

**The 4 Forest Restoration Initiative: Promoting Ecological Restoration, Wildfire Risk Reduction,  
and Sustainable Wood Products Industries**  
**A proposal for funding under the Collaborative Forest Landscape Restoration Program**

Ponderosa pine forests stretch almost continuously from the south rim of the Grand Canyon in north-central Arizona, across the vast Mogollon Rim to the White Mountains of eastern Arizona. Forests across this expanse surround and support communities, and provide invaluable wildlife habitat, recreational resources, and ecosystem services, ranging from clean water supply to carbon storage. Unfortunately, these forests have been degraded by unsustainable historical land uses and are threatened by unnaturally severe fire and climate change. There is an urgent need to restore northern Arizona's ponderosa pine forest ecosystems to reestablish beneficial natural fire regimes, sustain native biodiversity, and protect communities from unnaturally severe fires. The 4 Forest Restoration Initiative (4FRI) is an outgrowth of nearly a decade of collaborative efforts and analyses focused on accelerating forest restoration in northern Arizona. The central theme of these activities has been the broadly-recognized need to accelerate forest restoration and to shift restoration and management efforts from a short term, project-by-project basis to an integrated, landscape-scale program. After years of gridlock, resulting from intense disagreement over the direction of forest management, there is now an opportunity to move forward with accelerated, landscape-scale restoration at an unprecedented pace and scale. The current social support for landscape-scale restoration in northern Arizona presents an historic opportunity that should be recognized and acted upon immediately.

In order to fulfill a collective desire to move forward rapidly to on-the-ground implementation, a group of stakeholders and the Forest Service created the 4FRI to address ponderosa pine forest restoration on the four National Forests in northern Arizona: the Apache-Sitgreaves, Coconino, Kaibab, and Tonto National Forests. The Initiative's primary objective is to assure that the science-based and socially-acceptable agreements forged over the past several years result in implementation of long-term, landscape-scale forest restoration as soon as possible. The 4FRI vision is to undertake, across approximately 2.4 million acres of ponderosa pine forest, landscape-scale restoration that will support: resilient and diverse forest ecosystems; populations of native plants and animals; thriving communities in forested landscapes that have little threat of destructive wildfire; and appropriately-scaled, sustainable, forest products industries that strengthen local economies, while conserving natural resources and aesthetic values. Wood products enterprises that create value for harvested material will help offset the costs of restoration, allowing restoration to move forward more rapidly over larger areas. The ultimate goal of the 4FRI is to treat through mechanical thinning up to 50,000 acres per year across the four forests, to allow for increased use of prescribed fire and management of natural fires for restoration objectives, and to engage new industry such that all, or nearly all, of the cost of removal of forest restoration byproducts is covered by the value of the products removed.

## 1. Proposed Treatment

**Ecosystem characteristics:** Southwestern ponderosa pine ecosystems historically were shaped by natural processes, including frequent surface fires, episodic regeneration, insect infestations, and regional climate events such as droughts, that created heterogeneous forest structure at local and landscape scales with pattern shifts through time (Allen et al. 2002). Since European settlement, pervasive changes have homogenized the structure and altered the natural processes of these forests. Logging has decreased the number of old and large trees; grazing and fire suppression have promoted unnaturally dense stands of small trees (of the 2.4 million acres of ponderosa pine in the 4FRI area, 81% of it has high vegetation departure index from the reference conditions according to LANDFIRE fire regime condition class (FRCC) data layers). These conditions threaten the survival and recruitment of large trees and the maintenance of ecological systems by fueling increasingly extensive crown fires. Understory grasses and forbs have decreased in abundance and diversity and have been replaced by deep mats of pine needles. Nutrient cycling dynamics have been disrupted, and biodiversity levels have decreased. Old growth ponderosa pine forests have become rare, and meadows have shrunk due to tree encroachment, in large part due to the absence of frequent, low-intensity fire. An increase in the number, size, and severity of stand-replacing fires has affected and continues to threaten both human and ecological communities. The aftermath of such fires includes short term amplification of erosion and flooding. Landscape scars created by total canopy destruction may persist as grasslands, shrublands, or small tree thickets for decades to centuries. If the current trajectories of anthropogenically-driven change continue, serious ecological damage to ponderosa pine ecosystems will accumulate and, with global climate change, likely accelerate.

**Restoration objectives:** The goal of the 4FRI is to achieve ecological restoration across ~2.4 million acres of contiguous ponderosa pine forest on National Forest System lands in northern Arizona.<sup>1</sup> Restoration can be defined as a suite of intentional actions that initiate or accelerate ecosystem recovery with respect to health (functional processes), integrity (composition & structure), and sustainability (resilience & resistance to disturbance). Restoration attempts to return an ecosystem to its historic trajectory, although a restored ecosystem may not necessarily recover its former state since contemporary constraints and conditions can cause it to develop along an altered trajectory.

The overall goal of 4FRI treatments is to reset ecosystem trends towards a natural range of variability and to reestablish natural processes. The objective over the long-term is to facilitate the reestablishment of a multi-scale mosaic of age and structural classes through mechanical thinning, prescribed fire, and reintroduction of natural fire and other processes, which will work together to approximate the natural range of conditions in southwestern ponderosa pine forests (Long and Smith 2000). More specifically, restoration treatments will retain pre-settlement trees; retain post-settlement trees as needed to establish a range of desired future forest conditions; thin and remove hazardous fuels; utilize fire to emulate natural disturbance regimes; allow for the management of wildland fires to achieve ecological objectives; and reestablish understories in which native, rather than exotic, species thrive. Natural variability (spatial heterogeneity) of existing forest structure (groups of clumps of trees and existing large trees) will be incorporated into the treatment design. Treatments will be designed to achieve a range of post treatment conditions with regard to vegetation structure and composition to effectively reduce fire danger, improve wildlife habitat, and improve forest ecosystem resiliency in the long term (Covington et al. 2001; Omi and Martinson 2004). Successful restoration will allow low-severity fire to easily and inexpensively shape forest conditions in the future. This, in turn, will reduce the need for future maintenance thinning.

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<sup>1</sup> This area was identified in the *Analysis of Small-Diameter Wood Supply in Northern Arizona* (Hampton et al. 2008). All but 6% of these acres consist of NFS lands. The 4FRI landscape strategy covers all 2.4 million acres of the ponderosa pine belt on the National Forests of northern Arizona.

**Restoration accomplishments to date:** The restoration work that has occurred to date on the 4FRI landscape has been primarily under the normal programs of work on three of the four forests. The Apache-Sitgreaves National Forest (ASNF) has put the majority of its restoration efforts into the White Mountain Stewardship Contract (WMSC). Combined, the four forests currently conduct restoration activities on an average of 145,000 acres per year. This includes the following (some acres overlap):

- 17,000 acres of commercial timber harvest;
- 100,000 acres of prescribed burning (both WUI and non-WUI);
- 12,000 acres of forest vegetation improvement;
- 2,000 acres of forest vegetation establishment (planting or protecting naturally regenerated areas);
- 5,000 acres of noxious weed control;
- 6,000 acres of terrestrial wildlife habitat improvement, and;
- 3,000 acres of watershed health improvement projects.

In addition, the four forests managed unplanned wildland fires to meet restoration objectives on ~89,000 acres in 2009, up from ~10,000 acres in 2008. Many of the thinning and burning projects, which have been primarily in the WUI, also result in improved watershed conditions and wildlife habitat, which increases those specific accomplishments. For example, over the past 10 years the Coconino National Forest, working with the Greater Flagstaff Forests Partnership, has treated approximately 20,000 acres of the WUI around Flagstaff through commercial timber sales; about 22,000 acres of WUI have been mechanically treated under the WMSC since 2004. Implementation of the 4FRI project would increase mechanical thinning treatments by an average of 30,000 acres per year when fully implemented. The other restoration activities also would increase, although the amount would vary annually.

