Proposed Treatment

The proposed treatment is to restore shortleaf pine-bluestem woodlands in the 163,814-acre Arkansas red-cockaded woodpecker Habitat Management Area (RCW HMA), and in embedded and adjacent old growth restoration units totaling 26,374 acres. Gross project area is therefore 190,188 National Forest acres.

About 50,000 acres of the project area is in a restored condition. Many more acres are in the process of restoration, some having been thinned only, others having been thinned with midstory reduction, and still others having been thinned with midstory reduction and one or more prescribed burns applied. Because of the large project scale and long implementation time frame, some acres have not yet received any treatment.

The goal for this CFLR proposal is to supplement other funding sources in order to maintain the area already in a restored condition and continue the restoration work on an additional 60,000 acres during the next 10 years. Thus the total area in a substantially restored condition should be about 110,000 acres at the end of 10 years, and the remainder of the project area, about 80,000 acres, will be in various stages of restoration.

The framework for restoring these landscapes was established on the Ouachita National Forest two decades ago. Additional funds requested in this proposal will build upon that framework, allowing these pine/bluestem landscapes to once again be a significant feature in the Ouachita Mountains.

Land use changes in the Ouachita Mountains over the last century and a half, mostly cutting of the original forests and fire exclusion, have resulted in the loss of open shortleaf pine-bluestem woodlands. With the loss of these woodland habitats, their dependent flora and fauna declined or disappeared altogether.

The restoration prescription for both the RCW HMA and the old growth units includes reducing the basal area of overstory trees from the initial average of 120 sq. ft. per acre to about 60 sq. ft. per acre through thinning, followed by removal of the woody midstory vegetation, and then by prescribed burns applied generally at 3-year intervals. Desired conditions, i.e. open overstory canopies, midstories without woody vegetation, and understory vegetation of prairie grasses and forbs, can normally be achieved in about 10-12 years with one thinning, a midstory reduction treatment, and three effective prescribed burns. The condition can be maintained indefinitely by periodic thinnings to keep basal areas between 60 sq. ft. and 80 sq. ft. per acre at all times and effective prescribed burns applied at 3-5 year intervals. Long term perpetuation of the overstory shortleaf pines is accomplished by shelterwood regeneration cutting at 160-year intervals (160 year rotation) in the old growth units, and at120-year intervals (120 year rotation) in the red-cockaded woodpecker HMA.

The thinnings and occasional regeneration cutting treatments are accomplished with commercial timber sales. Traditionally the midstory reduction and prescribed burns have largely been accomplished with receipts retained from the timber sales under authority of the Knutson-Vandenberg Act, supplemented here and there with appropriated funds. Lately, some of this

work has been accomplished through stewardship contracts, or with receipts retained from stewardship projects. With the recent downturn in the business cycle and low prices being paid for stumpage, timber sales do not produce sufficient revenue to pay for all the necessary follow-up treatments. If successful with this proposal, our intent is to use CFLR grant funds to supplement timber sale receipts and continue the successful restoration and maintenance activities of the last two decades.

This project area in western Arkansas is a well consolidated cohesive landscape of contiguous public land which lends itself well to large scale restoration efforts. Interspersed among the large blocks of NFS lands are small blocks of private holdings (see maps in the Maps and Photo Section). However, this proposal is only for National Forest lands.

Desirable outcomes resulting from this work include:

