White Mountain Stewardship Project
Final 10-year Socioeconomic Assessment
The Ecological Restoration Institute

The Ecological Restoration Institute at Northern Arizona University is a pioneer in researching, implementing, and monitoring ecological restoration of dry, frequent-fire forests in the Intermountain West. These forests have been significantly altered during the last century, with decreased ecological and recreational values, near-elimination of natural low-intensity fire regimes, and greatly increased risk of large-scale fires. The ERI works with public agencies and other partners to restore these forests to a more ecologically healthy condition and trajectory—in the process, helping to significantly reduce the threat of catastrophic wildfire and its effects on human, animal, and plant communities.

Cover photo:

Cover photos (clockwise from top left):
Trees from a White Mountain Stewardship Project thinning operation are loaded onto trucks for delivery to Forest Energy Corporation in Show Low and other local wood processors (photo by Tana Kappel, The Nature Conservancy (TNC)). A group tours the Blue Ridge Project demonstration area (photo courtesy of TNC). The Forest Energy plant, recipient/contracting partner of Future Forest LLC, is visited on a media tour (photo courtesy of TNC). In 2011, the Wallow Fire burned more than 538,000 acres in the White Mountain region and replaced the Rodeo-Chediski Fire as the largest fire on record in Arizona (photo by Jayson Coil, USDA Forest Service).

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Executive Summary

The once-thriving east-central Arizona wood products industry came to a grinding halt in the early 1990s because of ongoing legal and social conflicts over federal forest management. In 2002, the largest fire in Arizona’s history scorched a record number of acres in the area, burning many homes and infrastructure. The growing wildfire threat and a decline in forest health shifted land management policy from gridlock toward collaboration in an effort to restore the forests to more natural conditions. Under U.S. Forest Service leadership and with a newly formed partnership of the Natural Resources Working Group, one of the first projects to attempt this was the White Mountain Stewardship Project (WMSP).

The White Mountain Stewardship Contract began on August 10, 2004 with a goal to treat 150,000 acres of degraded federal forests over 10 years. At the time, it was the largest and longest running stewardship contract in the country. The project focused treatments in wildland-urban interface areas throughout the White Mountain region in the Apache-Sitgreaves National Forest. The WMSP was referred to as “the experiment” because no other national forest had attempted a large 10-year stewardship contract. For the first time in this region, it brought together environmental groups, industry leaders, scientists, and community members to restore forest health through active forest management, protect communities, and re-tool and revitalize a local wood products industry.

One of the project’s biggest hurdles was to develop a new, competitive marketplace for the harvesting and processing of small-diameter trees/biomass and to provide markets for low-value restoration by-products through a single contractor model. One of the project’s greatest achievements is that implementation occurred in the absence of legal challenges—acres were treated, and the treatments were successful in protecting communities during Arizona’s largest wildfire to date, the 2011 Wallow Fire (538,049 acres). This report examines the project’s 10-year lifespan through a socioeconomic lens and presents findings on the project’s impact to forest management, the forest product industry, and social and economic conditions in the White Mountain region.

Some project challenges detailed in the report include:

- Stewardship contracting barriers.
- The single contractor model.
- A limited supply of raw material.
- The economic downturn of the Great Recession.
- The Wallow Fire impacts.

Many project successes are also captured, such as:

- Revitalized forest products industry in the White Mountains.
- Generational family businesses maintained.
- Benefits to forest health and ecosystem services.
- Meaningful collaboration among U.S. Forest Service, stakeholders, and citizens.
- Wildfire risk reduction and increased community protection.
- Paved the way for the nation’s next largest collaborative restoration project, the Four Forest Restoration Initiative, or 4FRI.

U.S. Forest Service personnel, stakeholders, and business owners closely involved with the WMSP were interviewed for this report. Quotes and summarized information from interviews, combined with quantitative economic data, tell the story of how an industry, an agency, and a regional community shifted from stagnation to stewardship. The report explores the economic challenges and opportunities faced by industry, and documents lessons learned that point to improvements to the stewardship-industry model.
Introduction

The Apache-Sitgreaves National Forest (ASNF) is located in the White Mountains range, a transition zone, just south of the Colorado Plateau and north of the Arizona Basin (Netstate 2001). The White Mountains of Arizona encompasses more than two million acres of diverse vegetation and approximately one million acres of ponderosa pine and mixed conifer forests (USDA 2016).

The White Mountain region is defined as a contiguous area anchored on the northwest by Snowflake-Taylor, on the east by Springerville-Eagar-Alpine, on the south by Whiteriver, and on the west by Heber-Overgaard (Fig. 1). The White Mountains can be characterized as a rural area with small towns scattered throughout. These towns are far from urban centers, thus availability of resources, access to transportation and market distribution channels are limited.

![Figure 1. The White Mountain Region](image)

The White Mountain region lies within the world’s largest contiguous ponderosa pine forest, which suffers degraded forest health conditions from past management practices like over-grazing, logging, and fire suppression. Beginning in the late 1800s, management practices disrupted the natural fire regime of frequent, low-intensity surface fires. These frequent (every 2–8 years) fires historically cleared the forest floor of woody debris, prevented overcrowding of seedlings, reinvigorated forbs and grasses, and created suitable wildlife habitat. Without frequent surface fires to control the growth of small, young trees, the forests in the White Mountains have become overcrowded and unhealthy. The semi-arid and dry forests of the Southwest are further challenged by recent drought and climate change, which have stressed forests and increased their susceptibility to insect infestations and unnatural, severe wildfires.

The Rodeo-Chediski Fire ignited in 2002 and burned approximately half a million acres—this fire was the largest wildfire ever recorded in Arizona. The majority (59 percent) burned on the White Mountain Apache
Indian reservation, 2 percent on private land, and the remainder (39 percent) on the Apache-Sitgreaves and Tonto national forests (WFLC 2010). The ecological and socioeconomic effects of this fire deeply affected the White Mountain region. According to a study by the Western Forestry Leadership Coalition (2010), more than 490 structures were destroyed and 30,000 residents were evacuated. The total estimated costs of the Rodeo-Chediski fire exceeded $308 million.

The Rodeo-Chediski Fire greatly affected the White Mountain region. The fire destroyed more than 490 structures and 30,000 residents were evacuated. Photo courtesy of the USDA Forest Service

With forest health in decline and the effects of the Rodeo-Chediski Fire, ASNF leadership understood the need to mitigate uncharacteristic, stand-replacing wildfires. To implement forest treatments and thin the excess small trees, leadership realized it needed to work with forest industry. The ASNF submitted a proposal to the U.S. Forest Service (USFS) Regional Office (Region 3) to plan and administer a 10-year stewardship contract. In 2004, this was approved by the Regional Office, which initiated the White Mountain Stewardship Project (WMSP).

This study spans the 10 years of the WMSP and is presented as a socioeconomic assessment. Quantitative and qualitative analyses were conducted and are collectively presented in this report.
Methodology

Economic Analysis Area

The White Mountain region includes parts of Navajo and Apache counties located in the eastern portion of the state. There is no census-designated metropolitan area in the region. The largest city is Show Low, which is a census-designated micro-economic area. The ASNF overlaps with the boundary of Greenlee County, but WMSP generated little economic activity in this county. Navajo and Apache counties include areas in the Native American tribal territories. Although the county economic profiles include economic data from the reservations, this data was not included in the WMSP economic region. Table 1 summarizes the latest demographic information available for the state of Arizona and the two counties.

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<td>175.4 (total)</td>
<td>209.5 (total)</td>
<td>10.05%</td>
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(Source: US Census Bureau; Bureau of Labor Statistics; Unemployment not seasonally adjusted; Income in 2004 and 2014 dollars)

Table 1. Demographic information: Arizona, Apache and Navajo Counties

Annual Economic Monitoring from 2005–2014

In a separate report, titled 2013–2014 White Mountain Stewardship Project Economic Assessment, we analyzed primary (2013 and 2014) and secondary data (2005–2012) in order to analyze long-term changes in economic activities of the WMSP. Findings were selected from this economic assessment to provide supplemental information for this report.

Interviews with Businesses, U.S. Forest Service, and Stakeholders

A subsample of firms (n=11) was selected for an interview from a population of 24 related wood products enterprises that had worked in some capacity with the WMSP and completed an economic survey over the course of the first eight years (2005–2012) (Appendix A). Ideal interview participants were those businesses most involved with the WMSP and had a substantial impact on the outcomes of the project. Businesses were selected

1Assessment reports from 2005 to 2014, as well as other reviews and reports, are made available by the Apache-Sitgreaves National Forests and the White Mountain Stewardship Monitoring Board: http://www.fs.usda.gov/detail/asnf/workingtogether/partnerships/?cid=stelprdb5207073
from this population by consulting with key informants and by screening potential interviewees on the telephone. Based on input, an additional business not included in this population was selected for an interview.

Interviews were also conducted with stakeholders and USFS personnel. Stakeholders represented various non-governmental organizations. Forest Service and stakeholder respondents were selected with key informant input as well as using snowball sampling methodology. Interviewees were asked to provide contact information of

Figure 2. White Mountain Stewardship Project business locations.
USFS personnel (hereafter Forest staff, collectively, or Forest staff member) and stakeholders most involved with the WMSP. All potential respondents agreed to participate in the study.

To solicit participation from selected businesses, an initial e-mail was sent explaining the study and requesting participation. In addition, a follow-up telephone call was made to secure their involvement and to answer any questions they may have about the study. For those businesses that qualified for an economic questionnaire (2013/2014), the survey was e-mailed to them ahead of time so the business owner could complete the questionnaire and submit it at the time of the interview.

A total of 21 in-depth interviews were conducted with businesses (n=12), Forest staff (n=5) and stakeholders (n=4) between December 2014 and April 2015. All business interviews were conducted in-person and most interviews with Forest staff and stakeholders were telephone interviews. Interviews ranged from one to four hours with the average interview lasting 1.5 hours. All interviews were audio recorded and detailed notes were developed for the analysis.

Two interview protocols were developed. One interview guide was constructed for businesses and one for USFS and stakeholders (a subset of questions were designed for the USFS respondents only). Interviews were semi-structured. The direction of the interview and the questions selected from the guides varied and were dependent on the background/knowledge of the respondent as well as answers from previous questions. The interview guides were designed to lead the respondents through a chronological recollection of the project. Interviewees were asked to provide accounts that related to events before, during, and after the WMSP. This design assisted with sequentially and thematically organizing the data for analysis and presentation in this report.

Overview of Businesses (n=12)

Interviews were conducted with 12 privately owned businesses located across the White Mountain region (see Fig. 2 for WMSP business locations). Businesses represented three subgroup categories: 1) sustained (established prior to the WMSP and operating) (n=8), 2) new and sustained (established during the WMSP and operating) (n=1), and 3) new and no longer operating (n=3). Respondents were primarily president/Chief Executive Officer (CEO) and owners of the businesses. Many business owners represented several generations in the timber industry and the number of years in business ranged from 10 to 62. These enterprises worked with the WMSP between one and 10 years with an average of six and a half years.

Businesses interviewed were involved in: 1) harvesting operations (n=6); 2) small diameter mills and finished products (n=3) (pallets, cabin manufacturing products, dimensional lumber, and furniture parts); 3) manufactured finished products (n=2) (treated agriculture posts and poles and pellets); and 4) bio-power (n=1).

Overview of USFS (n=5)

Interviews were conducted with USFS line officers and staff members who worked on the WMSP (n=5). Most of the personnel interviewed were veterans of the USFS and worked for the agency between nine and 44 years, averaging 28 years. USFS respondents worked on the WMSP between two and a half and 10 years, averaging five years. USFS respondents spanned the length of the contract—representing experiences throughout the 10 years of the project.
Overview of Stakeholders (n=4)

Interviews were conducted with a variety of stakeholders (n=4) working with various conservation groups and professional organizations. Those interviewed collaborated on the WMSP for the majority of its term, between eight and 10 years. Three of those interviewed were members of the WMSP Multi-Party Monitoring Board.

Findings

Forest Management and Forest Product Industry Conditions Prior to the White Mountain Stewardship Project

For 11 years prior to the WMSP, timber sales and forest harvesting were limited on the ASNF. Beginning in 1993, when the Mexican spotted owl (MSO) was listed as a threatened species, legal challenges by interest groups reduced active forest management—limiting the raw material supply for the existing forest products industry (USFWS 2012). A business owner described the situation as “log wars” and that the forest was “shut down.” Raw material supply at the time was limited to the White Mountain Apache Indian reservation.

Due to lack of supply, mills began to close. There was a paper mill and power plant located in Snowflake, on the west side of the White Mountains. The paper mill was also affected by dwindling supply from federal lands and, in 1999, the mill was forced to convert to utilizing only recycled material, which further decreased the demand for raw wood fiber by-products.

Following the decline in logging on regional national forests in the mid-1990s, most forest industry and a trained workforce disappeared from the area. The loss of industry and wood supply depressed the local economy. Although the wood supply from federal forests was uncertain, the few remaining firms adapted their business models to stay afloat. For example, logging operators traveled long distances outside of the White Mountain region and worked on a variety of activities such as clearing orchards for housing developments in Phoenix, Arizona and slash procurement/chipping in New Mexico. These operators reported they did not return to work in the White Mountains until the WMSP began. Manufacturing firms that stayed in the White Mountains focused on various activities like log home construction and manufacturing molding and furniture parts.

Adding to these trying times was the Rodeo-Chediski Fire. It deeply affected the communities scattered throughout the White Mountains. Community members were frustrated by the perceived inaction of the ASNF prior to the fire. Projects that were previously approved under the National Environmental Policy Act (NEPA) and cleared for treatment (mechanical/hand tree thinning and prescribed burning) had not been treated because of protracted litigation that resulted in these areas burning in the fire. Forest staff stated that many residents believed if these forest treatments had occurred, the fire might have been less severe and property and forest value losses might have been reduced. The effects of the Rodeo-Chediski Fire further depleted raw material supply from the ASNF and businesses found the only option on federal land was salvage logging in the burned area.

The results of this fire prompted numerous communities to prepare Community Wildfire Protection Plans (CWPP). The plans would assist with fire risk mitigation strategies in their communities. Numerous grants from the Rural Conservation and Development, Four Corners Partnership, and USDA Rural Development assisted businesses in the region—these earlier grants allowed for initial investments in equipment that would not have been made due to the uncertainty of supply at the time.
Key Factors Leading to the White Mountain Stewardship Project

In 1997, multiple stakeholders and community members came together to build consensus on forest restoration issues, especially over concerns related to the recent listing of the MSO as a threatened species. This led to a diverse group of stakeholders forming the Natural Resources Working Group (NRWG) (Abrams and Burns 2007).

To demonstrate a willingness to work together, the NRWG, in conjunction with the ASNF (hereafter Forest), designed the Blue Ridge Demonstration Project. This project demonstrated a variety of on-the-ground treatments to prompt discussions and provide an opportunity for various interest groups to share concerns. These treatments, collaboratively designed with scientists from Northern Arizona University’s (NAU) School of Forestry and the Ecological Restoration Institute, were foundational prescriptions for the WMSP. A Forest staff member said the lack of industry to process small diameter wood products (i.e. paper mill) had a “chilling effect” on attracting bidders for the project’s conventional timber sale.

To assist with the lack of contractors bidding on the project, the Forest obtained funding to pay operators to implement a variety of experimental prescriptions. Forest staff said this resulted in an embedded contract, which was a timber sale contract embedded in a service contract. This type of contract was the precursor to the White Mountain Stewardship Contract (WMSC). The Blue Ridge pilot project provided the needed experience in harvesting small diameter trees. It also provided the agency and the contractor an opportunity for trial and error and informed harvesting efficiencies once the WMSP began. Experience with this project provided the NRWG with information needed to begin to promote new approaches to forest management and contracts.

