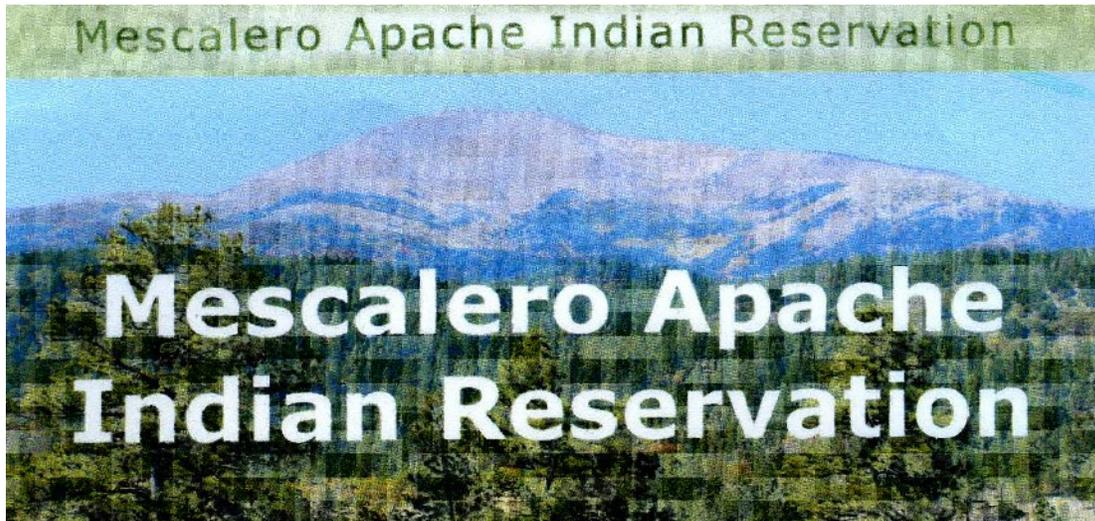


The Peoples' Forest: Emerging Strategies on the Mescalero Apache Forest Reserves¹

By Linda Moon Stumpff²



ABSTRACT

This case raises questions about how American Indian Tribes reshape the care of forests on Indian lands by coordinating science-based forestry methodology and traditional ecological knowledge to meet their goals. Working the case, students are challenged to look for ways that the Mescalero Apache Indian Tribe, its membership, and its partners can reach beyond seemingly conflicting economic and restoration goals to apply forestry science and traditional ecological knowledge in restoration efforts. Can forestry science's existing predictive formulae be used to achieve tribal goals, or will new scientific research need to coordinate with traditional ecological knowledge to achieve these goals? Prescribed fire and thinning are important tools for meeting today's challenging conditions, intensified by drought and climate change. Within the context of the case, natural resource activities are connected to legal, scientific, cultural, economic,

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and policy considerations. Currently decisions are made to achieve cultural and ecological restoration in a perfect storm of high fire danger, climate change, global economics and lowered timber harvests.

INTRODUCTION

Interdependent goals drive change and adaptation in a time when climate change, fire threat, and changing funding inputs challenge the Mescalero Apache Indian Tribe's (MAIT) desire to restore their forest reserves while maintaining tribal ownership and keeping natural resource jobs for tribal members. These forest reserves include mixed conifer and ponderosa-dominant zones: aspens, pinyon-juniper woodlands and oaks added to the diversity at different elevations. These forests were typically more open than those of the Northwest, without the extremely tall fast-growing species of the rain-dependent temperate rainforests. Recently, the Mescalero Integrated Natural Resource Management Plan (IRMP) identified three major goals for forestry on the nearly half-million acre Mescalero Apache Indian Reservation (MAIR) located in southeastern New Mexico. First on the agenda was the need to identify broad and specific natural resource strategies through "scientific collaborations that honor the traditional Apache system of communicating needs through tribal leaders specialized in specific areas." (IRMP, 2005, p7) Second, the forest reserves should be re-inventoried and the goals of the forestry program should be reassessed to assure that management practices are best serving the Tribe. Third, increased communication about forestry science and management with the Tribal Council, the tribal public and partners is needed. All three of these actions are important in creating the basis for collaboration. These interdependent goals require a balancing act in a changing economic and ecological environment.

Tribal History-Forest History

Native peoples protect forest reserves and the watersheds as critical natural and cultural resources. For more than 400 years, the Apache people faced threats to their lands, culture, and economy. High mobility was essential for hunting, gathering, and trading activities and for the protection of their lands and people. By the seventeenth century, the Spanish intruded into the lucrative trade between the Pueblos, Apaches and other Tribes of the southwestern region. The Mescalero Apache people moved between Colorado and Utah on the north and south to the Mexican provinces of Sonora, to Chihuahua, and to the Mexican coast, creating a large province for trade and mobility. Pressure from Spanish colonization and the entrance of other Tribes forced from their original lands by the westward movement factored into the first round of threats. By the eighteenth century, raiding and competition for land increased, resulting in population movements and disruption of traditional relationships and landscapes. Though the Spanish, and later the Mexicans, signed treaties with the Mescalero, the changing relationships often destabilized the bands and resulted in genocidal policies like the scalp bounty in the states of Sonoma and Chihuahua (Mescalero Timber Trust (hereafter MTT, 1981, p.13). These policies led to conflicts between U.S. trappers and traders who attempted to collect the Apache scalp bounty. The Apaches responded with attacks as treaties came apart.