- Restoration of a once common but now rare ecosystem with most of its complement of native plants and animals present in viable numbers.
- Increases in site productivity from the effects of restoration activities on soil nutrients, chiefly nitrogen.
- Improved watershed conditions as the grass/forb ground cover better binds the soil, thus decreasing erosion and sedimentation.
- Red-cockaded woodpecker populations growing at a significantly higher rate than the recovery plan goal of 5% per year. Rates of 10-20% per year are possible, and could result in a population of over 100 breeding groups in 10 years.
- Improved habitat for the endangered American burying beetle with possibilities for population expansion into the project area.
- Greatly increased habitat for the bluestem grasses, pale-purple coneflower and other prairie flora.
- Increased habitat for important game animals including deer, turkeys, and bobwhites.
- Greater opportunities for hunting recreation.
- Increased habitat for Diana's fritillary (a butterfly), Bachman's sparrow, brown-headed nuthatches and several early successional neotropical migratory birds such as prairie warblers and yellow-breasted chats that have declined throughout their ranges.
- A continued and sustainable supply of industrial wood for timber using industries.
- Improved forest health conditions, including reduced risk for southern pine beetle caused tree mortality.
- An overall reduction of hazardous fuels and a lessened risk of tree mortality from wildfires.

Mechanisms for restoration include the following:

- Timber sales, using appropriated funding and largely force account personnel;
- Midstory reduction and timber stand improvement using KV funds, stewardship contracts, receipts retained from stewardship contracts, and appropriated dollars;
- Prescribed burning funded through KV, retained stewardship receipts, and appropriated dollars using contracts and force account crews.

Current NEPA decisions authorize 121,236 acres of restoration/maintenance treatments. In addition, decisions expected to be signed in FY 2010 or FY 2011 will authorize an additional 34,972 acres of treatments.

CFLR funds would allow restoration in 2010 of 1,800 acres. Annually thereafter, from 2011 through 2019, at least 17,500 acres will be treated with restoration actions using primarily KV funds. These funds will be part of the match for requested CFLR funds which, if received, will allow completion of an additional 17,500 acres each year, for a yearly total of 35,000 acres (see Table 1, Investment Section). These efforts will create a substantially restored condition in about 110,000 acres at the end of 10 years, with the remainder of the project area, about 80,000 acres, in various stages of restoration.

The overall acreage requested for CFLR funding and the work accomplished by the Forest with its own annual funding over the 10 year period will total more than 110,000 acres due to the different stages involved in the restoration and maintenance process. Acres will be reentered for 3-5 year rotation burns and for maintaining and completing restoration work in previously entered stands.

Priority with CFLR funds would be given to those areas where restoration has already begun and where funds to continue implementation are in short supply or are not available. CFLR priority would also target areas adjacent to active RCW clusters to provide recruitment habitat. In conjunction with the work mentioned above, new stands will also be entered for the first stages of restoration work. In other words, all stages of restoration work will be occurring in any given year from 2010 through 2019.

Multi-party monitoring of the restoration work with CFLR funds will be done in cooperation with The Nature Conservancy (TNC) and Audubon Arkansas. TNC will be monitoring changes in vegetation to assess progress toward desired conditions. Audubon will be monitoring responses of birds to restoration activities.

The objectives based monitoring program will be geared toward answering the following questions:
1) Are ecological restoration activities reducing hazardous fuels?
2) Is the health of the forest (pine-bluestem ecosystem) within the project area being enhanced and maintained?
3) Are restoration activities resulting in the expansion of RCW nesting and foraging habitat and an increase in the RCW population?
4) Are restoration activities resulting in an increase in habitat quality and populations of Bachman's sparrow, brown-headed nuthatch, prairie warbler, and yellow-breasted chat?

Forest health in the pine-bluestem restoration area will be defined by TNC and partners with a suite of desired ecological parameters including:

1. The existing set of native ecological systems is maintained within the restoration site and the regeneration of overstory trees is within the desired range of variation.
2. The density and diversity of overstory woody species is within the desired range of variation.
3. The density and diversity of midstory and understory woody species is within the desired range of variation.
4. The diversity and cover of the native herbaceous understory layer is within the desired range of variation.
5. The frequency, seasonality, and intensity of fire are maintained within the desired range of variation.
6. Non-native species are not a dominant component of any ecological system and are reduced or maintained below problem levels.