Restoration work under the WMSC was undertaken with the primary goal of preventing catastrophic wildfires, such as the Rodeo-Chediski fire of 2002 which burned nearly 500,000 acres (most of this area burned in less than one week). Planning was facilitated by the *White Mountains Landscape Assessment* (Abrams et al. 2005), which continues to serve as a foundational assessment for the 4FRI. The goals of the WMSC are to reduce the forest fuels, particularly in the WUI, take steps towards the restoration of forest structure and processes, and facilitate the re-creation of markets in order to support the completion of restoration work at decreased costs to the agency over time. Treatments have been designed so that high-risk WUI areas are treated first, with adjacent areas treated as appropriate to limit the need for re-entry to an area over the short-term. To date, approximately 22,000 WUI acres have been treated and 15,750 non-WUI acres have been treated. Prescriptions have been primarily for intermediate thinning with increased spatial heterogeneity incorporated into treatment design over time. To preserve large-diameter trees, many of the treatments have been done with a 16" dbh cutting cap, which has precluded stands from reaching fully restored conditions, but has moved stands along a positive restoration trajectory. Market capacity on the White Mountains has increased from almost nil to the potential to utilize ~20,000 acres of treatment byproducts per year. Currently this material goes primarily to local industries that make wood-stove pellets and shipping pallets and to a local biomass co-generation plant. Some material is used for dimensional lumber and specialty products such as posts and poles.

**Future 4FRI restoration program:** The 4FRI will continue and build upon the work accomplished under the WMSC. The USFS and stakeholders are in the process of finalizing the 4FRI landscape strategy, which is substantially complete and will be finalized in 2010. The USFS also is preparing for the issuance of a new and larger stewardship contract that will rely on acres currently NEPA-ready on the four forests for the first several years and then on acres identified for restoration treatments in the large-scale 4FRI project that is currently being planned. Acres that are currently NEPA-ready include:

- 25,000 NEPA-ready acres on the ASNF for treatment under the WMSC;

- 27,000 acres (the Rim Lakes project) on the ASNF planned for a decision in 2010—these acres could go towards the WMSC or a new 4FRI contract;
- ~11,000 NEPA-ready, prepped acres on the other three forests to support the 4FRI contract;
- 20,000 additional NEPA-ready acres across the four forests to support the 4FRI contract.

Future 4FRI planning and contracting is anticipated to take place as follows:

- The first large-scale planning area will cover ~750,000 acres, which will identify ~300,000 acres for thinning over 10 years at a rate of up to 30,000 acres of treatment per year;
- A large, long-term contract is expected to be awarded in early FY12. The concept is for a 10-year contract with up to 300,000 acres of treatment over the length of the contract. The specifics will not be known until the Request for Proposals is issued (scheduled for FY11) and negotiations with interested contractors are conducted. Implementation under the contract will begin in 2012.

Funding from the Collaborative Forest Landscape Restoration Fund (CFLRF) will be utilized to support:

- Work under the WMSC (for the first 1-2 years);
- Preparation of a new 4FRI stewardship contract;
- Sale preparation of large numbers of already NEPA-ready acres to support this new contract;
- Preparation of task orders and administration of sales under the new 4FRI contract;
- Accomplishment of other critical work, such as wildlife and archeological surveys, road maintenance, land line location, and the acquisition of personnel and infrastructure to support implementation of the first large-scale 4FRI project;
- Monitoring over the life of the 4FRI.

We do not anticipate utilizing CFLRF funding to pay for acres treated. After the first several years, funding will be used primarily to prepare and administer 4FRI sales and contracts and for monitoring.

Future planning and the application of treatment parameters will be based on previous collaborative efforts, including the six applicable Community Wildfire Protection Plans in the 4FRI area and also the *Analysis of Small-Diameter Wood Supply in Northern Arizona (Wood Supply Study)* (Hampton et al. 2008). Management areas with associated treatment parameters from that study include community protection management areas, Mexican spotted owl (MSO) restricted habitat, municipal watersheds, aquatic species watersheds, and wildlands. Mechanical treatments will not take place in wilderness areas, previously designated inventoried roadless areas, on steep slopes (>40%), in northern goshawk nest areas, or on soils with mechanized treatment limitations. Within areas such as MSO protected activity centers, previously treated areas, and streamside management zones, the nature of treatments, if any, will be evaluated on a site specific basis. Treatments have been and will continue to be prioritized in areas of highest fire danger and where the threat of fire immediately threatens communities. In areas further from communities, the 4FRI landscape strategy will identify areas where dynamic fire modeling can be used to strategically place treatments to optimize the effects of thinning treatments on predicted fire behavior and to allow for increased use of prescribed fire and wildland fires managed to meet restoration objectives. Other activities such as trail maintenance, road maintenance and decommissioning, noxious weed treatment and removal, meadow and grassland restoration, aspen regeneration and protection, and riparian area protection and restoration (including activities such as stream stabilization and the replacement of in-stream structures) will be incorporated into 4FRI planning and activities. Removal of treatment byproducts may be accomplished through burning, mastication, and/or removal of slash, tops, and limbs.

**Contracting mechanisms:** Stewardship contracting will be the primary contracting mechanism used for the 4FRI. A foundational assumption is that this effort only will be made possible by attracting new industry partners that are capable of removing forest restoration byproducts at significantly reduced rates of payment for acres treated. At present rates, the agency could not afford to pay for the restoration work

envisioned at a significantly increased scale and pace. The key will be to offer a contract at a large enough scale and with enough predictability of supply to encourage significant industry investment in the region. Industry partners will have to create products with enough added value so that the value of forest products increases and the goods-for-services exchange can occur at affordable rates for the agency. Based on the *Wood Supply Study*, there is enough small-diameter material available to offer an additional 30,000 acres of treatment for 20 years. In addition to the ~17,000 acres of mechanical thinning that are currently completed annually across the four forests, this will allow for nearly 50,000 acres to be treated each year. Several business plans have been advanced by industry partners that suggest there is a serious possibility to attract new industry on this scale at significantly reduced costs to the government.

Currently, the forests utilize force accounts, small-scale timber and service contracts, and stewardship contracts to accomplish restoration work. Although it is anticipated that stewardship contracts will be the primary mechanism utilized to complete future restoration work under the 4FRI over the next 20 years, the USFS anticipates that it will likely utilize a wide variety of mechanisms or tools to accomplish restoration objectives over the next several decades. In some areas, smaller-scale timber contracts may be utilized if the value of the forest products is considerably higher than the service work needed on a particular site. Stewardship agreements and force accounts will also be utilized, albeit on a much smaller scale than what is anticipated to occur under a stewardship contract.

**Monitoring:** Monitoring of projects under the WMSC has occurred through a stakeholder-led, multi-party monitoring board. Monitoring has been conducted for environmental, economic, and social impacts, identification of best management practices, and cumulative effects, and has included implementation monitoring to ensure that treatment prescriptions were followed. Lessons from this monitoring effort are being used to inform the design of the 4FRI monitoring strategy, which will be designed to have increased scientific reliability and validity. For all future stewardship contracts, a multi-party monitoring board will be formed with 4FRI stakeholders. Future 4FRI monitoring will be guided by the stakeholder-convened 4FRI Science and Monitoring Working Group. Implementation monitoring will occur to provide information on whether post-treatment vegetation meets project goals and objectives. Effectiveness monitoring will focus on whether the project goals and objectives are achieving ecological restoration. The 4FRI monitoring strategy will also be designed to track social and economic results of the initiative. Adaptive management will allow monitoring results to feed back into project planning. Monitoring will begin prior to implementation and continue for 15 years post-project completion.

**Annual reporting:** Annual reporting will be conducted and will tie directly to the goals and objectives laid forth in the Collaborative Forest Landscape Restoration Act (CFLRA) (such as, acres treated, economic benefits realized, monitoring results, and cost summaries), 10-Year Strategy from the Western Governors' Association (December 2006), and the Performance Accountability Systems associated with the Forest Service's databases. Annual reports will be an essential component in evaluating and communicating the effectiveness and efficiency of restoration treatments across the 4FRI treatment area and will support a long-term process of adaptive management. The reports will be based on a transparent effort among all relevant stakeholders to ensure data is coordinated, timely, accurate, and scientifically supported. Key contacts within all relevant land management agencies, existing and future multi-party monitoring groups, and academia will be established to ensure critical data needs are sustained.