The Blue Ridge Demonstration Project also set the stage for new industry partnerships, including WB Contracting (harvesting operations) and Forest Energy (pellet mill). Together these businesses harvested mostly wood boles from trees less than 8.9 inches diameter at breast height (DBH) and processed the small diameter material into pellets. These businesses went on to form Future Forest, LLC, one of the bidders on the WMSC.

Many businesses interviewed reported the Blue Ridge Project was a successful collaborative venture and believed this was key in bringing the WMSP to the Forest. At the table were the Forest, scientists, citizens, and environmental organizations like the Center for Biological Diversity (CBD) and the White Mountain Conservation League. One business owner described these early relationships as “synergistic,” and that the early collaboration built needed trust between the groups, which in the past, was almost nonexistent.
One stakeholder said the Rodeo-Chediski Fire spurred the NRWG into action. After the fire, some in the White Mountains communities pro-actively supported forest thinning, while others were against it. While the former position prevailed, it was clear there was a need to provide information to the public about the necessity and benefits of forest treatments. A Forest staff member described this transition as “[an] understanding within the community that changed from ‘logging is evil,’ to ‘logging is good.’”

In 2002, President George W. Bush’s administration launched the Healthy Forests Restoration Initiative. It was designed to minimize barriers to active forest management with the goal of reducing the risk of unnatural crown fires and restoring health to forests and rangelands (USDA 2016). The primary goal of this initiative was to streamline NEPA environmental planning requirements and construct more robust and legally defensible analyses. Notably, this initiative encouraged the use of a new stewardship contracting authority (2003) that allowed the exchange of forest products for ecological restoration services.

The Healthy Forests Restoration Act of 2003 provided legal authorities to: 1) expedite hazardous fuel reduction and forest restoration projects on federal land, 2) promote biomass removal and provide technical, educational, and financial assistance for watersheds on non-federal lands, 3) authorize large-scale silvicultural research, 4) authorize acquisition of Healthy Forests Reserves on private land to promote recovery of threatened and endangered species, improve biodiversity and carbon sequestration, and 5) direct the establishment of monitoring for insect or disease outbreaks (USDA 2016). This initiative and corresponding legislative components of the act contributed to the WMSP’s early momentum.

Initiation of the White Mountain Stewardship Project and Changes in Forest Management, Business, and Economic Conditions

In August 2004, the USFS Regional Office approved the ASNF proposal to initiate a 10-year stewardship contract. The contract specified treatment of 150,000 acres of primarily small diameter ponderosa pine. The management action emphasized reducing fire risk in wildland urban interface (WUI) areas in the White Mountains. This was the first long-term, 10-year stewardship contract in the nation (USDA 2003). The project’s scope was at a scale that far exceeded past projects on the ASNF. Although a larger firm, Louisiana Pacific, submitted a proposal through a group based in the eastern counties, Future Forest, LLC was selected as the sole
contractor for the WMSP. A stakeholder said that the Louisiana Pacific proposal included a sizeable oriented strand board (OSB) plant, but was too large and not appropriately scaled for the WMSP. He added that his organization was supportive of a smaller, local firm that would support community-based businesses.

A secondary goal of the project was to develop industry that could utilize the small diameter wood. The USFS realized industry was a necessary component for this project’s success. A Forest staff member said, “The Stewardship Project was a rather creative bold move by people inside and outside of the Forest Service to try to establish an industry that could pay for those treatments and the White Mountain Stewardship Project was a result of that.” A firm’s president said, “The White Mountain Stewardship Project came at a great time; it was a blessing.” Others said their business could not have returned to the industry if it were not for the WMSP, and that the project helped reestablish lost industry infrastructure. When the WMSP began, many businesses returned to the White Mountains for harvesting, milling, and producing a variety of finished products.

Changes in Harvesting and Milling Operations

Prior to the WMSP, and as businesses were adapting to the stewardship model, harvesting operators were transitioning from hand felling trees with chainsaws to mechanized harvesting operations. In addition, operations changed from harvesting primarily large diameter trees (equal to or greater than 12 inches DBH) to small diameter (5 inches to less than 12 inches DBH). To efficiently harvest small diameter trees, operators retrained crews and purchased new equipment, such as feller bunchers, in-woods chippers, and short log trucks.

At the same time, loggers were learning new techniques to increase efficiency in their operations and reduce costs (e.g. directional felling of trees for efficient skidding and directional placement on the landing for efficient loading on trucks). This was also the case for biomass/slash (limbs, bark, other parts of the tree that were not traditionally utilized). In the past, slash was lopped and scattered and left for a separate crew to bulldoze the slash into piles for burning. As industry utilized the slash in the later years of the project, the contractor procured the slash during harvesting operations. For example, log skidders were used to move logs as well as procure slash and were continuously active with slash removal as the machinery moved across the site. Similarly, operations changed for existing mills. Milling operations and equipment adapted from processing large to small diameter logs. For example, the Reidhead Brothers Lumber Mill purchased a small diameter mill, which made a significant contribution in processing small diameter logs from the WMSP.
Reestablishing Industry in the White Mountains

During the first two to three years of the project, it was difficult to attract businesses to the White Mountains because firms that had past experience with unreliable supply from federal land did not trust the agency to follow through with the supply stipulations of the contract. A Forest staff member said, “I would not have wanted to invest in a project with the Forest Service back then because our track record [to produce the material needed for industry] had not been that good for the last 10 years.” The new businesses that did emerge lacked the institutional history as well as the background to meet all of the challenges presented by processing small diameter wood into value added products at a relatively large scale.

Businesses at the time were challenged on many levels. The WMSP was a dramatic shift from past traditional timber sales. Businesses were reinventing their operations to harvest and process small diameter wood, using new equipment while, at the same time, determining the best markets/niches to fill with small diameter ponderosa pine products. While large diameter ponderosa pine can be processed into light structural framing products, the small diameter material removed was generally suitable for processing into non-structural products, such as pallet stock, molding, posts and poles, animal bedding, and mulch.
Due to the challenges these businesses faced at the time, direct economic effects of the WMSP were not realized immediately—there was a lag time (2 to 3 years) as established businesses were transitioning and as new businesses were being created. One business owner described this transition by saying that it took time to develop and expand the markets and amortize costs, but once his business developed a niche it shipped products across the western U.S.

**Economic Conditions During White Mountain Stewardship Project**

About four years into the project, housing markets across the country began to crash and the global economy was in the early stages of what came to be known as the Great Recession, a period of economic decline in the late decade of the 21st century. Effects from the Great Recession made transitioning to small diameter wood products (e.g. sill plates, garden mulch, molding, interior post/poles) difficult, as they were tied to the housing industry. The wood product industry was further challenged as the housing sector sank further into depression, with the downturn peaking in 2008/2009. One business, primarily involved in construction at the time, said his sales dropped by 70 percent. Businesses struggled to compete in the global market because it was difficult to find a competitive market niche. Despite the obstacles, businesses in the WMSP recognized the availability of the small diameter material and the potential to create products to match market demands.

**Employment Trends**

While employment in businesses tied to the WMSP had fluctuated, most firms interviewed reported modest increases in employment levels when they began to work on the project. Businesses that experienced a decrease in employment reported this occurred when they moved their operations from the White Mountain Apache Indian reservation to the WMSP. While working for the Fort Apache Timber Company, these enterprises reported their businesses were larger, had more consistent work, were more profitable, and had more employees than when they operated on the WMSP (in 2008, the Fort Apache Timber Company closed for unrelated reasons). Logging operators reported that they required fewer employees because they gained operational efficiencies when they moved their operation over to the WMSP by: 1) acquiring new equipment, 2) assigning workers to specified skills/duties, and 3) leaving the biomass (the contractor, Future Forest, procured the biomass). A logging operator said efficiencies were gained to a point that a four-person crew could fill eight to 10 truck-loads per day on the WMSP versus a 12-person crew on the reservation.

This is in line with the economic analyses of full-time equivalent (FTE) value (employment data is converted to a FTE to facilitate comparisons between firms) during the WMSP (Kim and Mottek Lucas 2015). In assessing the data, it is important to note the 2005 figure was inflated by a one-time reporting from a large business with 200 employees, located in Phoenix, Arizona (outside the WMSP economic area). Therefore, considering figures from 2006 to 2011, FTE had less noticeable variations (small decreases and increases) and reached its highest point in 2010 (316.6 FTE, see “FTE Value”) (Table 2 and Fig. 3). In 2012, there was a dramatic decline in FTE (105.3). The 2012 WMSP economic monitoring report noted that the 2011 Wallow Fire significantly decreased the available supply from the WMSP, which most likely affected enterprises that relied on this supply and were reflected in the subsequent decreased employment trends.
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<td>34.61</td>
<td>16.37</td>
<td>15.20</td>
<td>18.93</td>
<td>16.41</td>
<td>22.61</td>
<td>25.67</td>
<td>17.55</td>
<td>20.63</td>
<td>21.38</td>
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<tr>
<td><strong>Local WMSP FTE only</strong></td>
<td>80.6</td>
<td>90.2</td>
<td>128</td>
<td>146</td>
<td>158</td>
<td>253</td>
<td>186</td>
<td>88</td>
<td>51</td>
<td>62</td>
</tr>
<tr>
<td>Businesses in AZ</td>
<td>222</td>
<td>233</td>
<td>243</td>
<td>236</td>
<td>200</td>
<td>193</td>
<td>192</td>
<td>186</td>
<td>180</td>
<td>182</td>
</tr>
<tr>
<td>Employment in AZ</td>
<td>9,768</td>
<td>9,673</td>
<td>7,660</td>
<td>5,683</td>
<td>3,812</td>
<td>3,187</td>
<td>3,155</td>
<td>3,196</td>
<td>3,613</td>
<td>3,883</td>
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<tr>
<td>1000 green tons removed</td>
<td>73.1</td>
<td>182.5</td>
<td>152.3</td>
<td>179.1</td>
<td>169.8</td>
<td>251.7</td>
<td>254.4</td>
<td>224.1</td>
<td>184.3</td>
<td>149.0</td>
</tr>
<tr>
<td>Acres treated</td>
<td>3,105</td>
<td>8,221</td>
<td>8,871</td>
<td>8,802</td>
<td>6,213</td>
<td>9,446</td>
<td>8,562</td>
<td>5,955</td>
<td>6,807</td>
<td>4,620</td>
</tr>
</tbody>
</table>

Table 2. Number of employees and FTE with green tons removed and acres treated by the WMSP (2005–2014).

Figure 3. Number of employees and FTE of WMSP businesses (total employees and those residing locally within the pre-defined WMSP economic area (2005–2014)).

1 2005 figure is skewed by a one-time contribution of a business with 200 employees located in Phoenix.
2 % male employees among full and part time employees. Most seasonal employees were male.
3 Local WMSP FTE represents employment directly supported by materials from the WMSP and those local employees that reside in the pre-defined WMSP economic area (see Fig. 1).
4 Total number of establishments and total employees in all the subsectors in the Forestry and Logging sector (NAICS=113) and Wood Product Manufacturing sector (NAICS=321) in Arizona (Source: Bureau of Labor Statistics).
5 Small diameter wood and byproducts removed (green tons) and approximate acres treated by the WMSP reported by fiscal year.
Grants and Financial and Technical Assistance

Once the contract was issued and additional federal and state grants and financial assistance programs became available, businesses began to use the region’s small diameter wood and its byproducts. The Forest Products Laboratory’s Forest Products Marketing Unit awarded Woody Biomass Utilization Grants, which helped to develop markets for small diameter wood. From 2005 through 2011, the program helped businesses offset their startup costs by providing grants for equipment acquisition and technical assistance for an array of biomass uses. In total, firms in the White Mountains received $3.2 million, of which $2.6 million was actually spent and was matched by another $4.9 million of primarily in-kind contributions of grant recipients’ labor and services provided (Davis et al. 2014). Three organizations with missions primarily focused on sustainable forests, wood utilization, and rural economic development provided intermediary assistance with the grant process. The three groups included: 1) Northern Arizona Wood Products Association, 2) Little Colorado River Plateau Resource Conservation and Development, and 3) Small Business Development Center at Northland Pioneer College. These groups formed a team and provided technical assistance to potential grantees with proposal development and construction, financial projections, administration, and grant reporting.

Listed below are other notable financial and technical assistance contributions and grants that assisted with small diameter wood utilization during the WMSP.

1. Arizona Commerce Authority:
   a) Assisted with exports to Mexico.
   b) Healthy Forest Enterprise Incentives Program offered diesel fuel tax reduction and a tax exemption for equipment and parts (ACA 2015).

2. The town of Eagar’s city manager assisted in promoting forest health initiatives, such as:
   a) Developed workshops that assisted the wood products industry with hiring employees, managing budgets, developing business models, and acquiring financing.
   b) Promoted the White Mountains’ forest products industry and developed new markets through tours and various engagements.
   c) Through a grant from the Southwest Sustainable Forests Partnership, procured one of the first chippers in the White Mountains.

3. University of Arizona Cooperative Extension provided educational programs and staff (i.e. a member of the Multi-Party Monitoring Board, the NRWG, USFS Interdisciplinary Team).

“Without the stewardship contract as the foundation and without that grant money as the seed I don’t think the White Mountains situation would have been nearly as robust as it was.”

The WMSP presented many opportunities for businesses and the grants, along with other financial and technical assistance, further incentivized businesses to explore prospects and/or expand their enterprises. These incentives leveraged significant outcomes for the project like assistance with equipment acquisition to construct small diameter mills. The incentives increased the capacity of individual business development and the project as a whole. A stakeholder said, “Without the stewardship contract as the foundation and without that grant money as the seed I don’t think the White Mountains situation would have been nearly as robust as it was.”
The Stewardship Contract Authority

White Mountain Stewardship Contract: The Grand Experiment

Forest staff coined the WMSC as “the experiment” because this was the first long-term stewardship contract in the nation. Forest staff explained there had been no precedent to follow and the agency took great risks to determine the length of the contract and the number of acres to treat. Initially, the treatment area of 150,000 acres was derived from the number of acres in the WUI and the volume of wood fiber the USFS thought was needed to attract industry. The agency also determined the full length (10 years) within the authority was necessary for industry to realize some return on their investments.

Over the course of a year, the contract was developed based on past methods used in harvesting large timber, or saw logs. Mechanized harvesting equipment technologies and the process of thinning small diameter trees were novel and experimental at the time. As a result, the contractual requirements did not evolve to incorporate the new processes and efficiencies being developed as the WMSP progressed. For example, because biomass (e.g. tree limbs, bark, etc.) was utilized for the first time, large slash piles were no longer constructed by a separate crew, rather slash was either piled while harvesting or disbursed for broadcast burning. Also, flagging skid trails was no longer necessary because operators were not removing large trees from the site. Loggers said these outdated contractual requirements increased the time that it took to complete task orders. They believed the low market value of the small diameter wood should have lessened or omitted these contractual requirements. Operators also reported that the USFS tried to enforce out-of-date contractual requirements and, at times, instructions/procedures changed and/or were contradictory. Since these new practices and efficiencies arose after the contract was developed, the agency could not incorporate them. Flexibility in the contract was needed to consider these novel technologies and processes. Forest staff said a distinct advantage of the contract was that it focused on the overall goals of the project, which was treating acres.