Attempts to incarcerate them and add further restrictions to mobility limited their ability to utilize the traditional land base.

The 1855 Treaty was never ratified, but the Executive Order of 1873 recognized the Mescalero Reservation with the core areas of traditional territory, including major forest reserves. In 1909, Theodore Roosevelt attempted to withdraw forested lands from the MAIR to create the Alamo National Forest. In his last days of office, he signed a proclamation transferring 2.5 million acres of forested Indian lands, including portions of the MAIR, from all over the United States to the National Forest system. When the Forest Service attempted to create an authority to sell timber on these lands, the United States Department of Agriculture's (USDA's) Solicitor and the Attorney General of the United States both confirmed that no such authority existed any more than a Presidential authority ever existed to transfer the lands in the first place. The order did not hold, so the Mescalero lands were restored to the Tribe in 1912. Still, the threat of the loss of the management of almost all of their forested lands must have been jarring to the Tribe as yet another potential threat to their forests.

At Mescalero, forest preservation was given as the reason for not opening the reservation to settlers who were non-tribal members from outside the reservation. (MTT, 1981, p.29). As a result, the Dawes Act of 1887 that fragmented many reservations in the Northwest into a mosaic of private property holdings was never implemented at Mescalero. Forestry history on the MAIR contrasts with the harvest regime on Northwest Indian lands, where large timber cuts and contracts occurred early on, even before laws authorizing the sale of permits on Indian lands. This may be in part due to the greater timber value of the larger Northwest forests, ease of transport via rivers and the ocean, and perhaps a local federal management regime that re-interpreted the tribal trust as a public trust for the Northwest region.

One stark fact stood out in both cases—the trust was interpreted largely in economic terms, with objectives dictated by the federal government. J. P. Kinney, a key player in the development of Indian forestry in the Bureau of Indian Affairs (BIA) wrote to the Agent at Mescalero in 1910 that “Indian timber lands should be so managed as to afford constant revenue which can be used for the benefit of all Indians.” (MTT, 1981, Kinney, p.41) The trust responsibility for Mescalero forest reserves rested with the U.S. Indian agents: they held the reins of governance over the forest reserves. Logs and timber essential for building the structures was needed to implement government activities, to provide housing both for government employees and tribal members, and to support acculturation objectives by creating a farming economy and housing settlements. Early reports from the Indian agents and superintendents do not discuss the fire threat, prescribed burning or insect infestations, but they do record problems due to drought. It appears that the connection between drought and fire was not made by government managers of the time. Yet the agents were often unable to get funds for fuels management, brush disposal, and fire protection to protect forest reserves (Henderson, 1989, p.88).

Mescalero forests continued to receive closer monitoring by the BIA than other tribal forests because forest protection was in the interests of the local conservation and tourism industries. (MTT, 1981, p.60) Forest protection was buttressed by the growing tourist industry. Private local interests protested timber sales and other natural resource actions, keeping up their efforts over time. At one point around 1914, a movement existed to turn the entire Reservation into a national park. Although that didn't happen, strict forest conservation practices went into practice. Three hundred foot stream boundaries, selective harvesting, and other restrictions went into effect. In order to protect trails and recreation areas, trees, and other natural resources, contracts included more restrictions. And while the Mescalero forests avoided pillaging, over time the stock of large trees preferred by the market went down due to logging, fire, drought, disease, related environmental impacts, and new environmental impacts and restriction. Fire suppression combined with restrictions may have contributed to fire danger. Yet, during slower economic activity, Mescalero avoided an increase in larger, poorly managed timber-harvest operations conducted in the Northwest by external companies to make up the difference.

The self-determination policies of the 1970's opened the way to more intensive forest management at Mescalero. (Henderson, 1989, p. 176) The Tribe pressed the BIA to manage intensively and protect reserves. There were lawsuits in the 1970's, the first one alleging failure to adjust stumpage rates. The Tribe also sued the BIA for inadequate management and planning of forest resource development. (Henderson, 1989, p. 179) The South Block Sale Fire resulted in a suit because of fire resulting from a waste burner malfunction by the contractor and the sale was terminated in 1978. (Henderson, 1989, p.177) Between the years 1970-1980, only one timber contract and one salvage contract occurred. During this time, the Tribe began to work on forest and natural resource management through its own departments. In 1987 a tribally owned sawmill purchased cheaper national forest logs, saving tribal timber reserves for later and a chance at better markets.