## 2. Ecological Context

***Ecological conditions and the need for restoration:*** The development of dense, closed-canopy overstory conditions has substantially reduced or eliminated understory production and species richness and has altered ecosystem and hydrologic function across northern Arizona. Historically, fire-based disturbance regimes created patchy, structurally heterogeneous forest structure with multi-aged stands dominated by old trees interspersed with regenerating trees and grassy openings (Covington and Moore 1994, Allen et al. 2002, Fulé et al. 2001). Openings are now fewer, smaller, and fragmented patches with decreased rates of litter decomposition and increased fuels accumulation (Sabo et al. 2008). Wildlife, fish, and native plant habitats are threatened by decreased habitat resiliency and habitat loss due to uncharacteristic disturbance events. Fires are at risk of burning at a severity, frequency, and scale outside the natural range of variability (Swetnam and Betancourt 1998, Westerling et al. 2006). In severe post-fire habitats, invasive plant, animal, and pathogen species have an increased competitive advantage (Sheley and Petroff 1999). High-intensity crown fires can alter successional trajectories of post-burn vegetation, creating and entraining novel ecological systems as compared to those existing before such events (Savage and Mast 2005, Kuenzi et al. 2008). Following high-severity fire, riparian and aquatic habitats are also at risk from excessive erosion pulses, loss of riparian vegetation, and lower water yields (Baker 1990, Cain et al. 1997). Future climate patterns are predicted to put fish and wildlife habitats at further risk.

***Restored vegetation and habitat characteristics:*** The 4FRI strategy is designed to achieve restoration of forest structure, function and natural processes. Treatments will be informed by reference conditions, designed to reduce hazardous fuels, and strategically located on the landscape to maximize risk reduction of uncharacteristic fires. Long-term objectives are to reestablish a multi-scale mosaic of age and structural classes and to create a range of post-treatment conditions that effectively reduce fire danger and improve long-term forest ecosystem resiliency. Treatment designs will reflect natural heterogeneity and account for wildlife and other biodiversity considerations by retaining all pre-settlement trees (“old growth”) and post-settlement trees needed to reestablish historic structure. Thinning will create defined groups of trees and promote reestablishment of understory biodiversity. Expected effects of these treatments include: 1) restoration of natural variability in the form of more open, uneven-aged forests dominated by older trees, thereby restoring both habitat heterogeneity and the relationship between vegetation structure and natural processes such as fire; 2) increased native plant production and species richness resulting from reduced tree competition and increased moisture availability; 3) improvement of long-term ecosystem resiliency; 4) a broader window under which planned and unplanned ignitions may be successfully used as a management tool; and 5) successful restoration of low-severity fire.

***Ecological adaptation:*** According to presentations by climate change experts at a recent workshop convened by The Nature Conservancy on climate change in the 4FRI area, climate models for the Southwest predict increasing temperatures and lower effective moisture, leading to increased fire activity, drought-induced tree mortality, and shifts in species ranges.<sup>2</sup> Climate change compounds unpredictable shifts in environmental conditions, making it critical that restoration activities increase the adaptive capacity of ecosystems in the face of changing conditions (Flannigan 2000, Allen et al. 2002, Running 2006). Improving ecosystem resiliency and preventing large-scale ecological type shifts will likely enable more natural ecological responses to changing climate conditions. One way to reestablish ecosystem resiliency is to reestablish natural fire regimes, which correlate with climate conditions (Fulé, 2008). With increased presence of fire, forest conditions can incrementally shift over time, allowing for ecological adaptation that tracks and correlates with climate change (Allen et al. 2002). Restoration of more natural conditions will more closely match conditions to which species in this ecosystem are adapted. The combination of thinning and burning treatments, coupled with the reestablishment of

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<sup>2</sup>See presentations by Ganey and Vojta, Ironside et al., and Mearns; information available at: [http://nmconservation.org/downloads/data/flagstaff\\_climate\\_adaptation\\_workshop/](http://nmconservation.org/downloads/data/flagstaff_climate_adaptation_workshop/)

landscape scale fire processes, over time, will create forest conditions that are more resilient, are less prone to large-scale, mortality-driven “type shifts,” are entrained with ongoing climate cycles, and are composed of native species that can respond to changing conditions (Allen et al. 2002, Falk et al. 2006, Choi et al. 2008).

***Improvements to water quality and watershed function:*** Ponderosa pine forests in the 4FRI area are departed from their natural variability of ecological structures, functions, and processes. These conditions affect water cycles, potentially decreasing aquifer recharge and stream flows. Thinning can decrease evapotranspiration by 10 to 19% and potentially increase water yield by 1 to 3 inches per acre per year, thereby enhancing groundwater recharge (Brewer 2008, Dore et al. 2010). Restoring ground cover decreases the risk of nonpoint-source pollution and accelerated erosion downstream and improves nutrient cycling functions (Brewer 2008). Careful road design, placement, and use of best management practices will minimize sediment discharge, particularly during extreme weather events. Watershed function and downstream water quality is expected to be maintained or improved as a result of the 4FRI. The USFS is currently in the process of assessing watershed conditions for all of the 6<sup>th</sup> code HUCs across the entire 4FRI area in accordance with national direction from the Washington Office.

***Fish, wildlife, or Threatened & Endangered species improvements:*** There are a number of terrestrial and aquatic species listed under the Endangered Species Act that can be affected by the management of ponderosa pine ecosystems; a limited number of terrestrial listed species will be directly affected by the 4FRI. One listed species of primary concern is the Mexican spotted owl (MSO). All work in MSO habitat will be closely coordinated with the US Fish and Wildlife Service. The MSO Recovery Plan (USDI 1995) recognizes both timber management and fire as potential threats to MSO and encourages experimental treatments within MSO habitat, along with monitoring to determine effects, to reduce fire threat while minimizing negative impacts to owls. Sensitive species include all major taxa and common drivers of their status are the loss of understory vegetation, lack of or change to forest structural elements, or altered hydrologic regimes. Management recommendations for Northern Goshawk and MSO, two species that require a range of forest conditions, are in line with restoration objectives. Overarching guidance from the Management Recommendations for the Northern Goshawk (Reynolds et al. 1992), itself based on 14 key prey species, describes forest structure closely matching restored conditions. The resulting landscape will consist of different aged groups of trees interspersed with openings and meadows and will retain snags, logs, and large trees. Restoration will benefit key tree species like aspen and oak that are important to forest biodiversity and are currently being outcompeted by encroaching ponderosa pine as a result of historical forest and fire management practices (Griffis-Kyle and Beier 2003, Chambers 2002). Recent research has evaluated the effects of high-severity wildland fire and fuels reduction projects on avifauna and small mammals in ponderosa pine (Kotliar et al. 2007, Dickson et al. 2009, Bagne and Finch 2009a, Kalies et al. 2009). Reducing canopy cover and creating openings in dense, homogeneous forests can negatively affect some species such as tassel-eared squirrels (Dodd et al. 2006), but multiple studies in northern Arizona have concluded that fuels reduction projects have neutral to positive effects on most small mammals (Bagne and Finch 2009b, Kalies et al. 2009). Similar changes in bird species composition can occur with prescribed fire alone or in association with thinning (Hurteau 2007, Dickson et al. 2009). These studies lay the ground work for predicting and monitoring effects of restoration on small mammals and avifauna. Long-term, post-fire monitoring is not typically sustained, but the 4 FRI, with its monitoring and adaptive management components, is expected to provide long-term data to inform the science and management of southwest ponderosa pine forests.