Success will be measured first by tracking the implementation of treatments so that the Forest Service and its partners can show that they did what they said they are going to do, and second, that the outcomes were as predicted in moving forest conditions to the desired state.

Ecological Context

The Ouachita Mountain Physiographic Region is comprised of about 8 million acres in west-central Arkansas and southeastern Oklahoma. Of this total, about 2 million acres are owned by several large companies that produce wood products. The Ouachita National Forest is comprised of about 1.8 million acres. The remaining land is in private ownership, usually held by individuals in tracts from a few acres to several hundred acres in size.

In large part the native shortleaf pine-hardwood forests on the private industrial lands have been converted to loblolly pine plantations that range in age from very young to about 30 years. Companies focus on objectives to produce small sawtimber products under short rotations (30-35 years) rather than strategies that sustain natural ecosystems. Private non-industrial land uses vary and include pastures, tree plantations and native forests. Ouachita NF lands are managed under the principles of multiple use and ecosystem management. Strategies that sustain the diversity, structure, and function of the shortleaf pine-bluestem ecosystem meet objectives for producing wood products, producing clean water, and providing a variety of recreational opportunities as well.

Historic accounts by early travelers and settlers in the Ouachita Mountains described extensive areas of open shortleaf pine woodlands with understory vegetation dominated by prairie grasses and forbs. These woodlands were created and maintained by regular fires set by lightning, Native Americans and settlers. They supported a unique flora and fauna, including, among others, bison, elk, red-cockaded woodpecker, Bachman's sparrow, brown-headed nuthatch, bobwhite, Diana's fritillary (a butterfly), and a prairie flora of tall bluestem grasses and forbs such as the pale purple coneflower. With the cutting of the original stands early in the last century and some 70 years of fire exclusion, woodland ecosystems disappeared from the Ouachita Mountain landscapes. The second-growth forests are dense with high tree basal areas in the overstory, and multiple layers of woody vegetation in both the midstory and understory. Grasses and forbs are mostly absent. As a result of these changes, the prairie flora became confined to roadsides; bison and elk were extirpated; Bachman's sparrows, brown-headed nuthatches, bobwhites and Diana's fritillaries declined precipitously; and the red-cockaded woodpecker became endangered.

Prevailing vegetative conditions in the pine lands of the Ouachita National Forest today can best be described as dense shortleaf pine-hardwood forests comprised of trees ranging from 70 to 90 years old with well developed woody midstories and understories dominated by woody shrubs. The average stand has about 100 sq. ft. of basal area per acre of overstory shortleaf pines and 20-30 sq. ft. of basal area per acre in hardwoods. Most of the hardwood basal area is in small trees ranging from 3 to 9 inches d.b.h. See the photo depicting un-restored conditions in the Maps and Photo Section.

Desired conditions can best be described as open stands of shortleaf pine with some hardwoods, basal areas ranging between 60 sq. ft. and 80 sq. ft. per acre, with few or no woody midstory stems, and with understories dominated by tall prairie grasses, forbs, and occasional shrubs. See the photo showing desired conditions in the Maps and Photo Section. When restored, these conditions will give full scope to the re-development and maintenance of the unique woodland flora and fauna. In general, the treatment will benefit 16 species of birds that are of conservation

concern, 5 species of bats that prefer open stands, 16 species of herptiles, butterflies as a group, and some 150 species of native herbaceous plants that are largely absent from un-restored areas.

The red-cockaded woodpecker was once found in the pine lands of the Ouachita Mountains from Atoka County, Oklahoma to near Little Rock, Arkansas. Today it exists as one tiny population of about 15 groups on lands owned by the Oklahoma Department of Wildlife Conservation in McCurtain County, Oklahoma and a more robust population of 52 groups in the Arkansas HMA portion of this CFLR project area. The Arkansas population has increased to this level from a beginning population of 13 groups in 1990. Under restoration management the annual rate of population increase has averaged about 10 percent. This is double the 5 percent annual increase suggested as a goal by the Red-cockaded Recovery Plan. If the 10 percent rate of increase is sustained for the next 10 years, the population will exceed 100 groups. There are no possibilities for sustaining suitable habitat for, or for recovery of red-cockaded woodpecker populations on private lands in the Ouachita Mountains.