In the 1980s, strong tribal leadership put the MAIR in a good position for economic development while actions to preserve culture and carve out a strategic role in the future use of resources were taken. Tourism increased and in 1987 a resort was constructed that served the needs of large numbers of hunters and tourists in the region. In addition, the development of Ski Apache with a permit to utilize Forest Service lands for skiing and other outdoor recreation activities expanded the Tribe's recreation program. This was big-dollar tourism: construction of the new, larger high-end Inn of the Mountain Gods located on beautiful tribal lands followed. The recreational capacity of the nearby town of Ruidoso grew, with tourist activities ranging from horse-racing to skiing. Today, the Ski Apache ski area remains dependent upon yearly snowfall which can be highly variable. Managed well, tourism uses a limited amount of space and produces high returns. The Tribe initiated gaming and a new art gallery with Apache artists. Both difficulties and solutions emerged when the federal system, with its regulated prescriptions and restricted budget allocations for projects meshed with tribal objectives and adaptive policy evolutions. Nevertheless in less than 40 years, the Tribe became the largest employer in Lincoln County and the second largest employer in Otero County

after Holloman Air Force Base (BIA Environmental Assessment (hereafter BIA, EA), 2001 p. 2 This draft EA was prepared and written by MAIT Natural Resources Director Thora Padilla). Major business enterprises include Ski Apache, Mescalero Forest Products, a big-game hunting concession, and the major destination resort-casino complex including a golf course, all located in the heartland of the Peoples' traditional homelands.

In the long count of years, the mountains and the forest reserves played an important role in culture. The story of the Mountain Spirits, key to Apache belief systems and values, originated during times of hardship in the life and culture of the Mescalero Apache people and brought protection and strength. (BIA, EA, 2001, p. 3) For example, Sierra Blanca is a sacred mountain considered to be a home to the Mountain Spirits. For this reason, forest reserves on Sierra Blanca are no longer included in tribal timber harvest. Natural and cultural resource values color all phases of the process of working with the forest reserves, from the values that lay behind goal-setting, to the development of the scientific questions, to the selection of method, and finally to the interpretation of results. There is a great opportunity to inform applied forest practices in this context with traditional ecological knowledge.

The Forest Trust Evolves: Forestry Science and Silvicultural Prescriptions

The Indian Self Determination and Education Assistance Act of 1975 established a system called "638 contracting" that allowed Tribes to take over operations formerly conducted by the BIA. However, the types of operations and budgets were still limited by the federal bureaucratic structure of categories and budget lines. These regulations constrict funding to specific types of silvicultural prescriptions and restoration projects that apply forestry science to tribal forest reserves. For example, federal funding was available for restoration only in areas where timber harvest was conducted, leaving out important woodlands areas with key cultural importance.

The BIA continues to play multiple roles in tribal forestry, since they implement the Sustained Yield Program through Title 25CFR Sect. 15311, 1995 with responsibility for forest inventory, timber permits, identification and investigation of forest disease and insect infestation, research, development of silvicultural prescriptions, management of fire prevention and pre-suppression activities. Forest management policies include "supporting self-sustaining communities, value-added industries, and tribal jobs and labor." (Indian Forest Management Handbook, 53 IAM-H, 2004, p.5) Through its activities, BIA Forestry must try to satisfy the aspirations of the Mescalero Apache Indian Tribe. Law ties the BIA to general practices and sustained yield goals founded on forestry science that may or may not make it easy to satisfy the tribal objectives and visions that self-determination implies. The BIA must also try to achieve the retention of Indian land in its natural state, while an Indian Tribe determines the recreational, aesthetic, cultural, and traditional values of the Indian forest reserves that represent the highest and best use of the land. Multiple missions combined with unstable markets for timber and limited funding resulting in uneven harvest activities over time. The chart below demonstrates the widely varying range of timber volumes from year to year.

