the project during a harvest (including below-ground carbon). Harvested Merch is defined as the carbon in the merchantable portions (bole without bark) of the commercially harvested trees that are sent to mills to be processed into wood products. Harvested Merch conservatively includes both hardwood and softwood species. These values are used in row 9 and row 11, respectively, of the Offset Credit calculation worksheet. For the Mescalero Apache Tribe Forest Carbon Project the average annual value of the relevant baseline carbon pools are:

- Standing Live (AG+BG, IFM-1) – 5,704,001 tonnes CO2e
- Standing Dead (IFM-3) – 1,058,832 tonnes CO2e
- Harvested Live –146,479 tonnes CO2e
- Harvested Merch –86,574tonnes CO2e
- HWP in-use (IFM-7) – 26,768 tonnes CO2e
- HWP in landfills (IFM-8) – 18,952 tonnes CO2e

5-D. Determination of Weighted Average Carbon Stocks (WCS)

(Forest Offset Protocol §6.2.1.3, §9.1.1.1(25), §9.1.1.3(5))

The weighted average carbon stocks (WCS) estimate is not needed where the minimum baseline level (MBL) is equal to or above the common practice; therefore it was not estimated.

5-E. Estimating Baseline Carbon in Harvested Wood Products

(Forest Offset Protocol §6.2.3, §9.1.1.1(26), Appendix C)

The average amount of merchantable carbon harvested each year was calculated from the baseline modeling. This was done by using the harvest yields from FVS for each strata/prescription/timing choice combination. Appendix C of the Protocol requires a different methodology for calculating the carbon in harvested wood than it does for live trees. First, the merchantable cubic-foot volumes of all species that will be delivered to a mill are selected from the harvest yields. Harvested wood volumes excluding bark were calculated for softwood and hardwood, sawtimber and pulp. The volumes were multiplied by the average wood density factors for softwoods and hardwoods as calculated from the species-specific wood density values from the USFS Wood Handbook (GTR 190), weighted by the basal area composition of each species in the inventory. The total value of harvested wood in pounds was multiplied by 0.5 to convert to carbon and divided by 2,204.6 to convert from pounds to metric tons of carbon. The mill efficiency value used to arrive at the total carbon transferred into wood products was based on the regional factors for the "Rocky Mountain, South (RMS)" region for hardwood/softwood and sawlog/pulpwood categories as provided from the ARB website. The sawlog/pulpwood mill efficiencies are the same in the region. There was very little hardwood on the project area, and there is not a significant hardwood market in the region. The softwood mill efficiency of 0.7 was used

conservatively for all species. Next, the table C.2 worksheet was used to calculate the long-term carbon storage in in-use wood products. Product class assumptions were based on default values for the supersections, weighted by the project area acres in each supersection. Long-term storage in landfills was determined using the Table C.3 worksheet and the same default product class percentages.

6. Project Carbon Stocks-Improved Forest Management Projects

6-A. Actual Onsite Carbon Stocks

(Forest Offset Protocol §6.2.4, §9.1.1.1(23, 24), Appendix A, Appendix B)

The carbon inventory was collected in fall 2015, shortly after the project start date and later in the year than the main growing season, so the inventory data conservatively represents the project carbon stocks as of the project start date of October 16, 2015. The initial inventory was then grown forward on a pro-rated basis to the end of the initial reporting period of August 15, 2016, thus accounting for slightly less than one full growing season. There was no harvesting during the initial reporting period, so the actual carbon stocks at the end of the reporting period were not adjusted to account for harvesting.

A summary of the required carbon pools at the end of the reporting period is as follows:

- Standing Live (IFM-1) – 10,186,941 tonnes CO2e
- Standing Dead (IFM-3) – 1,058,832 tonnes CO2e
- Harvested Live – 0 tonnes CO2e
- Harvested Merch – 0 tonnes CO2e
- HWP in-use (IFM-7) – 0 tonnes CO2e
- HWP in landfills (IFM-8) –0 tonnes CO2e

The results of the volume and biomass queries discussed in Section 4-E of this OPDR were analyzed for the 2015 inventory data to calculate the statistics for live and standing dead carbon pools for each stratum.