Though not presently occurring in the project area, another endangered species, the American burying beetle, does occur near the project area and is known to favor areas with grassy ground level vegetation because of the large number of birds and small mammals that occur in such habitats. These beetles locate and bury carcasses of small birds and mammals on which they then lay their eggs. American burying beetles are expected to benefit from this woodland restoration project and expansion of populations into the project area is a possibility.

Studies carried out in the project area have shown that a number of other wildlife species benefit from woodland restoration. These include two important game animals, white-tailed deer and bobwhites. Preferred deer forage is seven times more abundant in restored stands than in untreated controls, and the project area is one of the few remaining places in Arkansas with huntable populations of bobwhites. The Diana's fritillary has declined throughout most of its range to the point that it has been discussed for listing as an endangered species. In June every year the Diana's is one of the most abundant butterflies in the restored portion of the project area. Two neotropical migratory bird species of concern, the prairie warbler and yellow-breasted chat, whose populations have been in recent decline range-wide, are present in good numbers in restored woodlands. Two other woodland bird species that have been in decline elsewhere, Bachman's sparrow and brown-headed nuthatch, occur regularly in the project area.

Though extensive studies have been completed on a number of wildlife species in these restored woodlands, none has yet focused on the wild turkey. Turkey numbers have been in decline since 2003, caused in part by unfavorable weather conditions during the reproductive season. Despite excellent turkey numbers in restored habitats prior to 2003, some professionals and a great many of the public have begun to wonder about the effects of prescribed burning, especially during the nesting season. This proposal includes funds for a cooperative study to determine the effects of burning on nesting turkeys and to determine how turkeys use these restored landscapes throughout the year.

In terms of watershed function and quality, restored woodlands will exceed un-restored areas, largely because the fibrous root systems of grasses bind the soil much better than leaf litter, thus reducing the potential for erosion and sedimentation. Constructed fire lines are a potential source of erosion and sedimentation. For this reason fire line construction is minimized. Existing roads

and streams are used as firebreaks whenever possible and those fire lines that must be constructed are water-barred, seeded, and in some cases, mulched when the prescribed burn is completed. The single largest contributor to sediment is the road system. In order to minimize sediment from roads, best management practices are observed in design, construction, and maintenance activities.

Non-native invasive species are not a major problem in the project area. Prescribed burning allows native fire-adapted plants to dominate, reducing many invasive and exotic species. Sericea lespedeza, once planted for erosion control on roadsides, still occurs along many system roads within the project area. Some roadsides have already been treated to control it and other roads can be treated as the need arises.

The permanent transportation system in the project area is largely in place. However, short segments of road sometimes have to be constructed in the project area to facilitate timber sales, though none of the funds requested in this proposal would be used for that purpose. During the development of project level plans, interdisciplinary teams consider the road network as part of the environmental analysis. Often a decision is made that a road or road segment is no longer needed for the permanent network. In those cases the road is decommissioned and obliterated. Over the last few years an average of 1 mile of road has been decommissioned in each project level watershed. Project plans are written for about 4 watersheds each year in the CFLR project area, resulting in the decommissioning of about 4 miles of road per year. Temporary roads are routinely used for logging operations. When logging is complete, the temporary roads are water-barred, re-seeded, and closed. The permanent roads are maintained according to best management practices detailed in the Forest Plan.