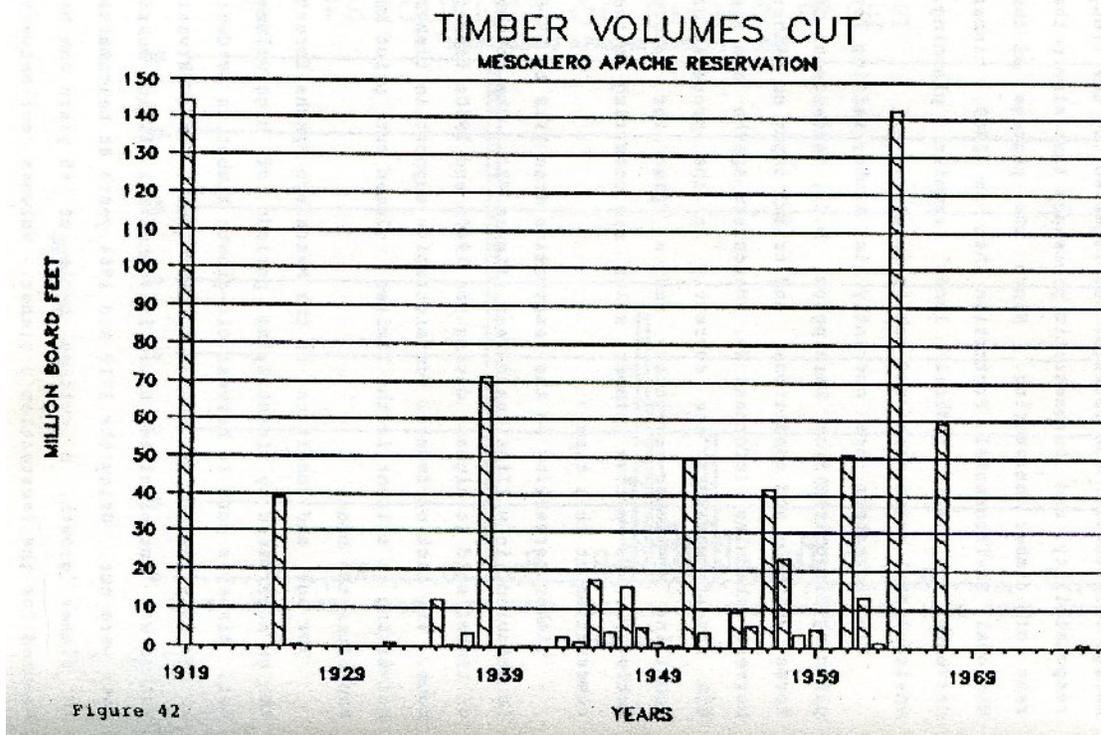


Figure 42
Timber chart showing annual timber volume. (Henderson, 1989)

In addition to the regulation of timber operations and sales, the BIA has a specific set of silvicultural prescriptions that apply to sustainable forest management. Bill Hornsby of BIA Forestry at Mescalero describes silviculture:

Silviculture is defined as the art and science of controlling the establishment, growth, composition, health and quality of forest and woodlands. This entails the manipulation of forest and woodland vegetation in stands and on landscapes to meet the diverse needs and values of landowners and society on a sustainable basis. A silvicultural prescription is a descriptive narrative of the selected silvicultural treatment including slash treatment, reforestation needs, site preparation, harvesting restrictions, and recommended harvesting methods and any other multiple resource concerns or directives. It also includes a schedule for future treatments. A prescription is required for all treatments that will affect the present and/or long-term character of a forest stand. (Hornsby, 2001)

However, there are no prescriptions for cultural uses that would ensure access to forest materials for such uses. Tribal members express a strong interest in being able to obtain teepee poles for various cultural uses and ceremonies. To achieve this, experimentation and adaptation means new practices like going into logging units to get teepee poles first, finding ways to identify areas that people don't have to go so far for them, setting standards for poles and how they are measured, collecting data to understand the

conditions under which they grow best, and looking to the future supply in 20 years with an eye to what kind of cyclic thinning would be appropriate while reducing fire threats. To formulate the required silvicultural prescription, forestry practices will need to adapt management to local traditional ecological knowledge about poles. Traditional knowledge emerges from an integrated body of knowledge, tested through practice, and connected to belief systems that is handed down through the generations through cultural ceremonies, practices, and oral transmission that connect humans with their environment. Forestry workers confirmed that if, as traditional knowledge suggested, too much sunlight makes teepee poles short and fat and logging lets too much sunlight in, some prescription for selective logging adapted to teepee pole growth should be forthcoming. It is also said that the northern aspect grows thinner poles than southern aspect. (BIA, EA, 2001, p. 18) Forestry workers echoed the need to reach a cultural understanding of how tee-pee poles are to be managed.

Foresters map pole stands, but these may not be the stands that residents want to use. Stands with teepee pole material are dynamic and eventually they grow too large for the desired size range for poles. Local community knowledge has a shorter timescale than traditional ecological knowledge. Local community knowledge is held by people who may or may not have indigenous origins to the area, but have made observations within their lifetime or have passed information down through several generations of family or other resources users in the area.. Knowledge of the location of poles of the right size and the timing for taking them is an example of local community knowledge. Knowledge of the long-term management practices to maintain stands of teepee poles of the kind that are needed for cultural purposes is an example of traditional ecological knowledge which is often the product of hundreds of years. Both kinds of knowledge are needed to create an appropriate prescription for managing the forest for teepee poles.

Tree thinning is one big priority and it will be important to see how this can be articulated with the teepee pole issue to minimize goal conflict. Prescribed burning presents similar problems to the teepee pole issue. Concern for significant big trees is also present and there is concern about how big trees used as markers and trails guides, but which were now being removed during logging. Tribal employees recommended monthly interdepartmental meetings to discuss timber harvest, assure a clear chain of command, identification of responsibilities, and also the need for mapping and communicating with the Tribal Council.