Large-scale, stand-replacing wildland fire, particularly on steep slopes, can lead to erosion and sedimentation pulses that scour or inundate aquatic habitat and riparian features. Thinning and prescribed fire will reduce the risk of stand-replacing wildland fire, thereby reducing potential loss of stream and riparian habitat values. Creating openings interspersed throughout the forest will allow more snow to accumulate on the ground, reducing sublimation (Ffolliot 1975, Baker 2003). Any increased water yields

and groundwater recharge across the 4FRI will benefit aquatic species. However, initiating a program of landscape-level thinning and burning could result in short-term increases in erosion and sediment deposition rates into riparian habitats. The 4FRI project would include buffers adjacent to stream courses and filter strips (unburned areas) to minimize impacts to aquatic resources, including native fish species listed under the ESA. Treatment units potentially affecting native and listed species will be coordinated with the US Fish and Wildlife Service.

Effects to Sensitive plants species are expected to be neutral or beneficial. Most of the Sensitive plants in ponderosa pine have restricted distributions or occur in specific soils and micro-habitats. These areas can be avoided and the 4FRI planning effort will work closely with local botanists. Micro-sites such as those described above can be surveyed, buffered if necessary, or in some cases, receive overstory treatments to enhance plant health. Moving the landscape towards restored conditions should benefit endemic species, but the 4FRI will move cautiously in regards to Threatened, Endangered, and Sensitive plants.

***Management of invasive and exotic species:*** Invasive weed populations in the 4FRI area average 6% of the ponderosa pine habitat, ranging from 2% to 17% by forest. Invasive and exotic plants can establish rapidly following high-intensity fire. Disturbance associated with 4FRI implementation will likely facilitate the spread and establishment of new populations of invasive species. The Coconino and Kaibab National Forests have completed a joint EIS on integrated treatment of noxious and invasive weeds. The Tonto and Apache-Sitgreaves National Forests have individual noxious weed strategies. These strategies will be implemented in all 4FRI projects and the 4FRI monitoring plan will allow for quicker detection and response in order to control new or existing populations of invasive and exotic species.

***Effects of insects and disease:*** Much of the 4FRI area is susceptible to insect and disease infestations. The age-class most susceptible is the old growth component of the forest. Insect and pathogen populations have responded to changing forest structure and variability in climate. The threat of bark beetle (*Ips* spp.) outbreaks is more significant in ponderosa pine today than in pre-1950s forests (Lynch et al. 2008). Dwarf mistletoe incidence and severity have also increased (Lynch et al. 2008). Aspen and oak clones within ponderosa pine forests represent key wildlife habitats (Chambers 2002, Griffis-Kyle and Beier 2003). Both habitat components are suffering from detrimental cumulative effects of biotic and abiotic agents, including conifer encroachment. The potential for severe levels of insect outbreaks and pathogen-related mortality continues to increase, especially during drought years. Current trends are sufficiently different from historic trends to anticipate altered ecosystem processes in the future. Climate model predictions indicate drought and fire effects, and subsequent insect and disease cycles, will likely increase. Current rates of treatments to restore ponderosa pine to healthier conditions are not keeping pace with the risks to old growth and the overall ponderosa pine ecosystem. Ecological restoration under the 4FRI will create openings within the forest matrix, expanding root zones and increasing water and nutrient availability to trees. This will reduce risks from insects and disease, especially to existing old growth, and potentially foster endemic levels of insects and disease. Ecological restoration should reduce tree densities, promote recruitment of old growth, and enhance resilience to drought conditions.

***Status of roads and trails:*** No permanent roads will be constructed under the 4FRI. Construction of temporary roads and upgrades, road maintenance and rehabilitation, and relocation of existing roads will occur as needed for implementation and where it benefits resources. Projects will be designed to minimize the need for and impact of temporary roads. USFS staff are conducting comprehensive evaluations of transportation systems as part of travel management planning across the four forests, and travel management plans will likely be completed starting in 2011. 4FRI planning will coordinate closely with these teams and plan for decommissioning of roads in accordance with opportunities identified in travel management plan.

### **3. Collaboration**

***Representation of stakeholder interests and previous accomplishments:*** The 4FRI represents the culmination of a longstanding series of collaborative efforts designed to build agreement around landscape-scale forest restoration across northern Arizona. For more than a decade, diverse stakeholders have participated in community-based, collaborative restoration efforts such as the White Mountain Stewardship Contract, Greater Flagstaff Forests Partnership, and Community Wildlife Protection Plan (CWPP) processes. Taking advantage of lessons learned through these ongoing efforts, a broad array of stakeholders have agreed over the past decade with increasing specificity on a direction and set of strategies for landscape-scale forest restoration that are ecologically appropriate, socially supported, and economically viable.

Over the course of the last eight years, key stakeholders in the region, including representatives of many cities and towns in northern Arizona, all seven counties in northern Arizona, all major environmental NGOs with forest management/restoration programs, key existing wood products industries, key scientific research institutions, area tribes, and natural resource management agencies have worked to define viable landscape-scale forest restoration strategies for the 4FRI region through processes including the *Western Mogollon Plateau Adaptive Landscape Assessment* (Sisk et al. 2004), *White Mountains Adaptive Landscape Assessment* (Abrams et al. 2005), *Statewide Strategy for Restoring Arizona's Forests* (Governor's Forest Health Councils, 2007), *Analysis of Small Diameter Wood Supply in Northern Arizona* (Hampton et al. 2008), and *Kaibab Forest Health Focus* (Sisk et al. 2009). In total, these efforts have engaged several hundred stakeholders and tens of thousands of hours of expert and stakeholder time and have been supported by more than \$3 million in public and private dollars. More importantly, these efforts have culminated in a level, breadth, and specificity of agreement surrounding landscape-scale forest restoration that is unprecedented in the Southwest and is likely unprecedented across the nation. This agreement has been generated through sequential landscape-scale assessments of current conditions, descriptions and analyses of restoration strategies, and consensus-based formulations of recommendations. Recommendations have centered around strategic direction for landscape-scale restoration, spatial priorities for treatments, general intensities for treatments, overall scale of restoration needed, and the need for and quantity of wood and biomass available for appropriately-scaled wood products industries.

Beginning in 2008, stakeholders began to synthesize landscape-scale, forest restoration recommendations, formalize support for such recommendations, and initiate landscape-scale restoration planning and implementation under the 4FRI. Bolstered by formal declarations of support from many cities and towns in northern Arizona, all northern Arizona counties, the statewide county supervisors' association, the state legislature, and key members of Arizona's congressional delegation, a large group with representatives of nearly all key stakeholders in the region (the 4FRI Collaborative Stakeholder Group)<sup>3</sup> embarked on the current effort to restore ponderosa pine forests across the Mogollon Rim and in the White Mountains. Concurrently, the Forest Service has made a commitment to prioritizing, planning, and implementing this effort across the 4FRI area. While this effort does not currently prescribe actions across tribal lands, tribes have been and will continue to be engaged as the effort proceeds. It is the group's hope that forest restoration acceleration within the 4FRI area will complement and bolster similar efforts on tribal lands.

Working since 2009, the 4FRI Collaborative Stakeholder Group has developed and recently agreed upon a foundation document, entitled *The Path Forward*, to guide 4FRI implementation. This guide outlines an explicit zone of agreement for moving forward with landscape-scale restoration that includes a vision, principle, key strategies, ecological goals, science and collaboration-based adaptive management strategies, and sideboards. The document has secured unanimous agreement within the Stakeholder Group and is one of three foundational documents guiding the effort thus far. The second document is a Charter that describes the collaborative stakeholder structures and processes necessary to implement the

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<sup>3</sup> A 4FRI organization list is attached as Appendix A.

Initiative, including a 4FRI mission, vision, principles, goals, organizational structure, deliberation and decision rules, and participation guidelines. The third document (currently being finalized) is a Memorandum of Understanding between the Forest Service and the 4FRI Collaborative Stakeholder Group outlining a framework for ongoing collaboration. The MOU recognizes the unprecedented level of agreement formalized between key stakeholders, commits stakeholders to continue building agreement-based restoration recommendations to present to the Forest Service, and commits the Forest Service to utilizing those recommendations in combination with additional public comment as input in landscape-scale restoration planning processes.