In considering ecological adaptability, there remains little doubt that the climate of our world is changing. This may portend warmer and drier conditions in temperate zones in which this project area occurs. There could be an increase in the frequency and intensity of wild fires. If that eventuates, restored woodlands should be much more resistant to the effects of fires than dense multi-storied stands because fuels are reduced by regular prescribed burning and such stands have no woody midstory trees to act as a fuel ladder to the tree canopy. In 1963, a wild fire occurred just south of the project area in un-restored stands much like those of today. This fire, the Eagleton Fire, destroyed overstory trees on some 10,000 acres. Under all but the most extreme conditions, woodland stands are largely fire-proof when considering the potential for mortality of overstory trees. Changing conditions could also lead to irruptions of insect pest populations, especially the destructive southern pine beetle (spb). Woodlands should be less susceptible to the initiation and spread of spb outbreaks because of lower basal areas, which increases the distance between trees, and the increased vigor of individual trees growing in un-crowded conditions. Indeed, during the last spb epidemic in the Ouachita Mountains that occurred in 1995 and 1996, trees growing in restored woodlands were hardly affected.

Collaboration

Collaborators for this project proposal include The Nature Conservancy, Arkansas Audubon Society, Audubon Arkansas, Arkansas Game and Fish Commission, National Wild Turkey Federation, and Arkansas State University. The Nature Conservancy participated in its drafting, and if the grant is received, they will monitor the progress of vegetative change as work progresses. Audubon Arkansas will assist with additional monitoring of changes in bird populations. The Arkansas Game and Fish Commission, National Wild Turkey Federation, and Arkansas State University will cooperate with the Ouachita National Forest to study the effects of restoration, especially spring burning, on the wild turkey. Arkansas State University will also cooperate with the Forest Service on more extensive RCW monitoring work.

Collaboration has been the hallmark of the shortleaf pine-bluestem restoration project from its inception in the early 1990s. First, through a series of open meetings in 1992, the proposal for restoring a historic ecosystem and, in the process, providing for a recovered population of the endangered red-cockaded woodpecker was shared with the public and their ideas about how to go about it were solicited. Next, a group of citizens representing the various interests identified during the public meetings was invited to participate during the interdisciplinary process to plan the project. Those persons were from the Ouachita Watch League, a group opposed to clearcutting and herbicide use and who were then in litigation with the Forest Service over those issues; the timber industry whose interests lay in a continued supply of wood products from the Forest; the Arkansas Game and Fish Commission whose interests encompassed both game and non-game animals; and the Arkansas Audubon Society, interested in recovery of the red-cockaded woodpecker. Using guidance from the Regional Forester's long-term red-cockaded woodpecker management strategy and the Fish and Wildlife Service's recovery plan for the species, this group of people worked with ONF specialists to define desired future conditions for the project area. This work culminated in the issuance of a Draft Environmental Impact Statement that received no negative public responses and no appeals. The Record of Decision amending the Forest Plan and formally initiating implementation of this work was signed in May 1996.

Collaboration did not stop when the Forest planning phase ended. Throughout the subsequent 14 years, cooperation with partners has continued in the implementation phase. Arkansas Game and Fish Commission personnel routinely participate in the development of watershed project level decisions that direct actual restoration implementation on the ground. Personnel from the Arkansas Audubon Society have assisted with population monitoring for the RCW and with translocations of donated RCWs from other populations. The Arkansas Natural Heritage Commission has collaborated on several occasions to arrange mutually beneficial swaps of individual red-cockaded woodpeckers to augment RCW populations on both National Forest and Commission lands. The National Wild Turkey Federation regularly contributes funding through their Super Fund program to help cover restoration costs. Their largest single contribution was $10,000 designated to help pay for helicopter time for prescribed burning. These cooperative efforts continue today.