The sampling error at the 90% level is calculated by multiplying the total combined standard error by the t value of 1.645. The pooled sampling error for all strata was determined following guidance in Appendix A.4 of the Protocol and using the following formula from Iles (Iles, 1996).

$$(SE_1^2 + SE_2^2 + SE_3^2)^{0.5} = \text{Total Combined Sampling Error}$$

where: SE_n *= total sampling error in volume units for Strata n*

The following table summarizes the data and statistics for each of the strata and the pooled sampling error for all the strata combined.

Table 18. Carbon statistics by strata 2015.

Strata	No. of Obs	Carbon (CO2/acre)						Acres	Total Carbon (CO2)
		Avg. Live AG	Avg. Live BG	Avg. Dead	Avg. Onsite	Std. Dev.	Std. Error		
MC	392	48.6	10.9	6.7	66.2	57.3	2.89	60,343	3,992,256
MP	391	39.7	8.9	4.7	53.3	46.0	2.33	84,830	4,522,587
PP	267	22.1	5.0	3.0	30.1	28.5	1.74	83,203	2,501,114
Total	***1050***							***228,375***	***11,015,957***
Average		***35.6***	***8.0***	***4.64***	***48.24***				

Table 19. Sampling error with stratification.

Total	Mean	n	StdError	Bound	Sampling Error
11,015,957.2	**48.24**	**1050**	**300,709.11**	**494,666.49**	**4.5%**

Stratified Sampling Error at 90% level = **4.5%**

Confidence Deduction = 0%

Since the sampling error is less than 5%, the confidence deduction is zero.

The following table shows the acreage allocation to each prescription by stratum in the 100-year modeled project scenario. The Mescalero Apache Tribe has general plans to continue harvesting in the future; however, because the harvests have not been specified on a year-by-year basis, we are assuming for the purposes of this project scenario that the projection consists entirely of let grow. If and when the Mescalero Apache Tribe decides to harvest in the future, actual carbon stocks will be updated to reflect actual harvests that have occurred according to the procedures outlined in the project's modeling plan.

Table 20. Project Acreage Allocation by Prescription and Strata

Strata	Prescription	Acres
MC	Let Grow (Grow)	60,343
	Patch clearcuts (CC_1)	-
	Single Tree Selection (STS)	-
	Subtotal	**60,343**
MP	Let Grow (Grow)	84,830
	Patch clearcuts (CC_1)	-
	Single Tree Selection (STS)	-
	Subtotal	**84,830**
PP	Let Grow (Grow)	83,2031
	Patch clearcuts (CC_1)	-
	Single Tree Selection (STS)	-
	Subtotal	**83,203**
Total		***228,376***

Table 21. Carbon (CO2e) Reported from the Project Activity Harvest Schedule

Year	AG Live Tree	BG Live Tree	Standing Dead	Cut-All	Cut-Merch
2015	8,131,867	1,825,258	1,058,832	-	-
2025	10,067,698	2,258,662	1,058,832	-	-
2035	12,278,318	2,752,103	1,058,832	-	-
2045	14,482,251	3,243,922	1,058,832	-	-
2055	16,848,764	3,770,503	1,058,832	-	-
2065	19,222,178	4,297,248	1,058,832	-	-
2075	21,438,742	4,789,979	1,058,832	-	-
2085	23,559,743	5,261,177	1,058,832	-	-
2095	25,517,683	5,695,887	1,058,832	-	-
2105	27,282,753	6,087,283	1,058,832	-	-
2115	28,880,198	6,440,878	1,058,832	-	-

6-B. Actual Carbon in Harvested Wood Products

(Forest Offset Protocol §6.2.5, §9.1.1.1(23, 24), Appendix A, Appendix B, Appendix C)

The FVS simulation of project activity was used to estimate the wood products carbon for the next 100 years. Since all project acres were allocated to the "let grow" scenario, no harvest is currently projected for the 100 year period. If any harvesting does occur at some point in the future, the actual harvested amount will be reported and used as determined from logging reports.