The Collaborative Stakeholder Group (with continuous representation by more than 75% of the group) has been meeting monthly for the last year with the USFS to begin formally planning and implementing the 4FRI. A 12-member representative Steering Committee provides ongoing direction for the effort. A Communications Working Group coordinates communication and outreach, an Industry Engagement Working Group identifies mechanisms to ensure appropriate industry involvement, a Landscape Strategy Working Group is working to develop cohesive recommendations for completing the 4FRI Landscape Strategy, and a Science and Monitoring Working Group is developing mechanisms for ensuring appropriate science support for the overall effort, including a monitoring and adaptive management program.

Thus far, the primary achievement of the collaborative effort has been to formalize an unprecedented level of social support for large landscape-scale forest restoration across the 4FRI area. The collaborative process has not only brought and kept all key entities at the table, but kept them actively engaged in the planning process. This engagement has resulted in the formulation of agreement-based strategies that will allow restoration to proceed with enough predictability and social support to allow significant, long-term investment by industry partners. This approach is balanced with flexibility mechanisms to allow for the rigorous implementation of an adaptive management program. The 4FRI has provided a compelling venue for stakeholders with traditionally disparate viewpoints to come together, stay together, and envision working together for the next 20 years and beyond.

***Multi-party monitoring:*** Collaborative monitoring for this effort, spearheaded by the Science and Monitoring Working Group in conjunction with the Forest Service, will be multi-party and multi-scale and will contribute to an adaptive management strategy. One of the inherent strengths of the 4FRI effort is that it brings together science providers and interpreters from academia, NGOs, and resource management agencies. This group brings to the effort decades of work experience in the 4FRI landscape as well as substantial public and private resources vital to any monitoring program's long-term success. Key researchers who have developed our understanding of how fire disturbance works in southwestern ponderosa pine communities, how these communities have changed since European-settlement, and how these factors influence wildlife and forest health are participating centrally in the 4FRI effort. Key stakeholders who have worked for decades with these researchers and managers to incorporate monitoring science within collaborative planning processes are also participating centrally. A collaborative, science-driven, monitoring and adaptive management strategy is currently being developed to address long-term ecological questions through systematic, applied, and question-driven science. Results of such efforts will be used to inform ongoing planning and implementation of the 4FRI project. Adaptive management strategies will be presented to the larger Collaborative Stakeholder Group for deliberation and approval, and monitoring and adaptive management results will be used in a coordinated fashion by the Collaborative Stakeholder Group and the Forest Service to track and refine the group's efforts to meet its landscape-scale forest restoration goals.

#### 4. Wildfire

***Current expected wildland fire behavior:*** In Southwestern ponderosa pine ecosystems, high-intensity fires currently burn across larger areas than they did historically (Swetnam and Betancourt 1998, Westerling et al. 2006). These ecosystems were shaped by a variety of natural processes, including a natural fire regime of predominantly frequent, low-intensity surface fires. However, within the 4FRI area, fires are now at risk of burning at a severity, frequency, and scale outside the historic range of variability, as a result of the fundamental shift in forest structure. For example, a predicted fire behavior data layer developed by the Forest Ecosystem Restoration Analysis Project at Northern Arizona University, using the FlamMap (Finney, 2006) fire behavior and analysis program and modeling at 97<sup>th</sup> percentile fire weather conditions, showed that within the 4FRI area 46% of the area was at risk of active crown fire and 15% at risk of passive crown fire. The current increase in number, size, and severity of stand-replacing fires has affected and continues to threaten both human and ecological communities. The intensity of these uncharacteristic fires can alter the successional trajectory of the burned areas, leading to entirely different post-fire vegetative communities than those that existed before the event, further perpetuating an unnatural fire regime (Savage and Mast 2005, Kuenzi et al. 2008).

***Addressing uncharacteristic wildland fire and reestablishing natural fire regimes:*** 4FRI treatments will be designed based on an integration of fire management planning, community protection activities, and a broad program of forest restoration to reduce hazardous fuels through thinning and prescribed burning, in order to create forest conditions where stand-replacing fires are rare under severe burning conditions. This program will reduce the potential for uncharacteristic wildland fire behavior, while creating conditions that facilitate the safe reestablishment and maintenance of natural fire regimes. Low and occasionally mixed-severity, frequent fire will be reintroduced through increased use of prescribed fire and increased management of wildland fire to meet restoration objectives. Areas where natural fires can burn have been identified across the 4FRI landscape, and treatments will be strategically placed to facilitate operational management of those natural fires. The USFS will continue to coordinate with the state and work with the public to address smoke management issues.

***Anticipating and managing wildland fires in a restored condition:*** Once restoration has taken place, we expect that it will be possible for an increased amount of low-severity, frequent fire to burn in this ecosystem. Successful restoration will allow low-severity fire to inexpensively shape forest conditions in the future and will broaden the temporal window and range of weather conditions under which prescribed burning can occur and wildland fires can be managed for restoration objectives. Unplanned ignitions (wildland fire) will be utilized where conditions are suitable to accomplish restoration objectives and will be favored in areas away from the WUI. Where conditions are not suitable for managing wildfires for resource objectives, protection objectives will be accomplished using a range of tactics commensurate with the potential burning conditions.

***Incorporation of CWPPs:*** A total of six Community Wildfire Protection Plans (CWPPs), including Tusayan, Flagstaff, Williams, Rim Country, Apache/Sitgreaves, and Blue Ridge, encouraged by the Healthy Forests Restoration Act of 2003, have been developed and approved by local governments within the 4FRI area. The WUI zones defined in the CWPPs will assist in developing location and types of treatments within the 4FRI area. These WUI zones' "high priority" areas as defined in the CWPPs were incorporated in Community Protection Management Areas (CPMAs) identified in the *Wood Supply Study* (Hampton, et al. 2008). The CPMAs with additional guidance from the CWPPs will be used during 4FRI planning to develop treatments and meet community protection and fire management objectives.

***Reduction of long-term wildland fire management costs:*** The cost of suppressing wildland fires has increased drastically over the last decade in response to numerous influences, including protection of the WUI, a reduced federal workforce, fuel densification and forest health issues, firefighter/public/media expectations, and intolerance to smoke (Mangan 1999; Calkins and Gebert 2009; Gebert et al. 2007).

Additionally, cost increases are influenced by climatic changes, which produce a greater number of large, long-duration fires in combination with prolonged fire seasons (Calkins and Gebert 2009). As a result of increased costs, Congress has increased Forest Service fire budgets by 40% since 2000 (O’Toole, 2002), with fire expenditures averaging \$1 billion per year from 2000-2008 (Gebert et al. 2007; Liang et al. 2008).

At present, USFS fire planning efforts are WUI-focused and occur at small spatial scales when compared to the extent and magnitude of large fires like the Rodeo-Chediski. The 4FRI approach reflects a new direction in fire management by developing a long term landscape level strategy to address wildland fire. The 4FRI mission to treat fuels strategically across the 2.4 million acre planning area would not only maximize restoration effectiveness, but enhance the ability to manage fires for restoration objectives, while simultaneously protecting values-at-risk and minimizing fire management costs.