No mention of collaboration in this project would be complete without a discussion of the collaborative research that has been accomplished, mostly through challenge cost-share

arrangements with partners. Faculty and graduate students at Oklahoma State University completed studies to determine the effects of restoration on vegetation, birds, small mammals, bobwhites, deer forage, and economics. Faculty and graduate students at the University of Arkansas completed studies on predation of black rat snakes on RCWs, factors affecting breeding success of RCWs, RCW home ranges and foraging characteristics, the effect of cavity restrictors on RCWs, the breeding success of translocated female RCWs, and the importance of early successional habitats for neotropical migratory birds. In all, eleven graduate students at these schools received advanced degrees by studying some aspect of restoration. Personnel from the Southern Research Station of the Forest Service contributed studies about the effects of restoration on reptiles, amphibians, butterflies and their nectar sources, and moth fauna. Faculty from the University of Arkansas at Monticello and Ouachita National Forest soil scientists cooperated on studies to determine the effects of restoration on soil and foliar nutrients. To date, these studies have resulted in more than 50 scientific articles being published in peer-refereed journals. Results of these studies are used adaptively to refine implementation techniques in a monitor-and-adjust manner.

Finally, the cooperation from the very beginning of various members of the Ouachita Timber Purchaser's Group must be acknowledged. To date, they have competed among themselves for, and bought every timber sale offered, either with the standard timber sale contract, or with a stewardship contract, making the restoration work economically possible.

The shortleaf-bluestem restoration project has benefitted greatly from two decades of collaborative efforts. The successful results have been recognized with two national awards, the Chief's Ecosystem Management Award in 1999, and the Chief's Wings Over the Americas Award in 2005.

Wildfire

Historically, the Ouachita Mountains supported extensive woodlands of open shortleaf pines and hardwoods, where woody midstory stems were largely absent, and understories were dominated by a prairie flora of tall grasses, chiefly bluestems, and forbs. These woodlands were fire-created and fire-maintained. The average fire return interval was less than 10 years. These were the forest conditions under which red-cockaded woodpeckers and other woodland fauna evolved and the conditions necessary for their continued existence. As the historic condition, these woodlands are considered to represent Fire Condition Class 1.

Today, prevailing vegetative conditions on the Ouachita National Forest include second growth stands of shortleaf pine and various hardwoods with overstory trees ranging in age from 70 to 90 years. The midstories are crowded with smaller trees and large shrubs, and the understories with woody shrubs. These dense multi-storied stands have almost no herbaceous plants in the understory because too little sunlight penetrates to the forest floor. Fire return intervals range from 40 years to more than 1200 years. In such stands there are no prairie flora and no red-cockaded woodpeckers. These areas are considered to be Fire Condition Class 3.

Fires in Condition Class 1 areas are fast moving ground fires, consuming mostly fine fuels of grasses and other herbaceous plant materials. Fire residence time is short since there are significantly less 1-hour, 10- hour, and 100-hour fuels available. Fires in Class 1 areas rarely kill overstory trees and there are no fuel ladders in the form of woody midstory stems to allow flames to reach the overstory canopy and become crown fires.

Wildfires do occur in restored Class 1 areas, but due to the reduction of fuels from rotational burning, they are not catastrophic. Too, fire suppression and rehabilitation costs are lower, about half those in un-restored areas, largely because of previously established fire lines where maintenance burning has been done. Some wildfires can be beneficial and guidelines within the project area allow them to burn to existing fire breaks, such as roads, creeks and lakes. This helps increase the total area burned from all ignition sources and induces a natural randomness into the pine-bluestem restoration process. Currently, approximately 25,000 acres are prescribed burned annually within the project area. This goal was set by taking into account available resources for burning and the key acres containing current RCW populations (approximately 75,000 acres) that must be burned every 3 years. The long term goal is to burn 40,000 acres annually, since the acres with RCWs are increasing and this increase can be encouraged by burning more acres in areas not yet restored. Burning 40,000 acres annually would move the Ouachita NF closer to the objective of burning each restored acre on a 3-5 year rotation.