6-C. Quantifying Secondary Effects

(Forest Offset Protocol §6.2.6, §9.1.1.1(23))

Secondary effects include changes in emissions due to unintended changes in regional carbon stocks that may result from the Forest Project, and are always negative. Secondary effects include activity shifting leakage that results from changes in forest management activity resulting from the Forest Project activity. The calculation itself is 20% of the difference between actual and baseline carbon in harvested wood. For the first year of the project this is 20% x (0 – 151,484) = -30,297 tonnes CO2e as shown in row 27 of the Offset Credit calculation worksheet pasted below.

7. Calculation of GHG Reductions and Removals

(Forest Offset Protocol §6)

Equation 6.1 was used for estimating the first reporting period GHG reductions and removals. This was implemented using a modified version of the Forest Project calculation worksheet provided by the Climate Action Reserve, and is provided along with the project input data. This process included the changes in onsite stocks, long-term average wood product storage, and secondary effects.

Table 22. GHG Reductions and Removals Worksheet

	Type of Project:		
	Improved Forest Management		
Reporting Period Data entered for end of each Period; after Period 2, each Period = 12 months	Reporting Period Data entered for end of each Period; after Period 2, each Period = 12 months	Initial Data at Start Date - October 2015	Start Date to End of Initial Reporting Period August 2016
Calc Row	Calculating GHG Reductions/Removals for Onsite Carbon Stocks - All Project Types		
1	Actual Onsite Carbon Stocks (tonnes CO2e)	11,015,957	11,245,772
2	Confidence Deduction	0.0%	0.0%

3	Adjusted Actual Onsite Carbon Stocks (adjusted for confidence deduction) (tonnes CO2e)	11,015,957	11,245,772
4	Increment in Actual Onsite Carbon Stocks (tonnes CO2e)		229,815
5	Baseline Onsite Carbon Stocks (tonnes CO2e)	6,762,833	6,762,833
6	Increment in Baseline Onsite Carbon Stocks (tonnes CO2e)		-
7	Quantified GHG Reductions / Removals for Onsite Carbon Stocks (tonnes CO2e)	4,253,124	229,815
Calc Row	Calculating Carbon Stored in Wood Products Including Market Effects and Leakage - All Project Types		
8	Actual Carbon in Trees Harvested for Wood Products in (tonnes CO2e)		-
9	Baseline Carbon in Trees Harvested for Wood Products (tonnes CO2e)		146,479
10	Actual Carbon in Harvested Wood Delivered to Mills (tonnes CO2e)		-
11	Baseline Carbon in Harvested Wood Delivered to Mills (tonnes CO2e)		86,574
12	Actual Carbon Stored Long-term in Wood Products (tonnes CO2e) - Excl Landfill		-
13	Actual Carbon Stored Long-term in Wood Products (tonnes CO2e) - Incl Landfill		-
14	Baseline Carbon Stored Long-term in Wood Products (tonnes CO2e) - Excl Landfill		26,768
15	Baseline Carbon Stored Long-term in Wood Products (tonnes CO2e) - Incl Landfill		45,719
16	Diff Between Actual and Baseline Carbon in Harvested Wood (tonnes CO2e) - Excl Landfill		(26,768)
17	Difference Between Actual and Baseline Carbon in Harvested Wood (tonnes CO2e) - Incl Landfill		(45,719)
18	Difference in Actual and Baseline Carbon Stored in Wood Products (tonnes CO2e) - Landfill Adj		(45,719)
19	GHG Reductions / Removals for Carbon Stored in Wood Products (tonnes CO2e) w/ mkt response		(36,575)