A comparison among fire suppression costs in the wildland, suppression costs in treated wildland areas, and costs of managing a wildland fire for resource benefit objectives gives a good indication of long-term wildland fire management cost reductions that are expected to occur as a result of 4FRI. Costs associated with the 2002 Rodeo-Chediski Fire, which occurred in the 4FRI area, provide an indication of suppression costs. This fire burned 467,066 acres during a three-week period, destroyed 491 structures, and cost \$153 million dollars, putting costs of suppression at approximately \$327.58/acre. While these values per acre reflect direct firefighting costs, they fail to display the magnitude of loss suffered by those people who lost their homes. Projecting just the suppression costs out at a 4% increase per year puts suppression costs of a wildfire similar to Rodeo-Chediski at approximately \$450/acre in 2010. Staff on the Kaibab National Forest have found suppression costs on recent fires to be as high as \$1080/acre. Simulations have found that the acres burned and associated costs are exponentially reduced in treated areas as compared to non-treated areas (Omi et al. 1999). Snider et al. (2003) demonstrated the cost effectiveness of spending up to \$505/acre to restore forests to prevent unnaturally severe fires (to avoid fire suppression costs), and Mason et al. (2006) determined positive net benefits of fuel removal treatments to be between \$606 and \$1,402 per acre. Additionally, management of wildland fires to meet restoration objectives, which could be done more frequently over larger areas once 4FRI treatments are implemented, costs as low as \$50-80 per acre, according to staff on the Coconino and Kaibab National Forests. Other forests in the region have estimated costs of managing fires to meet restoration objectives to range from \$35-209/acre (estimate from the Gila National Forest). Considering these figures, cost savings resulting from reduced wildfire management costs as a result of the 4FRI would be significant.

## 5. Utilization

Appropriately-scaled businesses will play a key role in achieving the goals of the 4FRI by harvesting, processing, and selling wood products, thereby reducing treatment costs and providing economic opportunities. Within the 4FRI area, a variety of wood products industries currently exist and various potential new utilization proposals have been advanced, ranging from micro-industries to larger-scale industries, with the economic capability to offset the costs of restoration treatment on tens of thousands of acres per year.

**Potential volume, type, and size of wood products to be utilized:** In 2008, the *Analysis of Small Diameter Woody Supply in Northern Arizona (Wood Supply Study)* (Hampton et al. 2008) was completed and filled a key information need by identifying, both through spatial analysis and a collaborative process, the volume of wood within the 4FRI area that might become available to existing and proposed wood utilization facilities as byproducts from forest restoration. Although the vast majority of the wood supply in the area is available on National Forest System land, the analysis also analyzed the available wood supply on the 6% of the area that is non-USFS land. The analysis offers a snapshot in time (year 2006) of wood volumes across the study area and the range of wood byproducts that could potentially be harvested with broad stakeholder support. The study estimated wood volume in three tree diameter classes of <5", 5-16", and >16" diameter at breast height (dbh, 4.5' above base). This analysis estimates a range of 850 million to 1 billion cubic feet of wood byproducts from tree boles alone (defined as the tree's main stem, from the ground to top of tree) and between 8 and 9.5 million green tons from branches and other tree crown biomass. The majority of the volume considered available for removal is in the 5-16" diameter class. The amount of potential forest restoration byproducts identified through this analysis far exceeds the current market demand. The results of this study will be used by the 4FRI to assist in the development of multi-year contracts, to attract new industrial users, and to supply wood fiber to existing, local, wood-product businesses.

**Anticipated industry utilization models and cost-offset opportunities:** The following are regional examples of current and potential industry with the capacity to utilize restoration byproducts:

- The White Mountain Stewardship Contract (WMSC), which officially began on August 10, 2004, has a goal to treat 150,000 acres of degraded federal forests over ten years using stewardship, end-results, contracting authorities. Over the last 5 ¼ years, work under the WMSC has provided for the removal and utilization of ~48,000 ccf per year and treatment of between 5,000-10,000 acres per year (average is 7,500 acres). Current industry and market capacity on the White Mountains could increase in the next several years up to ~20,000 acres of treatment per year.

Table 1. Forest products utilization under the White Mountain Stewardship Contract

Type/Size	Percent of Removal	Use
Topwood	4.5%	Electrical Generation – Cogen Plant
Non-sawlog/5" to 8.9" DBH	35.5%	Electrical Generation – Cogen Plant, Pellets, Pallets
Merchantable Stemwood/9" to 11.9" DBH	32.3%	Pellets, Pallets
Merchantable Stemwood/12" to 15.9" DBH	25.5%	Pellets, Pallets, Dimensional Lumber
Merchantable Stemwood/16" + DBH	2.2%	Dimensional Lumber

- Arizona Forest Restoration Products (AZFRP) has developed a business plan to procure small diameter wood from throughout Northern Arizona and Western New Mexico for the production of oriented strand board (OSB) and to supply biomass power plants or other biomass users, while

following sound ecological restoration science. They have based their model on a typical annual production capacity of 470,000 msf - 3/8" (470 million square feet of board 3/8" thick), which will require approximately 258,000 ccf (25.8 million cubic feet) or 827,000 tons of green logs (with bark) each year. Harvesting this wood will require approximately 32,000 acres of forest to be thinned annually. AZFRP has stated that it could exchange, without additional payments for services rendered, its ecological restoration services for forest products (primarily small diameter ponderosa pine, typically 5" to 12" dbh, or larger if there are prescriptions for multiple age group management) as authorized by the stewardship contracting authority, and to pay a stumpage fee when the value of the wood harvested exceeds the costs of the thinning activities.

- Drake Biomass, LLC's business plan is based on the procurement of material for wood products and biomass from the west side of the 4FRI area. They will produce wood pellets for energy and heat and provide woody biomass to the new Drake Cement plant for use in cement kilns. They are interested in smaller, lower-value roundwood, slash, and other wood waste from current and future operators in the ponderosa pine type and elsewhere. They also plan to operate on ponderosa pine projects that might not provide economically feasible sales for wood products, but would be able to provide biomass for their operations. They estimate their needs to be approximately 101,000 ccf/yr or 350,000 tons/year. That translates to treating approximately 15,000 acres per year.

These are just three examples of current and potential industries that could utilize the material from the 4FRI. Numerous other entities have also expressed interest in the project, including the Northern Arizona Wood Products Association, Forest Energy Corporation, and Pioneer Association. In June 2009, the USFS Southwestern Regional Office issued a Sources Sought notice for industry to gauge the level of interest from private companies in this initiative. Responses to this notice were received from 41 different contractors and companies, ranging from biofuel and electricity generation companies to loggers and pellet producers. Although no contract has yet been issued and industry investments are largely theoretical at this stage, this broad and varied interest suggests a high potential for establishment of new industry and significant new job creation in northern Arizona through this effort.

***Additional cost-offset information:*** Net restoration costs within the 4FRI may vary widely because they are dependent on the value of the timber removed during the treatment. Such values are site specific and difficult to generalize. A feasibility study conducted by the Southwestern Regional Office suggests treatment costs may range from approximately \$125 to over \$1000 per acre, even when woody biomass is removed as a useable product. Wood products enterprises that create value for harvested material will help offset the costs of restoration, allowing restoration to move forward more rapidly over larger areas. The ultimate goal of the 4FRI is to engage new industry such that the value of the woody biomass removed approaches being equal to the cost of removal (removal of all forest restoration byproducts at no charge).

***Need for maintenance and rehabilitation of roads:*** No permanent roads will be constructed under the 4FRI. Construction of temporary roads and upgrades, road maintenance and rehabilitation, and relocation of existing roads will occur as needed for implementation and where it benefits resources. Projects will be designed to minimize the need for and impact of temporary roads. USFS staff are conducting comprehensive evaluations of transportation systems as part of travel management planning across the four forests, and travel management plans will likely be completed starting in 2011. 4FRI planning will coordinate closely with these teams and plan for decommissioning of roads in accordance with opportunities identified in travel management plans. 4FRI project planning and contracting will require additional travel analysis to identify needs and opportunities for road maintenance and decommissioning and associated costs.

## 6. Investments

***Federal and non-federal investments in the landscape:*** Federal investments in the landscape will primarily be planning and implementation of thinning, harvesting, and prescribed burning projects to meet restoration objectives. Other federal investments will include: control and monitoring of noxious weed populations; stream stabilization; aquatic organism passage; road and trail maintenance; meadow and grassland restoration; aspen regeneration and protection; trail reconstruction following fires; bridge installation and replacement to reduce vehicle impacts on streams; road decommissioning and closure; planning for the above projects; and multi-party monitoring of projects. Non-federal investments will include the same types of projects listed above, as many of these projects are done through partnerships. Non-federal investments outside of the project area are expected to consist of new infrastructure and industry based around wood products. The specifics of the type and size of industry will not be known until contract negotiations begin. However, as an example, Arizona Forest Restoration Products estimates that it would make a \$243 million investment to build a plant to process 30,000 acres of material per year.