To achieve the goal of open, park-like stands with a ground level community of grasses and forbs, fire behavior is modified to focus on the reduction of midstory trees and shrubs. Fire planning in these areas also includes construction and maintenance of strategic fuel breaks that allow modification of burns based upon weather, personnel, safety, and other factors. The National Wild Turkey Federation and several groups associated with Quail Unlimited have provided partnership dollars for burning, tools and supplies, and helicopter time. The Nature Conservancy and the Ouachita NF have a cooperative agreement to share crew resources to facilitate prescribed burn implementation.

Objectives of the burning program associated with habitat restoration include top killing 65-80% of hardwood sprouts left by the midstory treatments (WSI). This moves the process forward toward open, park-like conditions. If burning does not occur on a 3-5 year interval, the area will revert to pre-restoration conditions, including the return of dense midstories. Adhering to the burning rotation is critical. Another way of stating this is that the costs of burning to achieve and maintain the restored ecosystem are significantly less than repetitive vegetation treatments (that is, repeating WSI treatments) needed if burning is not kept on rotation.

In Class 3 areas, though wild fires are less frequent, they have a much greater potential for overstory damage. There is usually an abundance of the larger 10-hour, 100-hour and 1000-hour fuels and fire residence time is longer. The total heat generated in these fires is greater. This alone can kill overstory trees, depending on the time of year and moisture conditions. In addition, woody midstory vegetation can provide a fuel ladder to the canopy resulting in a devastating crown fire. It is not uncommon for wildfires in Class 3 areas to result in 10-25 percent mortality among overstory trees. Crown fires, of course, can result in near 100 percent mortality of overstory trees. Fires in Class 3 areas are more costly to suppress, especially during the mop-up phase.

One goal of ecological restoration is to reestablish and maintain the resilience of National Forest lands to provide a broad range of sustainable ecosystem services. Healthy and resilient landscapes will have greater capacity to survive natural disturbances and large scale threats to sustainability, especially under uncertain environmental conditions such as those driven by climate change. Finally prescribed burning furthers progress toward the national goal of recovery of species that are threatened with extinction, including the RCW, the key species within the pine-bluestem project area on the ONF.

At present, there are no community wildfire protection plans incorporated on the Ouachita National Forest. However, approximately 1,000 acres of intermingled private lands are prescribed burned each year along with NF lands in the project area. This is accomplished mostly under authority of the Stevens Act. These cooperative burns eliminate the need for firelines to exclude private lands and the fuel reduction on the private lands that results benefits both the private lands and adjacent NF lands.

Utilization

Biomass is currently removed from the project area in the form of sawtimber, usually used to produce dimension lumber and in some cases oriented strand board for construction; pulpwood, usually used to make paper; and firewood used for home heating. With the exception of firewood, there are at present no opportunities to utilize what is now unmerchantable material resulting from pre-commercial thinning and midstory reduction treatments. Too, firewood cutting only occurs in midstory reduction areas or regeneration areas that are relatively near all-weather roads. Most material cut during the midstory reduction or site preparation treatments remains on site, adding a significant amount of fuel that must be gradually reduced over several prescribed burning cycles. These areas with concentrated fuels complicate the follow-up large-scale prescribed burns when they occur within the burn unit.

During the period 2005-2009 the average sawtimber volume removed each year from the project area was 25,351 ccf. At an average weight of 3 tons per ccf, this represents a total weight of about 76,053 tons of biomass per year removed as sawtimber. For the same time period the average pulpwood volume removed each year was 10,224 ccf, representing a total weight of 30,671 tons of biomass removed annually. Average firewood biomass removed annually through the sale of permits during this period is estimated at 200 ccf, or 600 tons. Total average annual biomass removal for all products is 107,324 tons.

Average successful bid price for the sawtimber component of timber sales during this period was $97.95 per ccf. Therefore, the average annual value for sawtimber biomass removed from the project area was $2,483,130. The average successful pulpwood bid was $18.51 per ccf, and the average total value for pulpwood biomass removed each year is $189,246. Firewood is not bid competitively, but the estimated value is $8.23 per ccf. The 200 ccf in annual biomass removal as firewood is therefore valued at $1,646. The average annual receipts from the sale of all biomass products total $2,674,022.