The Trust Evolves: Policy and Politics

The Department of the Interior's responsibility for tribal forest reserves evolved with pressure from Indian Tribes. The determination of the Mescalero tribal membership and the ability of tribal leaders like the nationally known Mescalero Tribal Chairman Wendell Chino to politically position the MAIT in Washington, D.C. added another dimension to understanding why these forest reserves avoided the level of damage sustained by other tribal reserves. Chino's close ties with the Nixon administration and his political influence in the 1970's and 1980's when self-determination policies were developing brought funding and projects to Mescalero. Projects like the Inn of the Mountain Gods as

a recreation and tourism development put the spotlight on conserving natural resources. Sweeping clearcuts did not occur and massive reforestation would not be necessary. Instead, the realignment of goals and practices around tribal objectives framed the challenge. Droughts and fire suppression created a new set of problems, now exacerbated by climate change. Traditional ecological knowledge provides guidance in making appropriate responses to such changes. Forests in the adjoining Lincoln National Forest, lands lost to the Apache people in the wars, now pose an additional fire threat. New programs, such as the Stewardship Contract with the USDA Forest Service, reassert management authority and work to restore adjacent forest lands to a more responsive, safer and traditional fire regime.

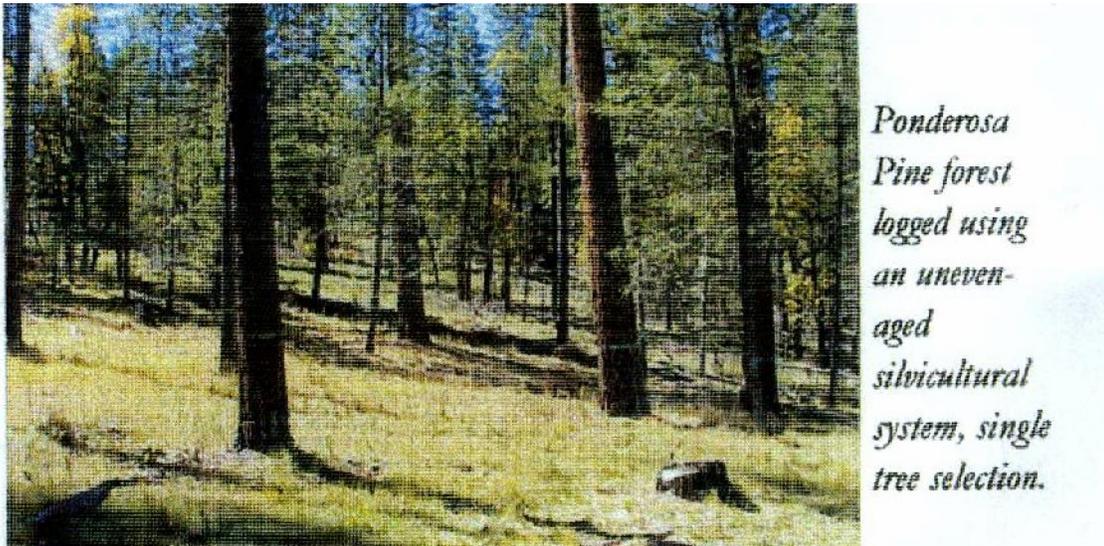
After self-determination policies were put in place on a continuing basis after 1975, much of the planning and implementation work shifted to the Tribe in the form of 638 contracts. These contracted functions are now delegated to the Mescalero Tribal Division of Natural Resources and Protection. This unit of tribal government has around 60 employees, plus 20-45 seasonal staff that accomplish forestry goals cooperatively with the BIA Branch of Forestry's approximately 45 employees. The latter may swell to 200-400 employees in fire season, depending on the severity of conditions. In addition to funds contracted from the BIA, the Tribe can receive funds from other federal agencies such as the Environmental Protection Agency (EPA), USDA Forest Service, and US Fish and Wildlife Service. The Tribe can receive funds from state, nonprofit, or private foundations or research organizations to conduct additional operations. This last option allows the Tribe to work in unfunded areas and to innovate in restoration and special watershed project activities.

Mescalero Today

Today, the 460,578 acre Mescalero Apache Indian Reservation is located in south-central New Mexico in the Sacramento Mountain Range. It borders Lincoln National Forest on the north and south and public and private lands to the east and west. The MAIR holds around 150,000 acres of forest reserves and extensive woodlands. The main transportation corridor is U.S. Highway 70. Sierra Blanca, a mountain sacred to the Mescalero Apache radiates like a jewel in the necklace of tribal culture, yet it sits near the edge of the Reservation boundary and extends into the adjacent National Forest. A ski basin is located on the mountain, operated by the Tribe through a USDA Forest Service permit. The Tribe's socio-economic web weaves together the forest reserves, with a first class resort-casino ringed by forest trust lands and a generous watershed that feeds a beautiful lake, golf course, and hunting and fishing opportunities.