Calc Row	Calculation Other Secondary Effects - Reforestation Projects		
20	Mobile Combustion Emission Factor (average tonnes CO2e per acre)		
21	Initial Site Prep Acres in Project Area (Acres)		
22	One-time combustion emissions associated with machinery use in site preparation (CO2e tonnes)		-
23	Leakage Risk Percentage for Leakage from Shifting Cropland and Grazing Activities (%)		
24	Secondary Effect emissions due to shifting cropland or grazing activities (tonnes CO2e)		-
25	Other Secondary Effect Emissions for Reforestation Projects (tonnes CO2e)		NA
Calc Row	Calculating Other Secondary Effects - Improved Forest Management Projects		
26	Difference Between Actual and Baseline Carbon in Trees Harvested for Wood Products (tonnes CO2e)		(146,479)
27	Other Secondary Effects Emissions (shifting activities/materials) IFM Projects (tonnes CO2e)		(29,296)
Calc Row	Determing the Uncertainty Discount Factor and Calculating Other Secondary Effects - Avoided Conversion Projects		
28	Appraised Fair Market Value of Anticipated Alternative Land Use of Project Area (000$)		
29	Appraised Fair Market Value of the Current Forested Land use of Project Area (000$)		
30	Avoided Conversion Discount Factor		0%
31	Quantified GHG Reductions / Removals for Onsite Carbon Stocks (tonnes CO2e)		229,815
32	Other Secondary Effect Emissions for Avoided Conversion Projects (tonnes CO2e)		NA
Calc Row	Quantified GHG Reductions and Removals		
33	Annual GHG Reductions/Removals Net of Discounts and Secondary Effects (tonnes CO2e)	4,253,124	163,944

34	Cumulative GHG Reductions/Removals; not incl.neg. carryover or reversals (tonnes CO2e)	4,253,124	4,417,068
35	Cumulative Negative Carryover from Prior Year (tonnes CO2e)		0
36	Credits Issued - Net of Negative Carryover, bef. Buffer or adjust for Reversals (tonnes CO2e)	4,253,124	163,944
Calc Row	Calculation of Buffer Pool Contribution		
37	Project Specific Reversal Risk Rating	15.8%	15.8%
38	Buffer Pool Contributions (Credits)	671,994	25,903
Calc Row	Accounting for Reversals		
39	Annual Reversals (tonnes CO2e)		-
40	Total "Avoidable Reversals" to be compensated (tonnes CO2e)		-
41	"Unavoidable Reversals" compensated from the Buffer Pool (tonnes CO2e)		-
Calc Row	Compensating for Avoidable Reversals		
42	"Avoidable Reversals" compensated from Forest Owners Account (tonnes CO2e)		-
43	"Avoidable Reversals" compensated by retirement of other eligible credits or instruments (tonnes CO2e)		-
44	Carryover "Avoidable Reversals" which need to be compensated (tonnes CO2e)		-
Calc Row	Credits Issued to Account Holder		
45	Annual Credits Issued to Account Holder	3,581,130	138,041
46	Cumulative Credits Issued to Account Holder	3,581,130	3,719,171

8. Reversal Risk Rating

8-A. Reversal Risk Rating by Category

(Forest Offset Protocol §7.2.2, §9.1.1.1(27), Appendix D.1, D.2, D.3, D.4)

Financial Risk: Contributions to the buffer pool associated with financial risk come from the potential financial failure of an organization resulting in bankruptcy, which can lead to dissolution of agreements and forest management activities to recover losses that result in reversals. Forest projects that employ a Qualified Conservation Easement, or that occur on public lands, have lower risk. Although tribal lands are not considered as public lands, for Financial Risk calculation purposes tribal lands are considered as public lands; hence the default value for public lands is used for buffer pool contribution.

- Financial Risk Default Buffer Pool Contribution 1%

Management Risk: Management failure is the risk of management activities that directly or indirectly could lead to a reversal. Forest projects that occur on public lands or employ a Qualified Conservation Easement are exempt from this risk category. There are three categories of management risk: illegal logging, conversion to an alternative use, and over-harvesting. The Mescalero Apache Tribe Forest Carbon Project is within the United States, thus the default illegal harvesting risk of 0% is used.