A rubber-tired skidder works on the Porcupine Task Order, part of White Mountain Stewardship Contract, on the Black Mesa Ranger District. Photo courtesy of the USDA Forest Service, Apache-Sitgreaves National Forest
**Performance Measure: Acres Versus Tons**

Prior to the WMSC, when extracting large diameter trees was the focus, loggers were paid by measuring each stem in one thousand board feet (using a Scribner Decimal C formula). The cost of sorting and measuring each stem was offset by proceeds the agency received from timber sale receipts. However, this approach was unnecessary and inappropriate for assessing the removal of small diameter trees. Instead, the agency estimated the volume of the small diameter material from a sample of timber cruises extrapolated across the project area. The volume (green tons) extracted then could be confirmed by weighing the material.

Initially, the relationship between acres and volume of small diameter material was not well understood. For example, the agency estimated 10.7 tons would be removed on each acre. About halfway through the project, beginning in 2008, industry began to remove and utilize forest byproducts (slash) from the western side of the ASNF. This was an acceptable hauling distance to the biomass power plant located in Snowflake. Based on tracking the acre-to-volume relationship during the WMSP, the 10.7 ton per acre figure increased to an average of 25.8 tons per acre. The 25.8 tons of fiber removed included both saw logs and biomass. However, this average only included biomass extracted from a portion of the ASNF from 2008 to 2014. Forest staff experiences revealed that the proportion of saw logs to biomass was two to one—two truck-loads of saw logs produced one truck-load of biomass.

When request for proposals (RFPs) were released, the contract stipulated the awardee would be paid on a per acre basis. Three months after the contract was awarded, an amendment was devised stipulating the contractor would be paid on volume (green tonnage) rather than acres. According to Forest staff, this decision was made to give the contractor an advantage and assist with the viability of industry. Since acres varied in density (volume) and tonnage was a concise measurement, being paid by the ton eliminated uncertainty and provided assurances to the contractor. When both the agency and industry were asked which was the best metric to gauge performance, responses varied.

Several businesses believed treated acres was the ideal metric. However, to effectively gauge this, one firm suggested longitudinally comparing the number of acres treated versus the resources and cost (both on the USFS and industry side) expended to treat these acres. For example, the following questions were recommended: “What was the costs to treat these acres?” and “Are operations gaining efficiencies and decreasing the costs as the project progresses?” This information would assist both entities in determining whether the efficiency in environmental planning, administration, site preparation and harvesting operations were improving or declining. If this trends toward treating a greater number of acres at a lower cost, this type of tracking and reporting could motivate congressional leaders to ramp up investment for forest restoration.

Another firm believed there were advantages and disadvantages to both acres and tons that depended on whether you are the contractor or the consumer of raw material. Paying on green tonnage was to the contractor’s advantage. It incentivized the contractor to move the trees from the stump to the scale as quickly as possible because the operator was paid to move water. As a consumer of dirty chips, rather than using green tons, his firm preferred paying on bone dry tons (this figure is derived from weighing a sample of green chips as compared to the same sample dried and extrapolating the difference to the ton), which eliminated variation of the amounts of water that were in the trees/biomass when it was delivered.

Forest staff believed that gauging performance on a per acre basis was the best metric because it matched the agency’s targets. The problem with using green tons/volume was the variability of volume on each acre. For
example, some acres may have contained a small amount of volume, but they were strategically important to treat for fire mitigation; therefore, paying on per acre basis would have motivated the contractor to do any acre, regardless of its stocking levels. Another Forest employee said that tracking both metrics (acres and tons) would assist the agency in better understanding this relationship.

The agency’s decision to pay the contractor on tonnage did motivate the contractor to increase productivity on each acre. As the project matured and agreements between the agency and interest groups were reached, treatment intensity increased; thereby, more small trees and biomass/slash were removed from each acre. Forest staff said that by 2013, treatments intensified to almost double the volume removed on the same number of acres.

In line with employment (FTE) trends (Fig. 3, p. 13), acres treated and raw material removed dropped significantly in 2009, correlating with the Great Recession. In 2010, the number of acres treated reached its highest point and began to decline in 2011. Volume removed peaked in both 2010 and 2011 and began to decline in 2012. The increase in acreage in 2010 could be attributed to supplemental funding (American Recovery and Reinvestment Act) the Forest received to increase the number of acres treated. Increased volume removed in 2011/12 could be attributed to several factors: 1) increased biomass removed on each acre, and 2) agreements were reached between stakeholders and the Forest that allowed for adapted prescriptions to remove more volume on each acre. Both acres and tons experienced a dramatic decline for the final three years of the project (Fig. 4). This decline could be linked to several factors like the 2011 Wallow Fire.

![Figure 4. Raw fiber (green tons) removed and approximate acres treated during the WMSP.](image)

**Budgetary Constraints, Cost to the Federal Government, and Acres Treated**

Stewardship Contract Authority essentially allows for the exchange of goods for services (USDA n.d., Stewardship Contracting Overview). In the case of the WMSP, the value of the small diameter wood (5 inches to less than 12 inches DBH) was less than the cost to thin the forest. However, some costs were offset by a small portion of larger material (“stumpage” above 12 inches DBH) that was extracted. Since the majority of material harvested was small diameter of little value, the contractor was paid on a per acre basis (equated to volume) for the difference between the stumpage (paid to the USFS) and small diameter fiber (paid to Future Forest, LLC).
Originally, the WMSP set out to treat 150,000 acres over 10 years. However, because of federal budget limitations, the final commitment was to treat 5,000 acres annually. Since the contractor was paid on tonnage, according Forest staff, the USFS developed a formula that equated acres to tons. Future Forest, LLC was paid $500 per acre, which was equivalent to 53,500 tons per 5,000 acres (10.7 tons per acre). The increased material removed as the project progressed could be attributed to more aggressive prescriptions (more trees were removed on each acre) and procurement of slash. Although the amount of material removed increased, a good portion of this was biomass, which had the lowest value and increased transportation costs. In the end, the price paid to the contractor ($500 per acre) remained the same throughout the life of the contract.

An annual budget of $5 million was equally distributed ($2.5 million each) to Future Forest, LLC and the agency. The contractor used the funding to pay for thinning operations and the USFS used the funding for NEPA planning, contract administration, and site preparation. Three percent of the budget was allocated to the Multi-Party Monitoring Board; a requirement of the authority. A Forest staff member explained there had been a fundamental shift in budgeting and funding allocations within the Forest. The Forest staff member said, “It shifted how the money was used on the Forest and it created a commitment from the Regional Office to fund the White Mountain Stewardship Project.” However, subcontractors were not subsidized; they were paid by the green ton directly by the contractor, Future Forest, LLC.

The ASNF worked to raise the visibility of the project through working closely with the Washington Office and as a result it received two sources of supplemental funding: 1) unspent end-of-the-year funds from USFS units across the country; in turn, these Forests were able to meet their fuel reduction target obligations with on-the-ground WMSP accomplishments (2004–2007); and 2) American Recovery and Reinvestment Act (ARRA) funding, an economic stimulus incentive program promoted by President Barack Obama’s administration and authorized by Congress (2009–2010). In 2012, the harvesting operations were funded, but the Forest saw funding dwindle and these costs (mostly site prep costs at the time) had to come from internal program dollars. Although project funding was a notable and continuous struggle, these innovations enabled the agency to increase the 50,000-acre commitment to thinning approximately 70,000 acres, which was still less than half of the initial target. Many respondents believed the repercussions of the agency’s limited funding constrained industry and contractor capacity. Forest staff speculated that if more acres had been treated (another 5,000 acres annually), industry capacity might have increased, allowing them to be more competitive. And in turn, increased capacity might have decreased the price the agency paid the contractor.

The contract required an evaluation every two years to determine if the amount paid by the federal government to the contractor matched original projections. Although there was variation in treatment costs on each acre, some were more expensive than others, costs averaged out across total acres treated. The assessments over the life of the contract determined the cost per acre was on target with the original projection. As the project progressed, there was an expectation that the cost of thinning would decrease with increased operational efficiencies, but the cost of thinning ($500 per acre) remained the same throughout the project. This was partly due to the economic downturn and reduced demand for wood products that had a direct effect on profit margins. In addition, the subsidy assisted with high transportation and slash procurement costs. Forest staff explained that the environmental planning costs decreased as the project progressed, but was challenged by the rate of inflation.
WMSP Facts:

- Initial acre offering of the contract: 150,000
- Actual acres treated: 70,602.90 (approximately 50 percent of projected acres)
- Actual tons removed: 1,820,340.29 (includes biomass and saw logs)
- Average tons removed per acre: 25.8 (equivalent to approximately one truck-load per acre)
- Average cost to the federal government (subsidy to Future Forest, LLC): $500 per acre
- Annual budget: $5 million total = $2.5 million USFS (for admin, planning and site preparation); $2.5 million Future Forest, LLC (operating expenses to treat 5,000 acres/year)
- Tons pile burned: 681,693
- Number of truck-loads of fiber removed: 69,469

Avoided Costs to the U.S. Forest Service and Public

Although the contract cost the federal government on average $500 per acre to thin primarily small diameter trees, several factors helped the agency and the public avoid costs:

1. Beginning in 2008, industry removed and utilized forest byproducts. The need to pile burn in some areas was reduced (pile burning cost the agency an average of $75 per acre during the latter half of the project). Agency costs to burn piles in some areas in the forest was reduced.

2. Forest treatments prior to the Wallow Fire (2011) reduced losses in infrastructure and overall forest health that was beneficial to both the agency and the communities in the White Mountains. According to a fuel treatment effectiveness assessment conducted by the USFS (2011), WMSP fuel treatments saved all but one of the structures in Alpine and helped firefighters safely contain the fire. A study by Waltz et al. (2014) revealed fire effects were dramatically different in treated versus untreated sites and identified four key findings: 1) fire severity was noticeably lower in treated stands—on average, tree mortality in untreated areas was six times greater than in treated units; 2) treated stands retained a greater number of large trees than untreated units; 3) treated areas contained higher cover of native grasses than in untreated sites; and 4) untreated units comprised larger patch sizes with high-severity fire effects than that of treated areas.

Increased Efficiencies in U.S. Forest Service Processes

Throughout the project, the agency was able to increase efficiency and reduce costs in several ways:

1. Environmental analyses were streamlined because they contained a larger number of acres than had been previously analyzed by the Forest and were not legally challenged by interest groups.

2. Harvesting small diameter trees with low value did not require direct measurement and accountability as it had in the past when high valued timber was harvested from the forest—this eliminated the need to inventory every tree, instead volume was estimated.

3. As the project progressed, marking every tree for harvest was eliminated with “designation by description”
(DxD) in which, the prescription (the on-the-ground plan for thinning) was implemented as described by the Forest’s silviculturist.

4. Administering a single, large contract to a sole contractor was less time consuming and complicated than overseeing multiple contracts and contractors.

If it is assumed that increased efficiency realized by the agency was attributable to increased economy of scale, this implies that as the size of production increased, the cost advantage per unit also increased. Total WMSP treatment cost consisted of fixed (e.g. USFS administration, environmental analyses, etc.) and variable (e.g. Future Forest, LLC logging operations) components. As the WMSP’s scope increased (e.g. acres treated), fixed cost per unit (e.g. planning cost per acre) decreased. Although the costs incurred by the USFS during the WMSP were mostly fixed, they were spread over 10 years and administered by multiple branches within the agency. The distribution of the costs over time among different branches in the agency also varied. Further, costs to the USFS were dependent on how much planning, site preparation, and monitoring were completed by agency personnel versus outside contractors. All of these factors made it difficult to estimate the expenses on a per acre basis and to quantify the cost advantage gained over time. However, interview results confirmed that by undertaking treatments that contained a larger number of acres, the agency increased efficiency (i.e. increased economy of scale) and it promoted a substantial cost savings for the USFS.

A USFS line officer explained transformations within the agency were a departure from past policies and procedures and increased efficiencies allowed the ASNF to slowly gain ground. The line officer said that prior to the WMSP, the agency was inundated with lawsuits that created an environment of complacency within the USFS. Additionally, there was pushback at the Regional and Washington Office levels because of public concerns over perceived “corruption” of “loggers’ choice,” where in the past loggers selected the most valuable trees to harvest.

The USFS line officer said, “It was really hard to turn our organization into a production organization again after all those years of complacency.” They added that the Forest had to find the right people to work on the stewardship project, particularly those who had “a fire in their belly.” The line officer said that maintaining the status quo within the agency was more in line with career security than taking risks that were not formally recognized by the agency as an accomplishment. This was reported as one of the agency’s greatest challenges. The line officer said it was a difficult transition and a complete paradigm shift in goals and objectives for federal land management projects. However, once these processes were in place, they cumulatively and markedly increased efficiency and reduced agency costs.

**Paradigm Shift in Forest Management: Focus on Forest Structure**

For much of its existence, the USFS was an agency focused on what was being extracted from the forest and the high valued products that could be manufactured from the raw material. Once the WMSP began and low value small diameter logs and biomass were being removed, the emphasis shifted to the residual forest structure. The USFS worked with ecologists from the School of Forestry and the Ecological Restoration Institute at NAU to determine the characteristics of a sustainable, fire resilient forested ecosystem. This paved the way for a new paradigm of forest management, one with an emphasis on the retention of larger, fire resistant trees and the removal of excessive smaller trees that acted as ladder fuels. According to Forest staff, this shift was supported by industry. One USFS employee said it was the first time they witnessed the utilization of the entire tree. Ultimately, the Wallow Fire became an opportunity to test theories about the effectiveness of restoration treatments on fire behavior and ecosystem resiliency.
Barriers and Challenges to Stewardship Contracting

Respondents identified several contractual barriers and challenges:

1. **Prevailing wage:** Davis Bacon Act wages, known as “prevailing wage,” was a mandatory contractual requirement for in-the-woods operators and was identified by loggers as one of the greatest barriers these businesses faced. Loggers said this requirement was especially burdensome and had a profound effect on their bottom lines. In their opinion, the prevailing wages required under the contract were much higher (15 to 20 percent) than the going industry rates in the White Mountains at the time. Logging operators reported, the prevailing wage rate was $24 per hour, and they believed the required rates were approximately $4 more per hour than what operators not under the requirements of the contract were being paid in the region. As a comparison, Bureau of Labor Statistics’ data revealed median hourly wage of “farming, fishing, and forestry occupations” in Arizona as of May 2014 was $8.90 per hour and “first-line supervisors” of these occupations’ hourly wage was $20.76.2

   To further the prevailing wage discrepancy, a business owner explained, operators that required the highest skill level (e.g. a feller who operated a hot saw required this operator to cut accurately and quickly) were paid the same as those operators who required less expertise (e.g. a loader who mechanically placed logs onto a log truck). Similarly, the experience of the equipment operator was not a consideration under this pay scale. Within the prevailing wage requirement, a “journeyman” who is an experienced equipment operator, received the same wages as an “apprentice” operating the same piece of equipment, but is being trained for the job. According to logging operators, paying the same wages to those in training who are less productive as those with years of experience not only affected their profit margins, but also negatively affected employee morale.

2. **Costs to the contractor/subcontractor:** Subcontractors shared that, considering how the contract was written, “The economics [did] not pan out.” If the USFS wants more acres thinned, many operators believed the agency needed to understand the harvesting operational costs involved and match the contractual requirements to these expenses. As stated earlier in the report, outdated contractual requirements (e.g. flagging skid trails) increased costs to the loggers. This was confirmed by Forest personnel who said the contract was “overregulated,” which increased operational costs.