***Anticipated decreases in restoration costs:*** Costs associated with the 4FRI will decrease over time due to: 1) planning efficiencies that result from the utilization of innovative approaches based on remotely-sensed data to accomplish landscape-scale planning, 2) efficiencies associated with increases in the scale of operations, and 3) costs that are shifted to industry or community partners as restoration activities increase in scale. In 2008, a Southwestern Regional Office task force identified potential cost savings that would occur as a result of accelerated implementation of restoration thinning treatments on up to 30,000 additional acres per year. The group anticipated cost savings in all five primary cost centers: NFMA consistency, NEPA project planning, sale preparation/layout, contract administration, and post-project monitoring. Total costs per acre, including planning, surveys, sale preparation and administration, and monitoring, but not including payments for acres treated, are projected to decrease from current costs of, on average, \$360/acre to \$182/acre. For example, sale preparation and administration costs are expected to decrease from \$200/acre to \$74/acre and from \$75/acre to \$47/acre, respectively, after the first three years of implementation. The costs of implementing prescribed fire also would decrease over time once areas to be burned have been thinned.

Decreased costs to the federal government also would result from industry utilization of forest products and the associated reductions in payment rates under stewardship contracts. The current capacity to conduct mechanical thinning for restoration is about 17,000 acres/year across the four forests. This is based on the current funding and staffing, as well as available industry and markets for wood. As the project proceeds, we will be able to increase thinning to cover a total of 45,000-50,000 acres/year. This will be due to an expected increase in funding and staffing for the forests as well as an increased industry capacity to utilize material so that the value of forest products offsets and reduces over time payment rates under stewardship contracts. Current thinning costs vary from \$125/acre to \$750/acre and are expected to decrease over time and potentially be completely offset by product value as the number of acres treated increases to nearly 50,000 acres/year across the landscape.

***Benefits to local economies—job creation:*** The implementation of landscape-scale restoration includes a wide range of economic activities, including: logging during the implementation of restoration treatments; transportation of logs and biomass to processing facilities; utilization of logs and biomass; shipping of byproducts of utilization; support activities (mechanical maintenance, fuel procurement, etc.); indirect activities (economic activities created in turn by direct activities, e.g. spare parts procurement, supply of fuel, etc.); and, induced economic activities (resulting changes in spending from households). CFLRF dollars would support existing employment and immediately contribute to the creation of new employment. Existing sources of data, including estimates from industry business plans and from economic assessments from the White Mountains, indicate that, in combination with current work taking place on the four forests, the implementation of mechanical thinning treatments over an additional 30,000 acres of industry-supported restoration will have the capability to support ~600 private sector jobs. A

new report from the Ecological Restoration Institute estimates that the 4FRI could support 700+ jobs a year for 20 years (Kim 2010). We estimate that the impact of the CFLRP funding would be to support approximately 250-300 FTE direct employees in the short-term and then contribute to the creation of an additional 320 to 475 FTE direct employees once accelerated restoration activities are fully underway.<sup>4</sup> Additionally, the implementation of 4FRI is expected to trigger the reconstruction of an appropriate-scale utilization infrastructure. To provide an example, a study conducted by the Northern Arizona University W.A. Franke College of Business to analyze the economic impact of AZFRP's utilization model identified the potential for creation of 425 FTE construction jobs. Such jobs are temporary by nature but are expected to boost the northern Arizona economy for a period of 18-24 months as investments are made in a new utilization infrastructure.

Efforts towards achieving landscape-scale restoration will require the US Forest Service to add many new positions in northern Arizona. Collaborative efforts, coordination, environmental planning and analysis, surveys, sale preparation and administration, and contractor oversight will require a significantly expanded federal workforce. To date, the Forest Service has added four new FTEs to create a 4FRI implementation team, with the addition of two more positions on the horizon. Prior to implementation, large-scale planning and environmental analyses will be required in order to complete the NEPA process. This will require additional personnel from various technical specialties, including biologists, archeologists, hydrologists, soil scientists, and NEPA specialists, among others. In order to ramp up to the envisioned scale of implementation, a substantially larger workforce of silviculturists, foresters, and timber markers will be required, along with administrative support from contracting officers, resource clerks, sale administrators, harvest inspectors and engineers. The Southwestern Regional Office has rigorously explored the efficiencies associated with different staffing options for the 4FRI. All told, it is expected that this large scale restoration effort would require ~48 new FTE federal employees, which would be composed of a mix of seasonal and year-round personnel from the GS 5-13 levels. We estimate these jobs to include: 6 GS 11-13 core 4FRI team members; 17 GS 5-12 positions in preparation; 15 GS 5-12 positions in sale administration; and 10 GS 5-12 positions in NEPA and other resource specialties.

***Other employment and training opportunities for private, nonprofit, small business and youth groups:*** Because landscape-scale restoration will require innovative, high quality, and efficient preparation and harvesting strategies, and because such capacities have been lost (or have yet to be developed), it will be essential to build and implement work-force training programs, both on-the-job and within educational institutions. It will also be necessary to recruit trainees for such programs, as well as groom potential forest professionals and technicians, beginning at the high-school level. Since a number of the projects are currently or expected to be done in conjunction with partners, there will be employment and training opportunities for local, private, and non-profit entities (such as Coconino County's Sustainable Economic Development Initiative (SEDI) Workforce Training Project). There will also be employment and training opportunities for youth groups (YCC, AmeriCorps, and Tribal crews). The development of new industry or expansion of existing industry is expected to provide substantial opportunity for employment and training opportunities for a variety of small and medium-size businesses.

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<sup>4</sup> Estimates are that accelerated restoration under 4FRI will support 120-150 logging and trucking, 150-250 roundwood utilization, and 50-75 biomass utilization FTE direct employees.