Federal policies and prescriptions are being adapted to meet tribal goals: the days of adapting tribal needs to federal policies have faded into the past. Today, conditions are constantly changing. Forestry science drives forestry practices on these lands, while traditional ecological knowledge is the basis for setting out a strategy to meet cultural objectives. Assumptions and objectives of the two ways of knowing may differ, yet at Mescalero it seems possible to find ways to integrate both into future forest management. The Tribe uses planning activities to elicit public opinion from tribal members. By 2007,

timber prices were down and lesser numbers of large-diameter logs were available due to various environmental factors and current environmental restrictions. This reduced the income stream from the forest, while expensive treatments are needed to restore the forests and protect them from threats. (BIA Forestry interview, Davis, John, 2007) At the same time, the lessening income stream from timber fees affects the ability to support these activities.



BIA brochure

FIRE, FUELS AND FORESTS—FORESTRY’S PERFECT STORM

By 1995, the Federal Wildland Management Policy and Program Review recognized the unhealthy conditions on public lands which may cause unplanned wildfires. In 1992, MAIT included more prescribed burning in forested areas and promoted the use of fire for hazard reduction in recreation areas and around residences. While planned timber harvest of smaller timber contributes to thinning treatments that improve forest health, economics and access limit positive results “in the worst timber market since 1938.” (BIA Forestry interview, Davis, John 2008) In the oak woodlands, habitat enhancement is desirable for many important cultural uses and traditional food sources. Pinyon-juniper tree zones are becoming dense and they overtake grasslands where no treatments occur. Meanwhile, federal restoration funds apply only to areas under timber harvest.



PHOTO: completed pinyon thinning project reduces fire hazards. BIA brochure

THE SCIENCE OF FOREST MANAGEMENT

Professional standards applied by the BIA outline the current management regime that calls for uneven aged management for all stands meeting appropriate silvicultural criteria, with the aim of managing sustainable and healthy reserves. Plans are adapted to deal with federally-listed threatened and endangered species like the Mexican spotted owl, bald eagle and four plant species. The Tribe implemented its Mexican spotted owl plan four years before the federal listing under the Endangered Species Act.

Resolving fuels reduction needs with limited funding and silvicultural prescriptions that may not be a direct fit to the Tribe's current goals means that they must look for non-governmental partners. The Natural Resources Department initiated a project with the, Northern Arizona University's Environmental Institute to try to resolve this by completing a thinning project to meet restoration goals. (Interview with Thora Padilla, 2007) They did not use the standard thinning prescription, but they designed a project to meet tribally identified needs to restore the forest to a more open canopy with a greater variety of plants.

Wood pellet processing using waste material from mechanical thinning in fuel hazard projects provides another alternative for making use of smaller trees after thinning. Demand still exists for larger diameter trees from the mill processing beams, posts and 4X4s for trade with Mexico, but forest health is better served by processing small diameter material. Direct contracting, with no stumpage fees, may be another way to encourage contractors to remove fuels. Fuels management funding subsidized a small mill through the National Fire Plan fuel hazard budget that comingled funds to allow removal of some small diameter trees. The Tribe owns two saw mills. Located off the reservation in Alamogordo, one mill processes small diameter logs. The other mill,

located on the reservation, is set up for larger logs and employs tribal members. At the end of the day, the Tribal Council reviews forestry alternatives and must decide how to adjust them to meet various social, cultural and natural resource goals. As the following table indicates, the land holdings are complex and diverse.

MAIR LAND CATEGORIES

UNIT	Forest/landscape	Major uses	Plants, wildlife, special features
White Mountain 80,016 acres	Diverse: 75% forested: half in woodland cover	Cultural-religious Aesthetic, recreation Resort/Casino (Limited Use Areas: 68.889 acres)	Sierra Blanca (cultural) Peregrine, Mexican Spotted Owl, northern goshawk, eagle, Sac. Salamander, Sac. prickly poppy, Gooding's onion
Carrizo	97% forested conifer ponderosa	Most available to forestry Housing, business/industrial/recreational Limited use areas 14, 881	Bald eagle, northern goshawk, Mex. Spotted Owl, Sac. Mt. Salamander
Tularosa 78,292	96% forested mixed conifer 25% hardwood/brush Pinyon/juniper	Recreation-hunting, fishing Drinking water Good road access	Cult species: cattails, trees for teepee poles, brush for arbors Northern goshawk, Mexican Spotted Owl, bald eagle, Sacramento Mountain Salamander, Sacramento Mountains. thistle, Todsens' pennyroyal
Pine tree 129,601	86% forested--46% woodland cover, the rest ponderosa Rolling hills/meadows	Big-game hunting Livestock grazing	Springs Wildlife corridors Bald eagle, goshawk, Mexican spotted owl, hedgehog cactus

Elk Management 62,039	93% forested: most mixed conifer, ponderosa 10% woodland	Recreation Limited Use 339 acres.. Big game, fishing, summer cattle- grazing, fuel wood	Bald eagle, hedghehog cactus
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Chart derived from BIA, EA, 2005