3. **Cancellation ceiling:** Under the stewardship contracting authority, the USFS is required to set aside funds to cover contract cancellations (“default”); therefore, if a contract is cancelled, this assures the capital investments made by the contractor to fulfill the contract’s requirements are covered (Moseley and Davis 2010). The WMSP was no exception. According to operators and Forest staff, this obligation is detrimental to the stewardship contracting authority because with such a sizeable, costly contract,4 this tied up a large sum of money that could otherwise be used for on-the-ground stewardship work.

4. **Length of contract:** From industry’s perspective, business investments of millions of dollars will not occur on a 10-year contract. Most businesses believed with the onset of small diameter wood utilization, this was too short of a timeframe to have amortized investments, increased efficiencies, and developed markets. Although most enterprises believed a longer term contract with a certain guaranteed supply of raw material was needed, the 10-year timeframe did assist businesses with obtaining financing and these firms were able to realize some return on their investments.

5. **Subcontracted loggers hired by Future Forest, LLC did not have a written contract:** In the absence of a formal, written contract, subcontractors found it difficult to obtain financing for capital investments like equipment purchases.

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2 “Davis-Bacon Act and Related Act contractors and subcontractors must pay their laborers and mechanics employed under the contract no less than the locally prevailing wages and fringe benefits for corresponding work on similar projects in the area. The Davis-Bacon Act directs the Department of Labor to determine such locally prevailing wage rates” (USDL).


4 $5 million per year; however, this amount decreased incrementally as the contract progressed.
6. **Contracting at the Regional Office level:** The Contracting Officer’s Representative, or COR, was housed at the Regional Office in Albuquerque, New Mexico. The COR oversaw in-the-woods operations and this created “animosity” between the Region and the Forest—most of the CORs lacked a timber sale contracting background and had minimal knowledge of on-the-ground operations that were occurring in the White Mountains in Arizona. These issues were confirmed by many of the loggers who said most staff holding this position did not have the experience needed to understand the complexities of the novel harvesting operations occurring on WMSP sites. They added that the COR did not take the time to visit the sites to understand and observe mechanized harvesting operations. Therefore, the COR did not realize the disconnect between the contractual specifications and the new technologies/operational efficiencies gained by the loggers. These inconsistencies were compounded by high turnover rates.

**U.S. Forest Service Processes Used for the Stewardship Contract**

Generally, operators reported the agency’s administration and site preparation was timely and adequate. The agency hired outside contractors to increase their capacity to mark trees for harvesting. Once Future Forest, LLC established trust with various interest groups, the agency gained the social license needed to implement prescriptions through designation by description (DxD), which eliminated marking trees. This was a significant step to implement forest treatments more efficiently.

From the Forest’s perspective, their greatest constraint was funding, which affected their capacity to complete environmental planning and site preparation. In anticipation of budgetary constraints, the Forest strategized by completing “out-year” NEPA planning—knowing that NEPA takes a minimum of two years to complete, the Forest made sure NEPA-ready acres, known as shelf stock, was completed so the contractor was not delayed. However, funding limitations did not effect on-the-ground administration; the Forest provided adequate staff to administer released task orders. The Forest was flexible in administering task orders to meet the contractor’s needs. Forest staff explained this had not been the case in the past. For example, multiple task orders were available so the contractor could move from site to site to acquire the raw material to fill current market demands. Once task orders were complete, the Forest conducted implementation monitoring to ensure the contractor followed the prescription.

**Ecological Outcomes**

Generally, both the agency and industry believed the resulting forest treatments achieved the main objective, which was fire risk reduction in the WUI. In addition, they said these treatments also provided ecological benefits, such as increased diversity of wildflowers and grasses and improved wildlife habitat. Business owners said it “surpassed” their expectations. One business owner said, “I would give high marks for the thinning they did on the ground in the White Mountains.” Ecological monitoring conducted by the Ecological Restoration Institute (2010–2014) confirmed these observations and found treatments reduced predicted fire behavior (see pg. 36 for more information on ecological monitoring data).

As expected, treatments evolved as the project progressed. Initially, treatments were not thinned aggressively enough and residual stands were evenly spaced and uniform, known as jail bar treatments. These early treatment prescriptions were partially influenced by public opinion, and many believed if the public had been well informed and supportive at the time, the treatments would have evolved faster. An industry leader said, “We took baby steps to get to big steps.” In his opinion, the public had to see treatments in the field, with small changes occurring over time before they were comfortable with more aggressive treatments. “It’s critical to have public
support,” he said. Another business owner said, “At first, the public was skeptical, but as they saw the progress/motion, there was total buy-in.”

Past practices (e.g. high-grade logging) and the resulting distrust of the USFS caused CBD to petition for a 16-inch diameter cap. The Forest and CBD verbally agreed to consider and discuss a 16-inch diameter cap on a project-by-project basis. They scheduled site visits and conducted necessary discussions/agreements. This assured the environmental groups that large trees were not the priority for harvesting. However, Forest staff believed the diameter cap left an excessive amount of trees in some areas. In their opinion, this deterred the project from meeting the primary objective of fuels reduction and restoring the forest to resemble natural conditions. The staff member said that as the goals of the public became more ambitious, the NEPA planning documents became more complicated, time consuming, and costly.

A stakeholder said a demonstration project during the early years of the WMSP known as Eager South integrated fire risk reduction with multiple resource objectives (e.g. forest restoration principles and northern goshawk management guidelines). Trees greater than 16 inches DBH were cut and forest structure resembled historical conditions with clumps and groups of trees. Based on the Forest's fire modeling using a broad set of treatments, Eager South was the only treatment area that revealed statistically significant changes in predicted fire behavior. Lessons learned on the Eager South Project demonstrated that multiple resource objectives, including fire mitigation, could be achieved.

A restoration-based treatment in the Eager South Project area provided visible benefits after the 2011 Wallow Fire. In this photo, the hillside above the treated area in the foreground was untreated. Photo courtesy of TNC

As time went on, the public, stakeholders, scientists, and the agency agreed to adaptively manage treatments that thinned a greater number of trees and to mimic historic conditions with openings and arranging residual forest stand structure with clumps and groups of trees. “This was not full-blown systematic adaptive management that we idealize,” said a stakeholder, “but it was practical adaptive management that was afforded by the multi-party monitoring effort.”

The stakeholder added that because the project’s objectives focused on fuel reduction in the WUI, a broader application of forest restoration principles were not realized. With the focus on a relatively small footprint of
the WUI and ponderosa pine, he continued, many questions, such as effects to wildlife (e.g. MSO and northern goshawk) and mixed conifer, remained.

Although the majority of those interviewed believed ecological benefits were met, most thought more acres should have been thinned to further reduce fire risk. In addition, reentry thinning would likely need to occur in 15 years to maintain fire risk reduction and forest health. These considerations are especially critical when climate change effects are factored in—ongoing drought and higher temperatures are predicted to increase the likelihood of large crown-replacing wildfires and insect infestations (Westerling et al. 2006). Forest staff agreed and supported a more aggressive agency position by doubling or tripling the harvested acres. According to the Forest staff member, approximately 70,000 acres were treated, which is only about 7 percent of the one million acres of ponderosa pine forests on the ASNF.

Direct Business Effects

Innovations, Opportunities, Successes of the White Mountain Stewardship Project Firms

Guaranteed Supply

The most distinct advantage of the WMSP was the guaranteed supply of raw material. The WMSC provided needed assurances for businesses to grow and take risks. They were able to invest in infrastructure and develop new products and markets for small diameter wood. This guaranteed supply helped businesses secure financing. Without the contract, banks and other lenders would have been less likely to back the new business investments. According to one business owner, “The essence of a steward is that guaranteed wood is the right model in order to assure that private industry that has made multi-million dollar investments and bets can be assured that their wood will be there for use in their industry.” Moreover, with assurance of supply, businesses were able to focus on growth and development versus obtaining the raw material they needed to survive. According to a business leader, “[Before the WMSP], we worked harder trying to be in business than working at business.” This also provided assurances to the employees of these enterprises, which reduced turnover and the need to retrain the workforce.

Business Innovations and Efficiencies

The experience the WMSP provided to businesses faced with processing small diameter material was invaluable to their future business models. This afforded these enterprises the opportunity to experiment with and learn new technologies and “retool” equipment. Producers of finished products reported significant growth by adapting to commodities that were not tied to the depressed housing industry (e.g. treated agriculture posts and wood pellets). The mix of businesses evolved “organically,” a stakeholder explained. He said, “The dramatic change was they went from very little infrastructure and very little capacity to get work done, particularly in an organized manner, to having a well-honed tool that was shaped perfectly for the job.” This provided an unprecedented opportunity to harvest and process small diameter material at a relatively large scale. Once the WMSP was established, most firms reported increases in their profitability, while a few said it stayed about the same or reported unprofitable years.

As the project progressed, industry created efficiencies in harvesting, processing, and developing added-value
products. For example, logging operations developed processes to more efficiently procure slash as they harvested and moved material. Other operators reported they acquired and used new equipment more efficiently and assigned workers specialized tasks. A finished goods manufacturer explained that his firm developed efficiencies in production by redesigning peelers and adding chip bins to collect waste.

The Forest Energy plant, contracting partner of Future Forest LLC, is visited on a media tour. Photo courtesy of TNC

The Single Contractor System

Advantages of Single Contractor (Future Forest, LLC)

Future Forest, LLC was the sole contractor that oversaw the project. This presented the following distinct advantages:

1. The sole contractor acted as a broker of the raw material. They sorted it and distributed it to producers of finished goods, allowing for an efficient, regulated flow of raw material. One stakeholder said, “There was stability introduced into the system … that kept the wood flowing at a relatively steady pace” and made it possible for businesses to compete. This provided efficiency in directing the type of raw material to the appropriate processing facility. For example, saw timber was delivered to the Reidhead Brothers’ sawmill for pallet stock, clean chips were transported to Forest Energy for pellets, and dirty chips were trucked to Novo BioPower for energy.

2. Many loggers, subcontracted by Future Forest, LLC, felt secure in the process because they could count on being paid on time. “[Being paid on time] was a real plus,” said one logging operator. Another said it “was a huge benefit.” Operators explained that this was especially important in maintaining adequate cash flow with such slim profit margins. This model streamlined the process by allowing efficient transfer of funds whereby Future Forest, LLC paid the logging subcontractors, and the mills and other finished good producers paid the contractor for the raw material.

3. Future Forest, LLC provided credit terms to some of the finished producers. This allowed enterprises time to manufacture and sell the finished products, which assisted businesses with positive cash flow.

4. The single contractor eliminated the competitive bidding process, which can cause “bidding wars,” on timber sales for the logging operators. In essence, it prevented the larger companies with more capital from outcompeting smaller firms for the raw material.

5. The contractor committed resources to assist the development and reestablishment of the forest products industry in the White Mountains.

Agency processes and procedures that can be restrictive, time consuming and costly were alleviated with Future Forest, LLC overseeing the contract.
Varying Perspectives of the Single Contractor System

Business Perspective: Disadvantages to the Single Contractor Model

Future Forest, LLC was paid on average $500 per acre to remove trees from the forest. They controlled the timber supply, price, and distribution of raw material to various businesses in the White Mountains. Firms believed fostering competition was necessary for an open competitive market system to work. Given that the contractor lacked competition, the majority of those buying the raw material from Future Forest, LLC described their level of control over the market as a “monopoly.” Businesses believed the market should determine the price, not the contractor.

Business owners explained that initially this was not a significant problem because there was ample supply. But as the project reached the halfway point and supply began to dwindle, it became a critical issue. As enterprises built demand for their products, raw material was harder to obtain and costs increased. A business owner said he was unable to negotiate costs. He said, “it’s either I buy it or I don’t.” Another said, “[The contractor] controlled your money and livelihood.” He continued to explain that although the contractor was subsidized and likely increased efficiency in their operations, the price of the raw material never decreased. Instead, the price increased as the project progressed. One business leader said, “In the beginning we were all working together to develop small diameter value, and then as it progressed, the [steward] became our competitor rather than our supplier.”

Businesses assumed the contractor’s price was inflated because if a company refused to buy the material at the asking price, the contractor hauled the wood/biomass twice the distance. Additionally, many business owners supposed if they were not part of the contractor’s “inner circle,” they may have been excluded from receiving material altogether. Or, they may have been charged higher prices for comparable or lower grade material—these perceptions were shared among most of the firms interviewed, whether they were loggers, millers, or manufacturers. The contractor was described as “manipulative” and refused to work with logging operators who would not meet demands like leaving the byproducts (slash) for the contractor to remove. This created a hostile, competitive, non-collaborative business environment within the region and “defeat[ed] the concept of stewardship,” a business owner said.

The supply and pricing limitations defeated the forest cluster industry model, which deterred business growth, the creation of higher value-added products, and the cooperative spirit a burgeoning forest product industry needed to survive. Businesses agreed that without these challenges, more acres could have been treated and the cost per acre would have been reduced because increased profit margins would allow enterprises to pay higher prices for the raw material.

Forest Staff and Stakeholder Perspectives: Advantages to the Single Contractor Model

Although most firms believed improvements could be made with a sole contractor model, a Forest staff member held a different point of view. Forest staff explained that Future Forest, LLC was thinking long-term by attempting to estimate future costs of the raw material. That, in theory, when the subsidy ended, the price enterprises were paying were in line with current economic conditions (factored in inflation). Moreover, Forest staff pointed out, Future Forest, LLC provided credit terms to many of these businesses and it was reported that some of these firms were late paying their loans back. If this was the case, the contractor did not provide...
them raw material until the balance was paid off. In the end, the recession was a major factor in deterring the project’s progress and, Forest staff believed, this caused Future Forest, LLC to be blamed as a “scapegoat” by some enterprises.

One stakeholder interviewed supported the single contractor model and said that if the Forest had alternatively administered several small timber sale contracts in a competitive bid process, it might have negatively affected the success rate of the project as well as business stability. A Forest staff member agreed and said that when the Forest released and awarded 20 smaller salvage logging timber sale contracts after the Wallow Fire, approximately 40 percent of the awarded contracts were terminated for a variety of reasons (e.g. contractor could not complete and/or lacked the funds).

In the end, although firms had grievances with the sole contractor system, most believed the WMSP successfully restored forest health in the treated areas, reduced the risk of unnatural severe wildfires, and helped to reestablish and revitalize the forest products industry, the economy, and communities in the White Mountains.

Lumber and timbers at the Reidhead Brothers Lumber Mill in Nutrioso, Arizona.  
Photo courtesy of Mottek Consulting

Overall Impact to the Forest Products Industry

Types of Products and Industry: Forest Industry Cluster Model

Products Produced

Four types of materials were provided through the WMSP: 1) dirty chips (including bark), 2) clean chips (excluding bark), 3) round wood (5 to 9 inches DBH), and 4) saw timber (greater than 9 inches DBH). Since the project focused on harvesting primarily small diameter trees and removing and using biomass, saw timber was a smaller portion of total production than in the past and biomass utilization (dirty chips) was completely novel. A logging operator said that on average his operators extracted half a truck-load of logs to a load and a quarter of biomass. Forest staff reported similarly a two-to-one ratio of saw logs to biomass. Over the course of the project, more than 24 small forest products firms were involved in harvesting and processing these materials.