The risk of conversion is assigned a default buffer pool rating of 2% since the project area is not covered by a Qualified Conservation Easement.

The risk that the project might over-harvest as a result of high timber prices or due to fuel treatments is estimated to be the same as the default U.S. rate and is assigned a buffer pool contribution of 2%.

Default Illegal Harvesting (U.S) Buffer Pool Contribution	0%
Default Conversion to Alternative Land Use Buffer Pool Cont.	2%
Default Over Harvesting Buffer Pool Contribution	2%

Social Risk: Social risks exist due to changing government policies, regulations, and general economic conditions. The risks of social or political actions leading to reversals are low, but could be significant.

The social risk for the project is identified as 2% since the project is within the United States.

United States Default Social Risk Buffer Pool Contribution 2%

Natural disturbances can pose a significant risk to the permanence of the GHG reductions and GHG removal enhancements. Natural disturbance risks are only partially controllable by management activities. Management activities that improve resiliency to wildfire, insects, and disease can reduce these risks. Management activities that shift harvesting practices from live sequestering trees to trees that have succumbed to natural disturbances reduce or negate the reversal depending on the size and location of the disturbance.

Natural Disturbance Risk I – Wildfire: A wildfire has the potential to cause significant reversals, especially in certain carbon pools. These risks can be reduced by certain techniques including reducing surface fuel loads, removing ladder fuels, adding fuel breaks, and reducing stand density. However, these techniques cannot reduce emission risk to zero because all landowners will not undertake fuel treatments, nor can they prevent wildfire from occurring.

Within the Project Area a high level of fuel treatment has not been completed; thus the default wildfire risk of 4% is used. The resulting wildfire risk buffer pool contribution due to the low level of fuel treatment is calculated as

Wildfire Risk Buffer Pool Contribution (as described above) 4%

Natural Disturbance Risk II: A disease or insect outbreak has the potential to cause a reversal, especially in certain carbon pools. The default assigned risk rating for disease or insect outbreak is 3%.

Default Insect and Disease Outbreak Buffer Pool Contribution 3%

Natural Disturbance Risk III: A major windthrow event (hurricane, tornado, high wind event) has the potential to cause a reversal, especially in certain carbon pools. The default risk contribution from other catastrophic events is 3%.

Default Other Catastrophic Events Buffer Pool Contribution 3%

8-B. Summarizing the Risk Analysis and Calculating the Project Reversal Risk Rating

(Forest Offset Protocol §7.2.2, §9.1.1.1(27), Appendix D.5)

Table 234 below summarizes the assigned risk analysis by category for the project.

Table 23. Project Contribution to the Buffer Account Based on Risk

Risk Category	Contribution from Risk Descriptions Above	
	Source	**Forest Project without a Qualified Conservation Easement and/or Public Ownership**
Financial Failure	Default Risk	1%
Illegal Forest Biomass Removal	Default Risk	0%
Conversion	Default Risk	2%

Over-harvesting	Default Risk	2%
Social	Default Risk	2%
Wildfire	Default Risk	4%
Disease or Insect Outbreak	Default Risk	3%
Other Catastrophic Events	Default Risk	3%
Overall Contribution Based on Appendix D.5 Calculation		15.8%

Overall Contribution to Buffer Pool is 15.8% as calculated per the equation in the Forest Offset Protocol, Appendix D.5, and as shown below:

100% - ((1-1%) x (1-0%) x (1-2%) x (1-2%) x (1-2%) x (1-4%) x (1-3%) x (1-3%)) = 15.8%.

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Photographs: T. Robards, J. Salm, and E. Warms.