The Austrian Formula is the current method used to calculate the annual allowable harvest for the uneven aged forest strata by professional forest managers in the BIA. Though equations are likely to give accurate results, they work best when inventories are accurate and updated and they should include trees and plants for cultural use. This equation is designed to show how the annual volume adjustment converts an existing stand to a target stand over a period of time. A target stand in this case is a section of forest that has the desired mix of trees by species, ages, and class that meets the objectives of Sustained Yield while conserving the forest for multiple tribal objectives. (See Appendix I)

The Austrian formula uses “per acre” growth and volume data. (Bettinger, P., Siry, J., Boston, K., and Grebner, D.L. 2008, p. 217) The equation is generally accepted and the means of assessing available timber harvest levels. To get the result, the allowable annual cut (AAC) yielded by the formula is multiplied by the commercial forest acreage to determine the total volume of the AAC. By placing values from inventory and assessment data in the equation, an approximation of the AAC can be calculated. (Timberland Inventory p.1, BIA). The format for the equation for the Austrian equation, for the Austrian Formula can be illustrated as follows:

$$AAC+ = (I + \frac{V_{meas.} - V_{pred.}}{n})$$

Foresters develop alternatives by manipulating the number of acres in the equation. These are called “withdrawals”—in other words, removing a stated number of acres. Withdrawals can be made to provide for threatened and endangered species, and for ecological and cultural purposes. By substituting the reduced number of acres in the equation, they can calculate an adjusted AAC.

Besides the Austrian formula, other equations measuring forest growth, adding dynamic factors, predicting specific outcomes such as favoring one type of forest cover over another exist and are an important part of forestry research and science. (Bettinger, P., Siry, J., Boston, K and. Grebner, D.L. 2008)

THE CURRENT STATE OF FOREST HEALTH

Although the forest reserves of the MAIT are in better condition than many other tribal trust lands, they share some major ongoing problems of forest health that are likely to increase with drought and climate change. Some practices like thinning younger trees and prescribed burning enhance forest health, but they are expensive to carry out and they exceed the returns from the current economic market for wood. While dwarf mistletoe and pine bark beetle infestations increase on forested lands, the lack of a market for smaller pole logs hampers treatment.

The forests now have more dense stands of smaller trees. A contributing factor to the build-up of smaller trees that lack commercial value is the exclusion of fire from the ecosystem. Smaller logs left from pre-commercial thinning increase the already high fire risk, and the Tribe has concerns about waste, negative visual impacts, and conflicts with grazing and wildlife. The Tribe's sawmill in Alamogordo can handle the smaller logs, but tribal members don't work there, so it doesn't contribute to the Tribe's employment goals. Tribal members do work in the mill on the reservation that is outfitted for large diameter logs which are in shorter supply now due to a variety of factors including current tribal goals, restrictions, and removals due to wildlife and cultural concerns, and environmental planning that now reflects tribal goals and cultural concerns.. Starting up pulpwood sales helped to meet resource objectives, but a fading market ended the effort. Besides the build-up of small trees, fire suppression leads to other unintended consequences like loss of habitat, higher stem density, species decline, and loss of access to fire-dependent plants for cultural uses.

Scientific management itself affects the environment. Adaptation occurs with new technology, but cultures may find ways to absorb or assimilate knowledge and technology in ways that do not change the core of cultural relationships to the environment. How this might be accomplished leaves much room for creative and thoughtful action.

APPENDIX I: A. FOREST MANAGEMENT

Forest Management on the Mescalero Apache Reservation: A Powerpoint Presentation
By Bill Hornsby,³ Bureau of Indian Affairs Mescalero Agency
New Mexico Watershed Management, Restoration, Utilization and Protection (2001)
New Mexico Water Resources Research Institute.
<http://wrri.nmsu.edu/publish/watcon/proc46/Hornsby.pdf>

Section on Timber Management

Approximately 85% of the reservation is forested with 150,000 acres considered commercial forest. The commercial forest is managed on a 20-year cutting cycle with about 7,500 acres receiving treatment each year at an average harvest volume of 2,240 bdf/acre. A document called a Forest Officer's Report is prepared for each timber sale on the reservation. This report contains all the accumulate information about the timber sale including sale objectives, a description of the sale area and resource considerations, silvicultural prescriptions, transportation plan, volume estimate and stumpage appraisal, environmental assessment and associated NEPA documentation, wildlife and biological assessment, threatened and endangered species clearance and cultural resource survey reports.

Silviculture

Silviculture is defined as "the art and science of controlling the establishment, growth, composition, health and quality of forest and woodlands." This entails the manipulation of forest and woodland vegetation in stands and on landscapes to meet the diverse needs and values of landowners and society on a sustainable basis.

A silvicultural prescription is a descriptive narrative of he selected silvicultural treatment including slash treatment, reforestation needs, sit preparation, harvesting restrictions, and recommended harvesting methods and any other multiple resource concerns or directives. It also includes a schedule for future treatment. A prescription is required for all treatments that will affect the present and/or long-term character of a forest stand.