To produce a marketable finished product for small diameter ponderosa pine, mill operators produced green pallet stock (not kiln dried), also known as “rough-cut green timber.” Operators called this a “sweet spot” because they were able to realize an adequate profit margin. One mill operator said that if the markets were better at the time, producing full-service, finished products that were dried, planed, and graded, such as dimensional lumber,
could have increased profit margins. However, considering the lack of kilns to dry the lumber, coupled with the depressed economic conditions and housing market, producing green pallet stock was the best solution at the time. The majority of pallet stock produced were exported to Mexico, which was dependent on fluctuations in the exchange rate and could limit exports if the rate was unfavorable. The Vaagen Brothers Lumber mill, a high-speed small diameter mill, was an exception. It primarily produced square cants (4x4, 6x6, 8x8), also exporting these products to Mexico. Energy products, such as pellets for heating structures and bio-power, utilized clean and dirty chips. Other products manufactured included: mulch, livestock bedding, pressure-treated agriculture posts and poles, cabin manufacturing products, siding, molding, decking, and furniture parts.

A treatment plant that arose from the Woody Biomass Utilization Grant program developed an innovative method for treating posts and poles for outdoor uses like vineyard posts and fencing. One of the goals of this product line was to produce ponderosa pine round guardrail posts for highways in Arizona. The ponderosa pine round guardrail post underwent testing by the Arizona Department of Transportation (ADOT) to determine whether this species could be used as a surrogate for the standard 6x8 square posts made most commonly of Douglas fir and southern yellow pine. Since ADOT increased the soil compaction requirements, the test resulted in producing a minimum 8¾ inch (+ or – ½ inch) diameter round post, which was one inch greater (7¾ inch) than what is most cost effective to produce. The business owner said that while there was ample material in the forest to manufacture the posts, they did not receive enough logs from the WMSP to produce the quantities and qualities required for production. If the supply issue was resolved, retesting the ponderosa pine round posts with the former soil compaction requirements would help sustain the product line, but the test was expensive (more than $100,000). The firm was not willing to pursue further testing without assurance of a raw material supply.

**Forest Industry Cluster**

Businesses described the importance of establishing a forest product industry cluster model in the White Mountains that created a balanced system and assured the viability of all business sectors. Many firms developed niches and levels of expertise (e.g. logging, power production, milling, manufacturing value-added products, etc.) that not only provided less competition for products/services within the cluster, but also promoted efficient use of all segments of the log. A business owner said, “We have to all exist; if just one of you is there, the whole thing doesn’t work.”
**Types of Industry Matter**

Businesses emphasized the types of industry that can process various segments of a tree were critical to establish a productive forest industry cluster in the White Mountains. A biomass power plant is a “key mechanism to forest health,” one owner said. The biomass plant allowed for the removal of more material from the forest. This increased production per acre, further reduced fire risk, and was a cost savings to the Forest (i.e. the Forest did not have to pile and burn the slash).

This model promoted the highest and best value of production and price of finished goods. For example, the Vaagen Brothers Lumber mill bought superior grade saw logs at a higher price than Forest Energy that used forest byproducts (clean chips), a lower valued material. This model does not work if a primary consumer, such as a biomass energy plant or a high-speed, high-production sawmill, is missing.

![Photo courtesy of TNC](image.png)

However, this model faced challenges like inflated prices for raw material (especially in the last 3–5 years) as well as lacking a large, high production sawmill. High production sawmills serve as primary economic engines that can buy/utilize the highest valued material (the Vaagen Brothers Lumber mill only operated from December of 2012 to October of 2014 and was limited to processing small diameter logs, 5.5–13.5 inches DBH). According to business owners, another valued and necessary component of this model were companies that provided a relatively large number of high paying, benefit eligible jobs (e.g. the paper mill employed more than 300 benefit eligible positions).

**Location of Industry Is Important**

Due to high transportation costs, it was critical to reduce haul distances to processing facilities, especially when the material was low-value biomass. To sustain an economically viable model, Forest staff said that harvesting operations should lie within a 50- to 70-mile radius of processing facilities. Also important was locating mills centrally within the project area as well as having access to water and a railroad system. To operate cost effectively, biomass plants need to minimize haul distances more than any other consumer.

**Markets Matter**

According to business owners, business growth in the White Mountains was spurred by the WMSP. But demand dictated the types and quantities of products the market was able to absorb. For example, a firm’s
president explained that the market was limited for products like vigas (a whole-log rafter used in southwestern style homes) and mulch. If too many firms produced these products, the market would become saturated and it would cause the price to drop to a point that a suitable profit margin could not be realized. Therefore, developing innovative products that had a market and commanded the highest value was a necessary consideration in finding a productive business niche. One business described the change in their production as almost doubling, going from using 35,000 tons to 60,000 tons of material; however, this increase was due to both the WMSP and to market conditions.

**Forest Product Industry and Business Barriers and Challenges**

**During the White Mountain Stewardship Project**

**Lack of Infrastructure, Market Development, and Low Profit Margins Drove Inefficient Use of Raw Material**

The lack of industry to process high valued products, coupled with the volume that was being extracted from the forest in the first years of the contract, forced the contractor to utilize the wood any way that they could. As a result, whole trees were chipped for lower valued products like pellets.

In addition, businesses in the White Mountains reported minimal profit margins. Producers often processed the raw material at the lowest cost, a business president explained, using the easiest, fastest method that yielded the highest production. According to a business owner, this method kept businesses afloat and gave them the margin they needed to survive. For example, instead of distributing the various segments of a tree (e.g. saw logs, round wood, clean chips and dirty chips) to producers across the industry, whole trees were chipped for biomass. Adding to this, a mill to process larger logs was missing. For example, one of the existing mills in the WMSP area (the Vaagen Lumber mill) processed smaller logs—5.5 to 13.5 inches DBH. This resulted in chipping the large material rather than yielding the highest and best use for the logs.

**Effects of the Wallow Fire**

In the summer of 2011, the Wallow Fire burned more than 500,000 acres in the White Mountains. The Wallow Fire was comparable in size to the Rodeo–Chediski Fire in 2002. However, because of forest treatments implemented under the WMSP, the Wallow Fire burned less severely in treated areas and destroyed fewer structures than the Rodeo–Chediski. According to the report, "How Fuel Treatments Saved Homes from the Wallow Fire," earlier treatments outside of the WMSP that thinned fewer trees burned more severely than WMSP treatments (USDA 2011). This was also verified in a study conducted by Waltz et al. (2014) where findings revealed fire severity was noticeably lower in treated versus untreated stands. According to FirefighterNation.com (Devone-Pacheco 2011), a total of 36 structures (32 homes and four commercial buildings) were lost in the Wallow Fire compared to 490 structures in the Rodeo–Chediski (WFLC 2010). Regardless, this fire was devastating to the ecological, social, and economic conditions in the White Mountains.

The Wallow Fire occurred three years before the WMSC expired in 2014 and it contributed to the lack of wood supply. About 50,000 NEPA-approved acres burned in the fire. This severely limited the available green, or unburned, acreage available to the contractor and subcontractors. After the fire, the focus and majority of the work available on the Forest was salvage logging. According to a Forest staff member, “A lot of projects fell off the shelf then because they were burned up … they hadn’t been treated yet.” For some mills, such as Vaagen Brothers
Lumber, it could not retool fast enough to process the larger salvage trees. Burned trees have a harvest window before insects invade and logs deteriorate and lose value. The NEPA planning necessary to approve many areas for salvage logging took too long. There was little federal government assistance and businesses were frustrated that the Forest did not have a contingency plan.

In looking back, both the Forest and industry said they believed the WMSP should have worked more aggressively to harvest more acres before the Wallow Fire ignited, seven years after the project was initiated. However, there were constraints to treating acres at a certain pace and scale. For one, there was a lack of USFS funds to subsidize the project beyond approximately 5,000 acres per year. There was also a shortage of infrastructure to quickly process the material (e.g. Vaagen Brothers Lumber high-speed mill started too late).

In 2011, the Wallow Fire burned more than 500,000 acres in the White Mountain region and replaced the Rodeo-Chediski Fire as the largest fire on record in Arizona. Photo by Jayson Coil, USDA Forest Service

Had more acres been thinned, a business owner speculated, the outcomes of the fire might have been much less severe. However, one Forest staff member said that simply doubling the treated acres would have barely made a dent in the number of acres that needed treatment on the ASNF.

The Forest Service Was Thinking Too Small

Limited supply (initial offering of 5,000 acres annually), Forest staff explained, was not enough to substantially increase the capacity of existing firms and attract qualified new businesses that were needed to expand industry in the region. He added that the agency was thinking “too small” and this had a profound effect on the outcomes for industry and the project as a whole.

Inconsistent Supply, Diminished Interest/Support as the WMSP Progressed

Most businesses reported that during the last four to five years of the WMSP, supply of raw material diminished, while the number of businesses competing for the material increased. Although the Forest developed a five-year work plan that was clearly communicated to industry, many firms said they were out of logs. Businesses reported that the contractor’s price for the raw material became so high that it was impossible to realize a profit. Smaller firms were either outcompeted by the larger enterprises or were eliminated from the supply stream altogether.
Now halfway through the WMSP, the reliability of the wood supply was in question. Further business investments and growth were deterred. During this time, some businesses closed and others moved toward finding alternative sources of raw material. For example, the inflated prices caused Novo BioPower to purchase only 10 percent of its material from the WMSP. The majority of the material came from timber sale contracts outside of the WMSP and from thinning contracts in areas that contained pinyon-juniper. Novo BioPower also used green waste (approximately 5–15 percent of total production)—a inferior source of raw material—which was trucked on a backhaul approximately 175 miles from Phoenix to Snowflake, Arizona.

The Four Forest Restoration Initiative (4FRI) became the largest stewardship contract in the nation in 2012. Its purpose is to restore 2.4 million acres across northern Arizona (USDA 2015). As this project was gearing up, many understood that the focus and support from the USFS, stakeholders, and interest groups shifted from WMSP to 4FRI. One business leader said, once 4FRI started, “The old horse and the old dog didn’t look good anymore.” Industry in the White Mountains saw a shift in interest and continuity in the project because 4FRI was not subsidized—the WMSP cost the federal government $500 per acre, while the 4FRI contract expected a positive net cash flow that is dependent on the biomass to saw log ratio on each task order. According to the business leader, 4FRI slowed down the work on the WMSP. He said he understood the problem was the money was tight but the work was needed because it was important preventative maintenance. “When you see the fire raging over that mountain toward Alpine and you think the town is going to go and then it laid down [due to restoration treatments], that’s worth a lot of money.”

**Other Challenges Facing Businesses and Industry**

Businesses identified other extraneous factors that had a negative impact on the progress and success of the WMSP. Some key challenges are detailed below.

1. **High transportation costs.** Many factors contributed to high transportation costs:
   a) Over the course of the project, diesel fuel prices rose more than expected;
   b) Arizona had lower weight restrictions for logging trucks relative to other Four Corner states. For example, at the time, Arizona’s weight limit (80,000 pounds per truck-load) was lower than that of New Mexico’s (86,400 pounds per truck-load) (FHWA 2000); and
   c) The White Mountains are located in a rural area associated with longer haul distances.

2. **Federal environmental analysis planning timeline.** The timeline to complete the environmental analysis was a common grievance among firms in the White Mountains. This was especially apparent and significant when the NEPA analyses timeline exceeded the shelf life of the burned trees in the Wallow Fire. However, as stated earlier in the report, Forest staff noted that the emphasis given to certain public interests (e.g. Mexican spotted owl and goshawk provisions) resulted in NEPA planning documents that were more complicated, time-consuming, and costly.

3. **Government regulations made it difficult to compete in a global market.** Enterprises believed federal government regulations included in the NEPA process increased their costs. One business owner said, “It’s the cost in dealing with the government.” For example, this owner said the price of Canadian wood was lower
than a comparable product in Arizona at the time mainly because Canadian firms privately own and operate their land and do not face government regulations.

4. **Economic downturn.** The timing of the recession, about half way through the project, and its effect on the housing industry and related products was a major deterrent. Most interviewees believed it had a profound effect on overall project outcomes.

5. **Lack of a qualified, trained, dedicated workforce.** Many firms reported adapting the workforce to produce an acceptable quality and quantity of work was a constant challenge. As an example, a firm’s operating manager cited a lack of work ethic in maintaining older milling equipment. Workers waited for breakdowns rather than practicing preventative maintenance. Some businesses reported this was overcome by paying higher wages and obtaining better quality employees. Mill operators eventually changed this culture, which ultimately prevented downtime at the mills.

While these external factors negatively impacted the outcomes of WMSP, it is to be expected that any long-term project will face uncertainties.

**Collaboration**

Prior to and during the WMSP, several associations and collaborative groups emerged.

**Multi-Party Monitoring Board**

The White Mountain Multi-Party Monitoring Board (hereafter Board) consisted of a diverse set of stakeholders charged with monitoring the WMSP. Stewardship contracts are required to form multi-party monitoring boards to monitor and assess project treatments. Initially, Board members were appointed by the Forest Supervisor, which ensured a broad representation of interests. The Board oversaw ecological and economic monitoring and completed monitoring projects that the USFS did not normally do. However, a Board member explained that the group lacked resources for a concerted effort in outreach and social monitoring. Regardless, this exceeded the agency’s “normal monitoring practices,” a Forest staff member explained, and the Forest was supportive of the Board’s efforts.

The Board provided various stakeholders, including environmental groups, the opportunity to consistently and continuously engage in the process. A stakeholder said, “[Based on the funding that was available to the Board], it was a modest effort but a significant one.” The Nature Conservancy (TNC) played a key role in monitoring and was an intermediary between the Forest and environmental groups. TNC was trusted by many and seen as a neutral group that provided monitoring data. They brought a level of assurance that project effects would be measured, tracked, and reported back to the agency, stakeholders, and the community.

According to one stakeholder, given the small amount of funding received by the Board each year and the projects they chose, the monitoring group was able to represent the needs of multiple organizations. For example, the Board monitored treatment effects on black bear habitat and habitat connectivity of Abert’s/red squirrels and Merriam’s wild turkey. Further, economic monitoring and reporting spanned the entire project (2005–2014). Monitoring at this scale was ground breaking for federal forested lands. In 2010, the Board produced a report that summarized results of the first five years of the various monitoring efforts (Sitko and Hurteau 2010). A Board member said these results could be used to plan future treatments.

Assessment reports from 2005 to 2014, as well as other reviews and reports, are made available by the Apache-Sitgreaves National Forests and the White Mountain Stewardship Monitoring Board: http://www.fs.usda.gov/detail/asnf/workingtogether/partnerships/?cid=stelprdb5207073
Scientists from NAU’s School of Forestry and the Ecological Restoration Institute provided scientific expertise for the Board. Scientists assisted with two additional monitoring reports for the second phase of monitoring (2010–2014). They measured various ecological indicators (e.g. tree species/diameters and woody surface fuels) to answer four monitoring questions (Chancellor et al. 2013 and 2015). The monitoring questions and a brief summary of the findings are provided on p. 36.
**Question 1:** Is there a difference between pre-treatment crown fire potential and post-treatment desired fire behavior across selected analysis areas?

**Findings:** Treatments resulted in reductions in predicted fire behavior and changed from active pre-treatment crown fire potential to passive post-treatment crown fire potential.

**Question 2:** What proportion of treated acres exhibited a change in Fire Regime Condition Class from 2004 to 2014?

**Findings:** Treatments moved the forest along a trajectory toward less ecologically departed stands, similar to historic conditions. The changes were very small, which is expected at the small scale of these treatments.

**Question 3:** Are patch sizes of denser (e.g. untreated or lightly treated) areas connected? What is the range of areas and sizes of these patches?

**Findings:** Connectivity of untreated and lightly treated areas was generally low across the project areas that were treated. However, little information is available to guide restoration prescriptions at emulating natural landscape patterns and there is no research to date that has indicated large patches of closed-canopied forest prior to historical fire regime disruption.