## 7. Funding Estimates

**2010:** The work will include preparation of 7,000 to 10,000 acres that have NEPA completed. They will be included in task orders in FY12 and 13. There may also be some road improvement work or survey work that will be done this fiscal year for task orders in FY12 or FY13.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2010 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2010 Funding Type	Dollars/Value Planned
FY 2010 Funding for Implementation	26,137,000
FY 2010 Funding for Monitoring	878,000
1. USFS Appropriated Funds	\$14,749,000
2. USFS Permanent & Trust Funds	\$1,176,000
3. Partnership Funds	\$756,000
4. Partnership In-Kind Services Value	\$216,000
5. Estimated Forest Product Value	\$275,000
6. Other (specify) Recovery Act funds	\$7,843,000
FY 2010 Total (total of 1-6 above for matching CFLRP request)	\$25,015,000
FY 2010 CFLRP request (must be equal to or less than above total)	\$2,000,000
Funding off NFS lands associated with proposal in FY 2010 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2010 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2011:** The work will include preparation of 10,000 acres that have NEPA completed. They will be included in task orders in FY13 and 14. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used to pay for establishing office space and hiring of new employees needed to implement the project.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2011 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2011 Funding Type	Dollars/Value Planned
FY 2010 Funding for Implementation	\$18,365,000
FY 2010 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$275,000
6. Other (specify)	
FY 2011 Total (total of 1-6 above for matching CFLRP request)	\$15,425,000
FY 2011 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2011 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2011 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2012:** The work will include preparation of 15,000 acres and administration of approximately 10,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used to pay for establishing office space, hiring of new employees needed to implement the project, and some initial monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2012 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2012 Funding Type	Dollars/Value Planned
FY 2010 Funding for Implementation	\$18,483,000
FY 2010 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$393,000
6. Other (specify)	
FY 2012 Total (total of 1-6 above for matching CFLRP request)	\$15,543,000
FY 2012 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2012 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2012 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2013:** The work will include preparation of 20,000 acres and administration of approximately 15,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used for monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2013 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2013 Funding Type	Dollars/Value Planned
FY 2013 Funding for Implementation	\$18,603,000
FY 2013 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$513,000
6. Other (specify)	
FY 2013 Total (total of 1-6 above for matching CFLRP request)	\$15,663,000
FY 2013 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2013 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2013 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2014:** The work will include preparation of 25,000 acres and administration of approximately 20,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used for monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2014 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2014 Funding Type	Dollars/Value Planned
FY 2014 Funding for Implementation	\$18,683,000
FY 2014 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$593,000
6. Other (specify)	
FY 2014 Total (total of 1-6 above for matching CFLRP request)	\$15,743,000
FY 2014 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2014 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2014 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2015:** The work will include preparation of 30,000 acres and administration of approximately 25,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used for monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2015 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2015 Funding Type	Dollars/Value Planned
FY 2015 Funding for Implementation	\$18,763,000
FY 2015 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$673,000
6. Other (specify)	
FY 2015 Total (total of 1-6 above for matching CFLRP request)	\$15,823,000
FY 2015 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2015 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2015 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2016:** The work will include preparation of 30,000 acres and administration of approximately 30,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used for monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2016 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2016 Funding Type	Dollars/Value Planned
FY 2016 Funding for Implementation	\$18,843,000
FY 2016 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$753,000
6. Other (specify)	
FY 2016 Total (total of 1-6 above for matching CFLRP request)	\$15,903,000
FY 2016 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2016 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2016 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2017:** The work will include preparation of 30,000 acres and administration of approximately 30,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used for monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2017 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2017 Funding Type	Dollars/Value Planned
FY 2017 Funding for Implementation	\$18,843,000
FY 2017 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$753,000
6. Other (specify)	
FY 2017 Total (total of 1-6 above for matching CFLRP request)	\$15,903,000
FY 2017 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2017 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2017 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2018:** The work will include preparation of 30,000 acres and administration of approximately 30,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used for monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2018 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2018 Funding Type	Dollars/Value Planned
FY 2018 Funding for Implementation	\$18,843,000
FY 2018 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$753,000
6. Other (specify)	
FY 2018 Total (total of 1-6 above for matching CFLRP request)	\$15,903,000
FY 2018 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2018 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2018 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

**2019:** The work will include preparation of 30,000 acres and administration of approximately 30,000 acres. There will also be some road improvement work or survey work that will be done this fiscal year for task orders in future years. The funds will also be used for monitoring.

Funds to be used on NFS lands for ecological restoration treatments and monitoring that would be available in FY 2019 to match funding from the Collaborative Forested Landscape Restoration Fund	
Fiscal Year 2019 Funding Type	Dollars/Value Planned
FY 2019 Funding for Implementation	\$18,843,000
FY 2019 Funding for Monitoring	\$1,060,000
1. USFS Appropriated Funds	\$14,300,000
2. USFS Permanent & Trust Funds	\$150,000
3. Partnership Funds	\$500,000
4. Partnership In-Kind Services Value	\$200,000
5. Estimated Forest Product Value	\$753,000
6. Other (specify)	
FY 2019 Total (total of 1-6 above for matching CFLRP request)	\$15,903,000
FY 2019 CFLRP request (must be equal to or less than above total)	\$4,000,000
Funding off NFS lands associated with proposal in FY 2019 (does not count toward funding match from the Collaborative Forested Landscape Restoration Fund)	
Fiscal Year 2019 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

## 8. Funding Plan

### Planning

Sustained Regional Commitments will support the 4FRI Planning Team. This Team is responsible for 4FRI assessment and NEPA implementation. This commitment is comprised of equal parts WFHF (Hazardous Fuels), NFTM (Forest Products) and NFVW (Vegetation/Watershed) dollars.

### Implementation and Monitoring

Forest base budgets for implementation and monitoring will be adjusted to support 4FRI costs and more than match CFLRP funds. Total annual (non-CFLRP) funding for implementation and monitoring is expected to range between \$4 and \$11 million for the combined four forest strategy. This funding includes NFRR (NFTM, NFVW, NFWF), CMRD (road maintenance), NFLM (land survey) and WFHF (fuels) dollars. In fiscal years 2010 and 2011, IDIQ Contracts are in place to obligate the majority of CFLRP funds immediately. Cultural resource surveys, wildlife surveys, marking and cruising, and landline surveys can be contracted quickly.

### Implementation Strategy and Use of CFLRP Dollars

In FY10, CFLRP funds will be used to prepare 7,000 to 10,000 acres that have NEPA decisions completed across the four forests. The work will be done by contract, and the exact number of acres will be based on the cost per acre and any additional work that needs to be done. The additional work would include pre-implementation monitoring, cultural resource surveys, wildlife surveys, land line location, and road improvements needed.

In FY11, CFLRP funds will be used to prepare another 10,000 acres that either have NEPA completed or NEPA scheduled for completion in FY10. Much of this work also will be done by contract, as we begin to increase the workforce. Some of the funding requested for FY11 is to establish office space, pay for salary and TOS costs, as well as additional pre-implementation monitoring, resource surveys, land line location, and road improvements.

In FY12, we expect to award the first contract and therefore will be administering the first task order (estimated to be 10,000 acres). We will also prepare an additional 15,000 acres. We plan to complete hiring of necessary staff in this year, so there will also be TOS costs to cover. There will be additional work as described above, including monitoring, surveys, land line location, and road improvements.

From FY13 forward, the funds will be used for preparation of acres, administration of task orders, surveys, road improvements, and monitoring.

While the cost per acre of implementation is expected to substantially decrease over the first few years of the project, the requested funding level remains at \$4MM per year. This is because as costs decrease, the number of acres to be treated will increase. By year 10, we expect to have a second, or possibly a third, large contract underway.

### Assumptions

- The FY 2010 Final Budget is assumed to be the base level of funding.
- The first of several 10-year contracts would be solicited in fall 2010 and awarded in early 2012.
- The value of wood fiber remains at \$2/CCF even though it is expected to rise as infrastructure

settles in.

- The 4FRI will increase regional accomplishments. For example, once up to predicted outputs, the region would more than double the HARVEST-VOLUME-SOLD. Likewise Fuels, Wildlife, and Watershed accomplishments will ramp-up. It is assumed that the region would receive increased base funding at some fraction of the current per unit cost rate. Anticipated base budget increases are \$2.5 million in 2012, \$3.0 million in 2013, and \$5.0 million for each year beyond.
- Monitoring is built into annual budgets at 10% total expenditure. The Southwestern Region commits to supporting multi-party monitoring associated with the 4FRI for at least 20 years—the expected life of the 4FRI. Multi-party monitoring will continue for a number of years after implementation is complete in order to understand long-term effects of 4FRI activities.

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Organizations Involved in the 4 Forest Restoration Initiative:

- Arizona Forest Restoration Products
- Arizona Game and Fish Department
- Arizona State Forestry Division
- Arizona Eastern Counties Association
- Center for Biological Diversity
- Coconino County Board of Supervisors
- Coconino Natural Resources Conservation District
- Coconino Rural Environment Corps
- Ecological Restoration Institute
- Flagstaff Fire Department
- Forest Energy Corp.
- Gila County
- Graham County
- Grand Canyon Trust
- Greater Flagstaff Forest Partnership
- Greenlee County
- Northern Arizona Wood Products Association
- Natural Resources Working Group
- The Nature Conservancy
- Navajo County
- Northern AZ Logging Association
- Northern Arizona University Forest Ecosystem Restoration Analysis (ForestERA)
- Pioneer Association
- Rocky Mountain Elk Foundation
- Sierra Club
- Southwest Sustainable Forests Partnership
- USDA Forest Service Rocky Mountain Research Station
- USDA Forest Service
- US Fish and Wildlife Service