Silvicultural prescriptions are based on the best utilization of the existing stand conditions given the core objectives of the Mescalero Apache Tribe. Core objectives include:

- Minimize insect and disease damage.
- Where possible, manage stands to achieve desirable un-even age structures
- Improve the stocking, composition, and growth of young stands.
- Reserve some old growth trees throughout the forest.

³ Bill Hornsby is a forester with the Bureau of Indian Affairs, Branch of Forestry on the Mescalero Apache Reservation. He has worked for BIA for 15 years both at Mescalero and the Yakama Reservation in Washington. He graduated from West Virginia University in 1982 with a Bachelor of Science in Forestry and received his certification as a Silviculturist in 1996. The basic function of his position at Mescalero is to "help the Mescalero Apache Tribe manage its timber resources."

- Maintain an aesthetically pleasing forest that will (ensure) Forest Management on the Mescalero Apache Reservation yield(s) the desired level of forest products and produce/retain wildlife recreation, visual, range and water qualities.
- Use harvest techniques that will achieve maximum utilization of forest products
- Develop or maintain specific forested areas for traditional, religious and cultural forest values.

Silvicultural Systems

A silvicultural system is a planned process whereby a stand is tended, harvested, and re-established. The system name is based on the number of age classes (Even-aged, or Uneven-aged), and/or the regeneration method used (Shelterwood, Single Tree Selection, etc). A silvicultural system includes all treatments on a given stand over a long period of time. There are two types of silvicultural systems:

- Un-even-aged Systems- A Planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes.
- Even aged Systems. A planned sequence of treatments designed to maintain and regenerate a stand with one age class. The range of tree ages is usually less than 20% of the age of the tree at harvest.

All silvicultural treatments or cutting methods fit into two categories—Regeneration or Intermediate. The Regeneration Method is a cutting method by which a new age class is created. The establishment of regeneration is one of the main objectives for all regeneration cutting methods. The Intermediate Method is a cutting method designed to enhance growth, quality, vigor and composition of a stand after the establishment of regeneration and prior to final harvest.

Regeneration Method

There are two types of Regeneration Methods—Uneven aged and Even-aged. The even-aged regeneration methods are described as a “method of regenerating a forest stand an maintaining an uneven-aged structure by removing some trees in all classes either singly, in small groups, or in strips.” Even-aged regeneration methods are defined as “a method of regenerating a forest stand where the new stand contains only one age class.”

Un-even Aged Regeneration Methods.

There are two types or uneven-aged regeneration methods, single tree selection, and group selection. On the reservation, single tree selection is used much more frequently than group selection at this time. Single-tree selection is described as “a cutting method where individual trees of all size classes are removed more-or-less uniformly throughout the stand to achieve desired stand structural characteristics: “Establishment of a new cohort is an objective of this cutting method.”

Even-aged Regeneration Methods

There are basically three even-aged Regeneration Methods: the clear-cut cutting method, the shelterwood cutting method and the seed tree cutting method. While each of these

three cutting methods are different, they all are intended to be a way of regenerating a forest where the new stand contains only one age class.

Clear-cut Cutting Method

This Even-aged regeneration method is defined as “a method of regenerating an Even-aged stand in which the new age class develops in a fully-exposed microclimate after removal, in a single cutting, of all trees in the previous stand.” On the reservation, clear-cuts are most often implemented in areas where dwarf mistletoe infection levels are so severe that use of an Uneven-aged Regeneration Method is not feasible. The clear-cut with reserves variation of the traditional clear-cut cutting method is commonly used on the reservation. With this method, varying numbers of reserve trees are not harvested in order to attain goals other than regeneration.

Shelterwood Cutting Method

This Even-aged Regeneration method is defined as “a method of regenerating a stand in which a new age class develops beneath the partially-shaded micro-environment provided by the residual trees.” The treatment sequence includes three distinct types of cutting phases:

- Preparatory Phase. An optional harvest designed to enhance conditions for seed production
- Establishment Phase. A harvest designed to prepare the seedbed and to create a new age class
- Removal Phase. A harvest designed to release established regeneration from competition with the overwood

APPENDIX I B. EXAMPLE; APPLYING THE AUSTRIAN FORMULA

The following expression provides an example of working the Austrian formula using data from another area.

$$AAC = I (300 \text{ BF} \times 100 \text{ acres}) + \left\{ \frac{v \text{ measure (9500 BF)} - v \text{ predicted (11,000 BF)}}{n = 15 \text{ years}} \right\}$$

$$AAC = 3000 + \frac{\{ -1500 \text{ BF} \}}{15 \text{ years}} \times 100 \text{ acres}$$

$$AAC = 3000 - 100 \text{ BF}$$

$$AAC = 2900$$

This equation comes from: Bettinger, P., Siry, J., Boston, K. and Grebner, D.L. (2008), *Forest Management and Planning* Boston: Academic Press. The equation is generally accepted and would be found in many forestry texts and government handbooks. This is an excellent reference for comparing and choosing forest management equations.

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