**Question 4:** Are exotics/invasive species present at landings and slash piles? Identifying landings and slash piles following the Wallow Fire was difficult; therefore, this question was modified to also examine if these species are more commonly found in the WMSP area in various microsites (type of ground cover and its density and the amount of sunlight were measured).

**Findings:** 1) Most invasive species were either in full sun or partial sun and none were found in predominantly shaded microsites; 2) The majority of invasives were found in areas of full sun and bare soil, but they were also the predominant ground cover in areas of partial sun and litter; 3) Most invasive species, with the exception of bull thistle, were recorded in recently burned areas; and 4) Less than 2 percent of invasives were in areas with evidence of landings or slash piles, and 14 percent were recorded on roads or skid trails.

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**Interest Groups and Non-Governmental Organizations**

Notable associations and collaborative groups such as Northern Arizona Wood Products Association, Little Colorado River Plateau Resource Conservation and Development, and the Southwest Sustainable Forest Partnership were important linkages with the wood products industry. In addition, the NRWG, forming prior to the WMSP, continued to work and collaborate throughout the life of the project. A stakeholder described the long-lasting relationships within these organizations and their interactions with the Forest as a testament to the commitments that provided “open, strong, and enduring” relationships. “We weren’t casual partners. The stakes were real high.”

The USFS, Future Forest, LLC, the CBD, TNC, and other stakeholders came together in an unprecedented unified approach that paved the way for a new era in collaborative forest management. These organizations understood the value of listening to others’ points of view and were able to compromise to meet common goals.
For example, Forest staff said they would inform concerned stakeholders (i.e. CBD) if trees larger than 16 inches DBH were considered for harvesting. Next, the Forest’s silviculturist would meet stakeholders on project sites to discuss implications. A Forest staff member said this helped to inform all parties of the proposed actions upfront before any trees were cut, rather than be challenged after implementation. This strategy was highly successful throughout the project, and as trust in on-the-ground implementation increased, on-site visits became less necessary.

“A stakeholder provided another example of compromise between conservation groups and the agency. During the planning stage of the Eagar South Project, the Regional Office released new goshawk guidelines that concerned some stakeholders. The stakeholder recalled that it created “a huge amount of tension into a local collaborative situation.” The interest group worked with the Forest Supervisor and the silviculturist to overcome this issue; however, this stakeholder believed that the Regional Office was distant and uncooperative later in the project. Another stakeholder said that a novel project like Eagar South needed “a spirit of experimentation and flexibility” from everyone involved. The stakeholder emphasized that it was important to forgo agendas and try new approaches like cutting trees greater than 16 inches DBH. The stakeholder continued to say, “It may not be perfect on every acre, but when you see the green trees standing after the Wallow Fire, we knew we did something right.”

Collaboration within the U.S. Forest Service
Regional Office and the Apache-Sitgreaves National Forest

Businesses reported that at the start of the project, Regional and Forest leadership were project supporters and proponents. Seen as project “champions,” they were largely responsible for the first 10-year stewardship contract in the nation going to the ASNF and not to other Forests competing for the project. In addition, these leaders worked together to reach project goals like strategically placed forest treatments in WUI areas. An industry leader said there was “agreement and total transparency [between the Forest and the Region].” Another business owner said, “It was the right people at the right time,” and that “it was a true partnership.”

However, after the first five years of the project, the Forest and the Regional Office were challenged by a lack of funding. Assurances of continued funding were uncertain for a period of time. This was due to a decrease in the national budget, which funneled down and affected USFS budgets. In effect, the $5 million budget for the WMSP was the entire Region’s timber program budget (planning, site prep, and administration). A Forest staff member said it was difficult to keep the project on track with the Regional Office. The staff member continued to say, “People weren’t trying to deliberately undermine the experiment … It’s because the experiment was complicated and was not well understood.”

High turnover rates, which are common in the USFS, also presented challenges for the WMSP. When new leadership stepped in, they lacked knowledge of the project’s history and it often led to inconsistent visioning and inefficient and unproductive on-the-ground decision making. When the first Forest Supervisor left about half way through the project, it also presented problems for the Monitoring Board because they lost the administrative assistance that was initially provided by the Forest.
Apache-Sitgreaves National Forest and Other National Forests in Region 3

As the project progressed, the ASNF developed a track record for on-the-ground accomplishments, while other Forests in the Region had projects tied up in legal challenges or were unable to conduct prescribed fires due to unfavorable conditions. Meanwhile, other Forests in Region 3 were disgruntled by the notoriety and funding the WMSP received. Other units were concerned the ASNF was taking too much of the Region's budget and believed that the WMSP was costing the agency more than was expected to accomplish the goals of the project. On the other hand, an ASNF staff member spoke about his frustration over other Forests’ perceptions. He did not believe the ASNF was appropriately recognized for its substantial accomplishments and contributions in the Region.

Business Collaboration with the Apache-Sitgreaves National Forest

Logging operators reported cooperative and productive working relationships with the Forest. Because the Forest was familiar with the landscape, mechanical operations, and the needs of the logging operators, contract administration and oversight was in line with on-the-ground operations. Operators said the Forest was flexible, and their “openness to sharing and learning stood out.” Staff worked hard to incorporate operator needs and geographically balanced harvesting with business locals. Businesses reported strong relationships with the Forest Supervisors often referring to them as “champions.” One business owner said, “I would give five gold stars to the local [Forest] Supervisor.”

From the Forest’s perspective, there needed to be a fine balance between a strong industry partnership and a “hands-off” approach. The Forest was aware of the public wariness that the agency and industry would revert to former practices of high-grade logging. However, the Forest understood the risk businesses faced and worked closely with them to understand their needs.

While the Forest tried to work with industry in the later years of the project, industry began to develop plans for expansion without consulting the Forest. This led to unrealistic expectations and resulting disappointments for industry. In addition, the Forest was uncertain of the various business relationships and who the contractor was representing. The communication gaps resulted in infighting and unrealistic demands for raw material supply that subsequently drove a wedge between the Forest and industry.

“Collaboration nurtures efficiency, but when supply is tight, this goes by the wayside.”

Direct Business-to-Business Collaboration

There were times when raw fiber value was not optimized because the segments of the log were not distributed to specialized facilities for processing. Instead, whole trees were chipped for lower valued products such as pellets and bio-power. In the project’s later years, it became more prevalent because prices for raw material spiked. This increased competition for the raw fiber and broke down trust among industry sectors. These factors depleted the collaborative spirit needed for a healthy forest industry cluster. One business owner said, “Collaboration nurtures efficiency, but when supply is tight, this goes by the wayside.” However, when there was sufficient raw material available during the early years of the project, collaboration among industry was much stronger.

The WMSP motivated Vaagen Brothers Lumber and Novo BioPower, two major industry players, to establish facilities near the project area. Private firms formed critical partnerships and alliances. Since the WMSP ended, Vaagen Brothers Lumber, Novo BioPower, and Tri-Star Logging have joined together to form a new company, Novo Star.
Tri-Star Logging, which primarily harvests trees, forged a partnership with Novo BioPower and Vaagen Brothers Lumber to form a new company Novo Star.

Photo courtesy of ERI

This new partnership is an example of a healthy forest industry cluster: Vaagen Brothers Lumber processes raw fiber into value-added finished products, Novo BioPower utilizes the byproducts from the sawmill for energy, and Tri-Star Logging harvests trees. A substantial portion of the company’s output is chipped biomass, which eliminates transportation cost of the lowest value material. A business owner described this as, “Twenty loads of logs turns into 14 loads of biomass and instead of just putting it on a truck and trucking it somewhere, [my company is] going to convey it to a pile [here] and burn it.” About this new partnership, one stakeholder said, “[This] mill infrastructure fits the agreement perfectly ... the appropriateness of being the right tool for the job really stuck.”

Rural Economic Development and Community Outcomes

Economic Effects

Most respondents believed economic effects of the WMSP were substantial to the White Mountain region. However, Bureau of Labor Statistics data from 2014 reveal the number of businesses in forestry and wood manufacturing in Apache and Navajo counties dropped from 27 in 2005 to 21 in 2014, and they reached their highest level (29 businesses) in 2006 (Fig. 5). Employment also dropped in Apache and Navajo counties, from 452 in 2005 to 278 in 2014 and peaked in 2006 (453 jobs) (Fig. 6). Decreases in these indicators could be explained by: 1) the inclusion of one-time data reporting from a large milling facility located in Phoenix, Arizona (this resulted in high figures in 2005/06); 2) the closing of Fort Apache Timber Company mill (2008); 3) the recession (peaked in 2008/09); and 4) the Wallow Fire (2011). Although trends show a decrease in the number of businesses and employment over the course of the project, the WMSP facilitated a diversity of potential jobs at relatively high pay scales. Considering the economic downturn and effects from the Wallow Fire, most of the WMSP related businesses were able to maintain their businesses and adapt their business models to these changing factors.

Similar to the 2014 Bureau of Labor Statistics findings, WMSP economic assessments (2005–2014) demonstrated jobs for businesses related to WMSP ranged from a total of approximately 160 to 460 per year (see Appendix B.1 for the estimated WMSP employment impacts over the 10-year period). Additional analyses were conducted for the final two years of WMSP and are summarized on the next page.

6 To be consistent with previous economic monitoring reports and allow comparison over time, all employment impacts were calculated based on the Economic Base Theory and predetermined multiplier (1.63).

7 We used the economic impact modeling software IMPLAN 3.0 to describe the contributions of the WMSP to the local economy for 2013-2014. For more details on the methodologies employed, see the 2013-2014 Economic Monitoring report.
In 2013 the WMSP-related businesses in the region generated (proportion directly attributable to WMSP):\(^8\)

- more than 242 local jobs (51 percent),
- $13 million in wages (45 percent),
- $106 million in economic output/value of production (24 percent), and
- $13 million in state and local tax revenues, including personal taxes and taxes on production and imports, such as sales and property taxes, motor vehicle licenses and severance taxes (13 percent).

In 2014, the WMSP-related businesses in the region generated:

- about 292 local jobs (41 percent),
- $17 million in wages (34 percent),
- $118 million in economic output (21 percent), and
- $16 million in state and local tax revenues (11 percent).

![Total number of businesses in forestry and wood manufacturing.](image)

**Figure 5. Total number of firms in forestry and wood manufacturing in Arizona and Navajo and Apache Counties.**


The NRWG and Northern Arizona Wood Products Association conducted a survey of enterprises in the White Mountains that revealed capital investments made by these businesses totaled more than $130 million over the course of the project. The project also contributed to increased revenues for associated businesses such as auto/equipment parts, diesel fuel, utilities, and the real estate market (multiplier effect). For example, a milling firm reported local expenditures of: $26,000 on diesel fuel each week, $300,000–$400,000 in utilities annually, and $4,000–$5,000 on equipment parts each month. In addition, increases in retail sales added to the tax revenue base of local and state government.

\(^8\) The proportion of economic impacts attributable to WMSP is calculated based on the purchase ratio from Future Forest, LLC.
Figure 6. Total employment in forestry and wood manufacturing in Arizona, Navajo and Apache Counties. 

Most respondents believed the majority of economic effects occurred in the White Mountain region. However, some products were distributed throughout the state (e.g. vineyard posts, mulch) and some were distributed nationally (e.g. pellets) and internationally to Mexico (e.g. pallet stock). Equipment purchases were exclusively made out of state (Davis et al. 2014).

Social Effects

Overall, the project improved the residents’ quality of life in numerous ways across the White Mountains. First and foremost, residents witnessed the positive impacts treatments had on fire behavior and post-fire effects during the Wallow Fire—the fire was stopped before burning into many communities and destroying homes. According to Forest staff, the project received tremendous support from the community because they experienced the
The devastating effects of the Rodeo-Chediski Fire. Community members understood treatments were necessary to protect their community. The work the White Mountain Apache Indian tribe completed on tribal lands assisted with fire prevention measures on federal lands. Many respondents reported the White Mountain Apaches had been proactive in implementing forest treatments that assisted in reducing the fire’s advance in both the Rodeo-Chediski and Wallow fires.

The fear of fire caused towns in the White Mountains to compete for forest treatments. Harvesting operators said, “We had people pulling over telling us what a good job we did,” and, “The whole mountain embraced the thinning.”

One stakeholder said the local socio-political environment of the White Mountains community was fairly cohesive and, in his opinion, not as fragmented as other communities across the Southwest. The culture allowed for scaling up and working cooperatively on a relatively large project like the WMSP. The stakeholder added that the support from community members was “almost universal, kind of dramatic in its own right.” He added, “[I] can’t imagine an effort that was more supported.”

Although local residents were behind the project, many respondents stated seasonal residents, such as those living in Pinetop/Lakeside, were not as supportive. Since they did not live there year-round, they did not have first-hand experience of devastating wildfire impacts. They also had a different perception of what the forest should look like and preferred what they were used to seeing, which was untreated, dense forests.

Public opinion evolved to support forest treatments as the project progressed, but business owners felt that continuous positive messaging was critical. A business owner said, “[We] have to have a unified message so the public understands the value of the forests.” He added it was important for the public to also understand the overall value the forest provides in the form of ecosystem services (e.g. scenic beauty, watershed and wildlife values, recreational opportunities, etc.). A business leader agreed and said, “The benefits that come from forests are unbelievable, because they are renewable resource.”

“We have to have a unified message so the public understands the value of the forests.”
Overall Impact and Successes of the White Mountain Stewardship Project

When asked about long lasting successes of the WMSP, individual business, forest product Industry and overarching legacies of the project were identified.

The WMSP maintained generational family businesses. One of the most significant legacies of the WMSP was the ability to maintain generational family businesses. Several of these operators were fifth and sixth generation loggers. Many of these business owners recounted their family’s involvement in the timber industry and how the WMSP provided the opportunity to continue the family legacy. The WMSP proved that these firms were critical to the industries’ culture and their value and contributions should be preserved. One business owner said, “We can’t stop, it’s in our blood; we just keep trying and trying.”

Reestablished forest products industry. The WMSP revitalized a forest products industry that had once thrived in this region. The USFS, interest groups, and citizens understood appropriately scaled industry was necessary for project success and past perceptions of industry as a contributor to degraded wildlife habitat and forest health slowly waned. The WMSP also demonstrated that industry could process small diameter wood at a relatively large scale. Given the challenges that industry faced, they were able to conceptualize and produce added value products and build an efficient and effective forest industry cluster model. Forest staff said the most remarkable success was the stewardship project itself. “It was a huge bold step into the unknown and all the folks that were involved in that creation deserve a huge pat on the back.”

It was a huge bold step into the unknown and all the folks that were involved in that creation deserve a huge pat on the back.

Acres treated and the impact and benefit to forest health. Many business owners said that the greatest benefit and most laudable success of the project is witnessing first-hand the treated forest. The positive impact to forest health, watershed resiliency, and wildlife habitat was a huge benefit and a substantial savings and investment for national, state, and local governments as well as private utilities (e.g. Arizona Public Service and Salt River Project) that provide water and power to residents across the state. A CEO said, “A lot of people deserve an award for that.” A Forest staff member said, “It is probably one of the most outstanding achievements of the White Mountain Stewardship Contract … that work was accomplished.”

Cooperation among USFS, stakeholders, and citizens. Considering the social/political climate prior to the WMSC, including the MSO controversy that according to one interviewee “choked and killed the industry,” many highlighted the project’s successful collaboration. In the contract’s 10 years, there were no legal challenges or appeals to slow or stop treatments.