10. EXHIBIT I: GREENHOUSE GAS (GHG) ASSESSMENT BOUNDARIES CARBON POOLS/SOURCES THAT MUST BE ACCOUNTED FOR IN QUANTIFYING PROJECT REDUCTIONS AND REMOVALS

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
Primary Effect Sources, Sinks, and Reservoirs			
IFM-1 Standing Live Carbon (living trees)	Included	Included	Mandatory pool for measurement – Baseline modeled using initial field inventory measurements; Project measured by field measurements and updating forest carbon inventory.
IFM-2 Shrubs and Herbaceous Understory	Excluded	Excluded	NA
IFM-3 Standing dead carbon (carbon in all portions of dead, standing trees)	Included	Included	Mandatory pool for measurement – Baseline modeled using initial field inventory measurements; Project measured by updating forest carbon inventory.
IFM-4 Lying dead wood carbon	Excluded	Excluded	NA
IFM-5 Litter and duff carbon (carbon in dead plant material)	Excluded	Excluded	NA
IFM-6 Soil Carbon	Included/ Excluded	Excluded	It is not necessary to quantify soil carbon in this project in accordance with the Protocol, as deep ripping, furrowing, plowing, soil disturbance exceeding 25% of the project area and mechanical site preparation not on contour will not be permitted on the project area.

10. EXHIBIT I: GREENHOUSE GAS (GHG) ASSESSMENT BOUNDARIES CARBON POOLS/SOURCES THAT MUST BE ACCOUNTED FOR IN QUANTIFYING PROJECT REDUCTIONS AND REMOVALS

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
IFM-7 Carbon in in-use forest products	Included	Included	Baseline estimated from modeled harvesting volumes. Project estimated from measured harvest volumes.
IFM-8 Forest product carbon in landfills	Included or Excluded	Included	Excluded when project harvesting exceeds baseline. Included when project harvesting is below baseline. Baseline estimated from modeled harvesting volumes. Project estimated from measured harvest volumes.
Secondary Effect Sources, Sinks, and Reservoirs			
IFM-9 Biological Emissions from site preparation activities	Included	Included	Biological emissions from site preparation activities are not quantified separately, but rather are captured by measuring changes in included carbon reservoirs.
IFM-10 Mobil combustion emissions from site preparation activities	Excluded	Excluded	N/A
IFM-11 Mobile combustion emission from ongoing project operation and maintenance	Excluded	Excluded	N/A
IFM-12 Stationary combustion emissions from ongoing	Excluded	Excluded	N/A

10. EXHIBIT I: GREENHOUSE GAS (GHG) ASSESSMENT BOUNDARIES CARBON POOLS/SOURCES THAT MUST BE ACCOUNTED FOR IN QUANTIFYING PROJECT REDUCTIONS AND REMOVALS

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
project operation and maintenance			
IFM-13 Biological emissions from clearing of forestland outside of the Project Area	Excluded	Excluded	N/A
IFM-14 Biological emission/ removals from changes in harvesting on forestland outside the project area.	Included/ Excluded	Included	Not estimated for baseline. Estimated for project by using a default 20% "leakage" factor applied to the difference in harvest volume relative to baseline.
IFM-15 Combustion emissions from production, transportation, and disposal of forest products	Excluded	Excluded	N/A
IFM-16 Combustion emission from production, transportation, and disposal of alternative	Excluded	Excluded	N/A

10. EXHIBIT I: GREENHOUSE GAS (GHG) ASSESSMENT BOUNDARIES CARBON POOLS/SOURCES THAT MUST BE ACCOUNTED FOR IN QUANTIFYING PROJECT REDUCTIONS AND REMOVALS

Carbon Pool or Source (Forest Offset Protocol, §5.2)	Included or Optional (Forest Offset Protocol, §5.2)	Included in this project?	Justification/Quantification Method
materials to forest products			
IFM-17 Biological emissions from decomposition of forest products	Included	Included	For baseline, quantified as a component of calculating carbon stored for 100 years in wood products (SSR #IFM-7) and landfills (SSR #IFM-8) For project, quantified as a component of calculating carbon stored for 100 years in wood products (SSR #IFM-7) and landfills (SSR #IFM-8)