The Forest, contractor, and interest groups decided to focus on the majority of issues that they agreed upon, rather than a few issues where there was disagreement. A representative of a conservation group interviewed said it became clear the contractor and interest groups held similar objectives. They said, “We moved from being a watchdog group to a true cooperator and collaborator.” The environmental groups in the White Mountains also kept outside interest groups (e.g. Wild Earth Guardians) disengaged because they had trust that conservation groups directly involved would represent their interests.

A Forest line officer understood the need to foster cooperation because, they said, this was not “business as usual.” The line officer understood compromise was needed and said, “[It is time to] let them feel victory.” Another representative from the Forest said, “The 6,000 to 8,000 acres that were accomplished every year were actually
done, so I give big kudos to everybody involved—the Forest Service, the environmental community and the contractor—in having a relationship there that allowed that work to be done.” This level of cooperation was a formidable shift in values and had a profound effect on the success of the WMSP. The collaborative relationships serve as a model for a similar community-based project.

Community impact was profound. There was a notable economic impact from the WMSP on the small, rural communities scattered throughout the White Mountains. Similarly, a stakeholder said, the WMSP created a “significant” amount of community pride. After the Rodeo-Chediski Fire, the community faced problems head-on and developed solutions to prevent another severe wildfire. A Forest staff member said the success of treatments in the Wallow Fire “galvanized” community members, and the “finger-pointing” from the Rodeo-Chediski Fire faded. “When the Wallow fire came over the hill, it worked and what a great feeling,” a stakeholder said. “That success is pretty amazing,” He added that the Wallow Fire marked a new era of cooperation and collaboration by “pivoting on the future, rather than dwelling on old battles.” The focus also turned to sustaining forest health for future generations.

Reduced wildfire risk and saved communities: Wallow and San Juan fires as evidence. Evidence from the Wallow (June 2011) and San Juan (June 2014) fires showed that fire risk was reduced and forest treatments worked. In the absence of a guaranteed supply and an industry to process the raw material, most respondents believed the fires would have had devastating impacts. Business owners said that during the Wallow Fire, towns and lives in the eastern portion of the White Mountains—Alpine, Greer, Nutrioso, and Eagar—were saved because of the treatments. One business owner said, “That was inspirational to us.” A stakeholder said evidence of treatment effectiveness from the Wallow and San Juan fires assisted in paving the way toward large-scale landscape restoration.

Set the stage for the upcoming largest stewardship contract in the nation—The Four Forest Restoration Initiative (4FRI). The WMSP, the longest and largest restoration project in the nation at the time, had a high profile and allowed for innovation for an economically effective model to emerge. The project stimulated private industry advances and was what one business leader called “a stepping stone to [the next largest stewardship contract in the nation], the 4FRI.” Many said that in the absence of the WMSP, the 4FRI project would not be a reality today.

Two burn areas from the 2011 Wallow Fire experienced drastically different fire intensities. The previously treated area (right) had a low fire intensity due to the prior removal of excess fuels. This fire burned mostly on the ground with a high tree survival rate. The untreated area (left) experienced a high-intensity crown fire that scorched all of the trees and understory.

*Photos courtesy of the ERI*
Lessons Learned and Recommendations

Lessons learned from the WMSP and recommendations to develop solutions are outlined in this section. At times, several lessons learned are grouped and recommendations are collectively presented.

Project Initiation

**Be Ready to Act: Increase Capacity Through Diverse Funding**

A Forest Supervisor described defending constituents in the aftermath of the Rodeo-Chediski Fire. They said, “To pull off what the public was demanding … to treat these forests … this is the time and place and we just needed to go do it. I personally could not stand up to those communities that had the big fire like that and say, well we’re just going to continue as we always have. I just couldn’t do that anymore.”

This leader understood how the stewardship contract mechanism would obtain the cooperation, funding, support, and the legal leverage needed to meet public demands. This leader recognized the important opportunity to bring the WMSP to the ASNF and reacted quickly to secure the contract.

“ I personally could not stand up to those communities that had the big fire like that and say, well we’re just going to continue as we always have. ”

**Promote a Sense of Urgency: Develop Scalable Solutions**

The MSO controversy in the mid-90s and the legal challenges the agency faced created a culture of “complacency” in the agency, a Forest Supervisor recalled. The agency released timber sales for years, but the projects were often mired in litigation. As a result, completed environmental analyses often lacked agency motivation to move the projects forward. The Supervisor said, “They just gave up on it.” However, after the Rodeo-Chediski Fire, a sense of urgency quickly replaced apathy within the ASNF. The ASNF realized forest treatments were a solution to an exponentially growing problem.

Industry leaders and stakeholders also understood the importance of fire risk reduction in the WUI and agreed to work together to move forward. For one, they realized that severe stand replacing wildfires were no longer hundreds or thousands of acres, the new norm was half a million acres. As a result, the NRWG sought a broader solution to match the scale of the problem by promoting long-term supply guarantees with service contracts.
Recommendations:

To address disastrous disturbance events (e.g. large uncharacteristic stand replacing wildfires) with long-term solutions (e.g. forest treatments) and outcomes (e.g. fire resilient forests), seize opportunities to increase agency and industry capacity and/or allocate resources. To begin forest management initiatives:

1. Select an appropriately scaled mechanism and funding source (e.g. stewardship contract).

2. Seek alternative non-traditional funding sources (e.g. grants, publicly funded initiatives (bonds, taxes, user fees, etc.) to conduct forest treatments on public and private land; recent examples include:


   b) Oregon: Ashland Forest Resiliency Stewardship Project received $6.2 million in American Recovery and Reinvestment Act funding. Additional funding was secured from the Joints Chiefs Landscape Restoration Partnership Program and the USFS Hazardous Fuels programs (AFR 2016).

   c) New Mexico: Santa Fe Municipal Watershed Restoration Project developed an initial plan that was funded by a USDA USFS Collaborative Forest Restoration Program grant. Since May 2013, the City of Santa Fe water utility rates have covered the City’s obligations under this plan. The cost to retain the restored forest condition over 20 years is estimated at $5.1 million, an average of $258,000 per year.

Support Leaders Willing to Take Risks

The Forest Supervisor who initiated the WMSP was a leader willing to take risks. They described the incentive as, “If we’re asking all of these other people to take risks and stand up and make changes, [the Forest Service] better be able to do those ourselves.” Without these leadership qualities, the first large scale 10-year stewardship contract in the nation might not have been on the ASNF.

Recommendations:

Identify, recruit, and support leaders who are willing to take risks.

Support Pilot Projects

The Blue Ridge Demonstration Project opened the door for various groups to work together to test and develop novel ideas and processes for: 1) experimental prescriptions, 2) administrative processes (contracting/subsidies), 3) new technologies and harvesting operational efficiencies, 4) collaborative relationships and the formulation and development of trust, and 5) building capacity. This led to the concept and operation of a small-scale experimental project with a broader vision and helped to bring the WMSP to the ASNF.
**Recommendations:**

To develop and test novel concepts and practices, promote and incentivize small-scale pilot projects that will assist in learning and foster similar processes on a larger scale.

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**Collaboration**

*Foster Broad-Based Collaboration and a Multi-Party Monitoring Program*

The relationship building that occurred within the WMSP, coined by some as “collaborative conservation,” contradicted outdated past premises of both the agency and environmental organizations and introduced a new era and culture within these entities. With this came the understanding that industry is a critical component to get the job done and was no longer viewed as an antagonistic player in forest management and restoration. This created a productive and positive working environment with honest, open dialogue where common ground and goals were discussed.

The Multi-Party Monitoring Board directed the collection and analysis of best available science by scientists at NAU and the Ecological Restoration Institute. Interest groups trusted that treatments were grounded in science, and groups with varying perspectives found they could work through tough questions. “We can learn from each other, make commitments to each other to get us through tough times,” a stakeholder said.

The WMSP is an example of effective collaboration across a wide array of interests. The cooperation was built over time, first with the Blue Ridge Demonstration Project and then formation of the NRWG, seven years prior to the inception of the WMSP. Further trust evolved with the Multi-Party Monitoring Board effort. Together, these relationships resulted in positive outcomes for the WMSP.

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**Recommendations:**

1. Work with an already established collaborative group or form critical partnerships to: 1) define the issue and scope of the project, 2) reach agreements, 3) develop solutions, and 4) lobby state and federal legislatures for support and funding to increase capacity.

2. Support a collaboratively developed monitoring program, with interest groups, industry, academic institutions, local and state government, and the USFS.

3. Use successful outcomes of past projects, like the WMSP, to leverage government funding for forest management projects that includes a monitoring program. For example, in the case of the WMSP, saving communities in the Wallow Fire and unprecedented cooperation amongst stakeholders resulted in no legal challenges. These were formidable successes and should be emphasized to encourage further congressional appropriations, grants, and other financial assistance that would support forest restoration projects.
Advance Industry: Form U.S. Forest Service Partnership

From the wood products industry perspective, the USFS and industry must align as true partners to assure project success. A business owner said, “The only way to have well managed forests is to have healthy industry and they are a true partner in management of the forest and in providing these benefits [clean water/air, wildlife, etc.] to society.”

Many firms involved with the WMSP worked diligently toward developing value-added products from small diameter ponderosa pine. A mill owner explained that the WMSP was a learning experience in many areas: thinning small diameter trees and delivering, storing, and air drying the logs. “We invested and lost a couple of million dollars to prove the math, which we did.” He added, “The experts are the people that make it work on the ground—with the thinning and processing … I am sure that we are the small log experts in the United States and to have the Forest Service at all these levels not come up and ask us: ‘Can you help us and fix this dilemma?’ and ‘Would you be willing, and what would it take?’”

One stakeholder said the industry and the agency were disconnected at times. He said, “One thing we’ve learned after the last 10 years, is that we are all in this together. We need those businesses to be robust and vibrant and well-stocked with the materials to keep them operating. [This works] as long as it does not take over as the driver.” Forest staff agreed that close cooperation is needed with industry. Industry has experienced this massive change first-hand and should be consulted to review and improve upon past agency policies and procedures. He continued to say that lessons learned during the WMSP need to be relayed to decision makers, especially those without on the ground experience.

From the agency’s perspective, industry needed to fully understand how the USFS operates—its funding cycles, mechanisms, political environment, and national budgets. For example, during the WMSP, the Forest developed an internal five-year work plan and shared it with industry; however, industry made plans for expansion without consulting the Forest. Industry was ultimately disappointed because it had unrealistic expectations, which then created tension between the agency and industry.

Considering these different perspectives, clear communication among entities would increase the potential for positive outcomes. The USFS needed a comprehensive understanding of the economic factors required for industry’s sustainability, while industry was obliged to fully conceptualize the agency’s structure and processes.

District Ranger Ed Collins shows a thinned area in the ASNF. A portion of the thinning opened up meadow-like conditions and maintained groups of trees to benefit wildlife. 
Photo by Tana Kappel/TNC
Recommendations:

1. To advance an effective USFS-Industry partnership that results in realistic expectations and future planning throughout the life of the project, clearly communicate each group’s operational processes. This can be achieved by creating two critical positions that link these groups: 1) a forest industry analyst position at the Forest level, and 2) an industry liaison position.

2. Form a cooperative organization, or “co-op,” managed by a neutral intermediary organization that provides access to all types of raw material at competitive prices. A co-op would meet industry needs and be a critical link to current USFS supply. This would provide consistency in the supply chain so both industry and the agency can execute business/work plans that accurately reflect future industry demand and supply of raw material from federal lands.

3. Throughout the life of the project, conduct program evaluations that track strengths and weaknesses of industry to USFS relationships and offer solutions for improved communication and interaction.

Contractual Process

**Evaluate Subsidies**

Most respondents believed that subsidies were necessary to thin small trees and remove biomass. This material has low value and the costs are high to remove and transport it. Forest staff explained that the projected volume of fiber removed per acre at the start of the WMSP was 10.7 tons. The actual amount extracted was an average of 25.8 tons per acre (more than double). But, the WMSP subsidy did not decrease over the course of the project. There are several assumptions why the subsidy did not decrease: 1) the recession, 2) the effects of the Wallow Fire, and 3) the high costs of biomass removal and transportation. However, many factors, such as increased contractor operating efficiencies and increased volume removed per acre, should have had a positive net effect for the contractor. It is assumed the contractor’s operating costs were decreasing, while businesses reported increasing prices and revenues for the raw material. But, it is unclear if the contractor’s revenues exceeded costs over the course of the project.

A Forest staff member said, “In the next iteration of stewardship that private industry pays for all of it. I’m not certain anybody has found the formula yet to succeed in doing that in Arizona.” About transitioning from subsidies in the WMSP to none in 4FRI, a firm’s CEO said, “How you jump from [the USFS] paying [the contractor] $500 per acre [to the contractor paying the agency] is beyond me.”

A Forest staff member suggested that in order to adequately assess the applicability of subsidies, there should be enough flexibility in the contract to “learn and take advantage of new insights and opportunities.” For example, as volume per acre increased, having a protocol in the contract to expedite provisions (the subsidy amount was evaluated every two years), might have influenced the subsidy rate overtime.

While it was characterized that the WMSP cost the federal government $500 per acre to treat, there were several areas where benefits to the agency and the public were realized. For example, eliminating or minimizing the need to pile burn in some areas decreased expenses for the agency, and in turn, could be used to subsidize the contractor for slash removal and transport. Although a full cost accounting of the Wallow Fire has not been
conducted, assessments and studies confirm that treatments prior to the Wallow Fire saved homes, conserved forest resources and supported the forest’s resiliency. Further, costs to the agency were reduced as the agency was able to scale up when it completed planning, administration, and site prep for an expanded number of acres.

Recommendations:

Develop a contractual evaluation protocol that includes a reasonable timeframe to assess and respond to changing factors throughout the life of the contract. Several steps have been identified to achieve this:

Step I. To ensure the contract aligns with industrial indicators, involve industry in contract development/requirements by tracking a variety of outputs like:

1. Acres treated (acre to volume relationship);
2. Proportion of biomass to saw logs;
3. Contractor’s operating expenses—based on terrain, aspect, tree density, tree sizes, etc. (e.g. loading, hauling, mobilization, etc.);
4. Revenue of the raw material;
5. Value and types of products produced; and
6. Incorporation of novel technologies and processes as they develop.

This information would result in:

1. Matching harvesting operational costs to contractual requirements,
2. Aligning raw material pricing to market fluctuations and demands, and
3. Providing a reasonable figure needed to incentivize the contract.

Step II. Based on information collected in Step I, if subsidies are deemed necessary, regular assessments (based on a predetermined timeframe) should include:

1. The amount of the subsidy,
2. The duration of the subsidy, and
3. The necessity of selective subsidies (based on specific acres that are more expensive to treat).

Step III. Design subsequent contracts by incorporating lessons learned from prior contracts that include agency and industry perspectives. For example, enlist the expertise of the newly created USFS industry analyst and industry liaison positions.
**Determine the Best Performance Measure**

The WMSP contractor was paid for green tons (volume) removed (a formula derived by the agency equated this to $500 per acre), which had its advantages and disadvantages. For the contractor and some producers of finished products, tons (green or bone dried) was preferred because it eliminated uncertainty of the variable stocking levels on each acre and the variable amounts of water in the raw material. The advantage to the contractor (paid on volume) was necessary to incentivize an experimental project. The agency, though, preferred acres because that metric matched agency targets and was better understood by decision-makers and political leaders.

Compensating the contractor on a per acre basis might incentivize the contractor to treat acres where costs are lowest and/or revenues are highest. For example, under this model, the contractor might prioritize areas that are more accessible (e.g. flat terrain, availability of road systems, etc.) and/or have more merchantable sized timber. They may avoid treating areas that contain larger portions of small diameter material/biomass or are difficult to access. The areas that are most cost effective to the contractor are not always the areas prioritized for fire risk reduction objectives. In projects like the WMSP, it is necessary to derive a metric that incentivizes treating areas with high fuel loads and fire risk.

**Recommendations:**

In an experimental project with numerous unknowns (e.g. the acre-to-volume relationship) like the WMSP, paying the contractor on weight made sense. Considering fuel reduction objectives and industry viability, both metrics should be tracked longitudinally to better understand:

1. The acre-to-volume relationship that can be used by both the USFS and industry for future planning, and
2. The cost per acre to assess whether efficiencies are increasing for both entities.

**Track the following:**

**Acre-to-volume relationship:**

1. Average green tons per acre
2. Proportion of biomass to merchantable fiber

**USFS and industry costs:**

1. Agency costs (e.g. planning, administration, site prep, etc.)
2. Industry costs (e.g. harvesting operations, transportation, etc.)

**Questions to consider:**

1. Are efficiencies of both entities increasing and, subsequently, are costs decreasing?
2. As utilization per acre increases, are net treatment costs decreasing and does this effect translate to lowering or eliminating subsidies?
3. As utilization per acre increases, is this a result of economies of scale that allows for greater revenue and decreasing costs per unit of biomass?
Track On-the-Ground Processes and Efficiencies

The COR position, who oversaw in-the-woods operations, was housed at the Regional Office in New Mexico. This position’s geographic separation from the project and lack of practical experience created apprehension for both the Forest and the loggers. Logging operators and Forest personnel reported most staff in this position did not understand the daily harvesting operations. At times, it deterred harvesting operational efficiencies and increased costs for the contractor and subcontractors. This situation was compounded by the position’s high turnover rate throughout the WMSP. A stakeholder said that with the inevitable “revolving door” of key staff from the USFS, it was vital that replacements share a “common vision” about the project’s goals and objectives with their predecessors.

Recommendations:

Create a contracting mechanism that supports a Forest-level COR who has on-the-ground experience and understands local harvesting operational processes and efficiencies. When replacing agency staff, assure: 1) there is a transition plan in place, and 2) their visions and principles are in line with project goals and objectives.

Address Davis Bacon Act Wage Requirements

Davis Bacon Act wage, also known as the prevailing wage, is a required pay rate and scale under Acquisition Management (AQM) contracts like the WMSC. The Forest and industry agreed that because the raw material had little to no value, the Davis Bacon wage was a major barrier that deeply affected both the contractor and subcontractors’ bottom lines. If the value of the raw material is not enough to offset the cost to treat the forest and pay the prevailing wages, Forest staff believed that a subsidy is necessary.
**Recommendations:**

To evaluate whether Davis Bacon wages are indicative of regional labor wage rates:

1. Verify how rates are calculated with the Department of Labor;
2. Independently assess current wage rates by administering regional contractor/subcontractor surveys;
3. Promote differential pay scales (through legislative processes) that reflect workers’ skill and experiential levels;
4. Develop an apprentice/journeyman certification program through an academic institution—this will provide a training period for the workforce and lessen the pay burden to industry;
5. Create an equitable compensation that would offset the discrepancy of prevailing wage and industry standard wage in the region; and/or
6. Use a contractual instrument that does not have the Davis Bacon wage requirement.

**Administer Overlapping Contracts to Assure Supply Continuity**

Respondents identified four issues that all can be resolved through administering overlapping contracts: 1) Businesses required a sufficient timeframe to amortize investments; 2) There was a need to ensure a consistent raw material supply; 3) The single contractor system could use improvements; and 4) At close of the contract, a transition plan should be in place.

**Sufficient Timeframe to Amortize Investments**

Most firms and Forest personnel overwhelmingly agreed the contract period of 10 years made it difficult for businesses to amortize large investments in equipment and infrastructure and to develop new business models (e.g. markets, products, operating efficiencies). Most respondents believed the length and size of the contract (5,000 acres annually) significantly affected the type, size, and experience of industry involved. Most firms working with the WMSP were small, family owned and operated businesses, which were appropriately scaled for the size of the contract. A mill operator said that a large high-speed, high-production sawmill costs $30 to $50 million to build. Considering the size of investments, it was difficult for companies to amortize them in a 10-year period. As a result, larger enterprises steered clear of the project.

**Assurance of a Consistent Raw Material Supply**

Prior to the WMSP, supply of raw material from federal land was inconsistent and unreliable. The WMSP had the potential to reverse this trend, but there were many factors that prevented a reliable, steady supply stream:

1. Federal funding limitations markedly reduced the number of acres that could be treated.
2. The Wallow Fire burned the majority of the remaining NEPA-ready acres (50,000 acres).
3. The sole contractor limited supply to and set prices for firms in the White Mountains.
4. The 4FRI project diminished support and interest in the WMSP.

One Forest staff member said, “Continuity is probably a key item to focus on in the future on these projects.”
How do you maintain continuity from the inception of the project through its conclusion? Continuity in intent, continuity in financial support to the project.”

While supply consistency and a level of planning certainty is needed for corporate decision making, wood supply is dynamic and hinges on social and ecological factors that are beyond the agency’s control (e.g. large, severe wildfires; drought; insect infestations; threatened and endangered species, etc.). To minimize uninterrupted wood supply and to assure the success of long term contracts, contracts should be flexible and provide evaluative components that can respond to changing factors.

**Improvements to the Single Contractor System**

The sole contractor system presented advantages and disadvantages. The single contractor provided benefits of: brokering raw material, eliminating the competitive bidding system, and paying subcontractors on time. However, it also reduced competition since the market now did not dictate the price. The contractor set the price and industry in Arizona found it difficult to compete with national and global markets. The single contractor system also increased competition among consumers, which prevented the forest industry cluster model from fully developing.

Although lack of contractor competition was highlighted as a barrier by most firms, this subsidized economic model could not support a free market system. Instead, the sole contractor system eliminated the competitive bidding process and provided stability, reliability, and accountability and it assumed risks that might challenge multiple timber sale contractors.

**Have a Transition Plan in Place**

Many enterprises in the White Mountains were concerned about the future of their businesses at the close of the contract. Most mills and finished manufacturers interviewed said they were out of logs and could not fill orders. If companies in the region folded, many businesses believed the successes of and investments in the WMSP would also be lost. Investments included $130 million in industry capital investments (equipment and infrastructure); $50 million in federal funds; more than $7 million in grants and financial assistance; and numerous in-kind and financial contributions made by various stakeholders.

“Fill current infrastructure with affordable, meaningful fiber and you’ll get acres treated sooner rather than later.”

The first phase of 4FRI project began in 2012, with most harvesting activities planned for the Coconino and Kaibab national forests to the west of the White Mountains. This created a gap in supply for industry in the White Mountains. Many respondents said the WMSP “paved the way” for other stewardship contracts like 4FRI, and did not understand why the stewardship contract would begin in an area where little infrastructure existed. One firm’s president said, “We were open minded and optimistic, but [with 4FRI] it was tempered and our optimism [was] diluted.”

During these transition periods from one stewardship contract to another, it is paramount that there is a plan to assure supply to already established businesses. A stakeholder said, “That was our biggest downfall in not putting a lot of thought and action into creating a sustainable model that would last beyond the 10 years.” A business owner agreed and said, “Fill current infrastructure with affordable, meaningful fiber and you’ll get acres treated sooner rather than later. [The Forest Service] needs to maintain infrastructure while we create the new generation of industry.”
As the WMSP contract expired and the 4FRI project began, there was little transition and assurance of supply for existing businesses. To maintain contract duration (10 years), contracts should be sequenced to minimize supply gaps. Also, selecting a diplomatic and impartial contractor would assist in the overall success of the project.

**Recommendations:**

1. Initiate overlapping contracts with various contractors to minimize the interruption of a consistent, accurately forecasted wood supply stream to businesses throughout the region.
2. Evaluate contractor performance (e.g. conduct surveys/interviews with businesses) that would inform contractor selection of future contracts.

**Forest Industry Cluster Model**

**Support a Thriving Forest Industry Cluster Model**

Industry evolved during the WMSP to fill various niches to process all components of the tree. This included pressure treated post and poles on the high end, and bio-power on the low end. However, over the 10 years, many factors prevented the development of a well-rounded, highly functioning forest products industry cluster:

1. Critical infrastructure was missing: 1) a biomass energy facility (this facility opened and closed many times over the course of the project and was finally reestablished by Novo BioPower in 2013), and 2) a large high-production sawmill (the Vaagen mill was limited to processing logs from 5.5–13.5 inches DBH and only operated for two years);
2. The sole contractor system created gaps in the supply stream; and
3. Inefficient use of raw fiber (i.e. chipping whole trees) resulted in lost potential for the highest and best use of the raw material.

One stakeholder said that these three factors defeated the concept of stewardship. A Forest staff member said, “It’s not the ‘who,’ but ‘what’ you select as the product. You need a product that has sufficient value to actually offset the cost of the treatment.”

**Recommendations:**

1. Conduct a needs assessment to ensure a thriving forest industry cluster and to better understand gaps in infrastructure, supply, and production. Results can guide industry, the agency, and stakeholders to improve outcomes in fire risk reduction/forest restoration objectives and industry’s viability.
2. Develop and support programs (e.g. payment for ecosystem services, grants) that incentivizes establishment, growth, and expansion of a broad-based forest industry cluster.
3. Conduct research and development for small diameter ponderosa pine value-added products.
Collaborate to Improve Ecological Outcomes

Most respondents believed the NEPA planning process for the WMSP was time consuming and over regulated. However, Forest staff noted that addressing public concerns about forest treatment effects, particularly on wildlife like the MSO, increased the NEPA document’s complexity and the time and cost related to the environmental planning process.

The lack of legal challenges and subsequent delays in on-the-ground implementation was noted as an achievement. To reach agreements, potentially contentious issues (e.g. harvesting trees larger than 16-inches DBH) were debated on a project-by-project basis. This process assured all parties were informed up front, which alleviated potential lawsuits and delays. As the project progressed, trust in on-the-ground implementation increased, which minimized the necessity of site visits. Rather than adding complexity and restrictions to the NEPA documents, the USFS and stakeholders found a way to informally and adequately address their concerns.

Although the diameter cap was a verbal agreement between the Forest and CBD, the cap was often used in the WMSP treatments. The verbal agreement demonstrated that the agency was willing to listen and respond to stakeholder concerns.

While the diameter cap assured conservation groups that large trees would not be harvested, in some areas, it might have limited fire risk reduction goals. Forest staff suggested that rather than adopting a diameter cap, a monitoring system similar to that of the WMSP could offset concerns. He added that eliminating a strict cap would also improve outcomes for industry (i.e. increased availability of various sized logs would improve opportunities to produce a broader range of products).

Recommendations:

Create a monitoring system that assures the public’s interests and concerns are considered and met. In turn, this will assist in reducing limitations in achieving the project’s socioeconomic and ecological goals and would reduce the complexity and requirements in NEPA, resulting in a shorter planning timeline and decreased costs.
Grants and Financial Assistance

*Incentivize Projects with Financial Assistance*

Grants and financial assistance were largely available to organizations and enterprises before and during the WMSP. These grants assisted businesses, NGOs, and municipalities with equipment acquisition, business planning, product and market development, and provided businesses with tax savings. These incentives helped to jump-start creativity and innovation for a project like the WMSP.

**Recommendations:**

Create opportunities to incentivize novel projects and innovations with grants and other financial assistance.

Outreach and Education

*Promote Statewide Outreach Campaigns*

As public support for the project grew, residents adapted to the aesthetic change in forest structure. Public demand for forest treatments also increased. But, seasonal residents were harder to persuade.

Although communities in the White Mountains were affected by two large, severe wildfires in the span of nine years, memories of fires and their effects often fade with time. And with time, support for treatments can wane. For this reason, it is important to keep the public aware and informed through continuous outreach and education programs.

**Recommendations:**

Develop and conduct statewide campaigns with a unified message to include:

1. Support for fire mitigation and overall forest health initiatives through active forest management;

2. The value of forest treatments that maintain and enhance various ecosystem services (e.g. wildlife, recreation, watershed protection/improvements, etc.);

3. Gear campaigns toward the public (especially focused on seasonal residents and land owners), decision makers, and municipal, state, and congressional leaders.
Statewide Strategy

Support a Statewide Strategy that Includes Industry and Restoration Goals

The WMSP demonstrated that operational cost savings and improved efficiencies assisted the forest products industry. To promote these processes and incentivize industry, developing a statewide strategy that includes multi-jurisdictional lands and agencies and programs is an ideal model to collaboratively plan and execute various approaches.

An example of such a program is the Arizona Department of Transportation’s Healthy Forest Initiative that launched in November 2014. Weight limits increased from 80,000 to 90,000 pounds per truck-load, which gave Arizona companies a competitive edge because they had the ability to move more material from the woods to processing sites.

**Recommendations:**

Create a multijurisdictional statewide strategy that includes operational costs savings and efficiencies for the forest product industry by:

1. Strategically placing infrastructure to minimize haul distances from harvesting sites to processing facilities.
2. Sharing and strategically locating kilns and scales.
3. Adopting agency policies and operating procedures that conform to current technology and equipment.
4. Developing a forest product industry workforce.
   i. Fund field-related on-the-job training.
   ii. Eliminate costly marking of trees by training harvesting operators in conducting operations based on designation by description (DxD).
5. Create tax incentives for the forest product industry.
6. Create policies that ensure state resources (small diameter ponderosa pine) are used within the state (e.g. round guardrail posts manufactured for highways in Arizona).

**Conclusion**

From the outset, the WMSP faced many challenges and unknowns. A stewardship contract of its size and duration was unprecedented. In the beginning, the project was seen as a grand experiment with a diverse set of participants who had seen massive shifts in industry, land management, and forest health as well as in the socio-political realm. Despite challenges, there were many successes. Acres were treated, treatments were tested and proved effective in wildfire, and legal battles that typically delayed or halted progress never occurred.

With the WMSP, there was a fundamental shift from traditional timber extraction, where the primary goal is to maximize profits, to fire risk reduction, where the targets are improved forest health, increased community
protection, and enhanced ecosystem services. The project also focused on minimizing costs and maximizing returns for small diameter wood utilization. However, private industry alone was unable to offset treatment costs. Lessons learned presented in this report point to areas of improvement in the stewardship-industry model.

Experiments bring uncertainty and challenges. But, reframing challenges as lessons learned and formulating pragmatic, applicable solutions can help fuel the progress of future forest restoration initiatives.

**Acknowledgements:** This research was funded by the USDA Forest Service, Apache-Sitgreaves National Forest. The authors would like to thank the tremendous support and time of those who assisted in this research. For technical support, we would like to acknowledge Bruce Greco, Director of Outreach at Northern Arizona University’s Ecological Restoration Institute, who offered dedicated support throughout all phases of research; and Patrick Rappold, Arizona State Forestry Department, Wood Utilization and Marketing Specialist. For their extensive reviews of the paper, the authors would like to acknowledge Jesse Abrams, PhD, Research Associate, Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon; Dennis R. Becker, PhD, Director, Policy Analysis Group, Associate Professor Department of Natural Resources & Society, University of Idaho; and Evan E. Hjerpe, PhD, Executive Director, Conservation Economics Institute. Lastly, we are grateful to all who agreed to participate in our surveys and interviews.

**Literature Cited**


## Appendix A

**Firms Engaged in Woody Biomass Products Delivered by/to Future Forest, LLC (2005-2014)**

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*This includes one business that did get raw material from the Future Forest, LLC in 2014, but not in 2013.

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