The value of cutting and removing biomass and the revenue received for these biomass products that are sold, totally offset costs estimated at about $6,000,000 annually that would be required to do the same work without commercial timber sales. Further, retained receipts from the timber sales are presently used to pay for the midstory reduction treatments and prescribed burning. Without the sale of wood products, there would be no receipts to retain and any additional restoration work needed would have to be funded from appropriated sources, adding to the $6,000,000 costs.

The possibilities for the sale of small diameter trees and other presently unmerchantable biomass may increase in the near future. A facility is being built in the heart of the Forest near Rover, Arkansas. This mill will manufacture fuel pellets for home-heating stoves. When operational, this mill will require 21,650 green tons of biomass per year.

A biofuel-based electrical generating plant is being considered for co-location with an existing coal-fired power plant in LeFlore County, Oklahoma, about 35 miles northwest of the project area. Recent meetings have been held with Primenergy (biomass energy conversion), AES Shady

Point (parent company of the coal-fired plant), Endeavor (consultant for AES) and the Ouachita Mountains RC&D Council (USDA NRCS). These discussions have focused on assessing the availability of biomass to complete a feasibility study. If constructed, the plant will require 850 dry tons of biomass per day to operate, and it is likely that material from the project area will be within an operable distance of the plant. Plant officials were interested in currently unmerchantable material from midstory reduction and pre-commercial thinning operations and were investigating equipment and/or services needed to extract these current wastes from areas.

Both of these possible plants are green projects that will create new jobs and increase the production of renewable energy. If constructed, these plants could cause a change in the way the key restoration treatment of midstory reduction is executed. Service contracts for this work that currently cost $70-$120 per acre could potentially become much less costly or even begin to produce some revenue. In addition, it is likely that the first of the three prescribed burn treatments would be much less complicated due to a drastic reduction in the fuel loading across the area. The demand for biomass combined with the reduction in high-fuel-loaded prescribed burning would result in a financial and implementation windfall that will make it possible to complete significantly more acreage of midstory reduction and prescribed burning, both key treatments in moving forest communities toward desired conditions.

Investments

The goal for this CFLR proposal is to supplement other funding sources in order to maintain the 50,000 acre area already in a restored condition and continue restoration work on an additional 60,000 acres. The total area substantially restored will be about 110,000 acres in 10 years.

Future restoration costs will decrease with CFLR funding because rotational burns will be kept on schedule. When burns are not conducted due to a lack of funds, the area reverts to pre-restoration conditions which require more intensive treatments that can cost four times as much as burning.

Cost to the Forest to conduct restoration treatments on 17,500 acres in 2010 will be about $993,000. In 2010, we are requesting $100,000 in CFLR funds for treatments on an additional 1,800 acres. From 2011-2019, the annual cost to the Forest to treat 17,500 acres is about $993,000. These costs are the matching basis for our CFLR request for $993,000 to treat an additional 17,500 acres annually, and an additional $75,000 annually to fund Job Corp coop student participation (Table 1).

The ONF currently spends from $125,000 to $155,000 annually for monitoring in the project area. These costs are associated primarily with the RCW and partly provide the match for requested CFLR funds to do four additional monitoring projects (RCW, wild-turkey, vegetation and songbirds) and for educational outreach on the importance of native landscapes.

Non-federal investments will occur during the years 2010 through 2013 to monitor the effects of prescribed burning on the wild turkey (Table 2). Additional non-federal investments will be made to study red-cocked woodpeckers in the project area (Table 3).

The Nature Conservancy will monitor 96 vegetative plots over the entire restoration area. They will be donating $30,000 of in-kind labor annually from 2011-2019. Using TNC contributions as a match, we are requesting CFLR funds of $30,000 each year from 2011-2019 for this monitoring.

Audubon Arkansas will monitor the response of songbirds that require restored conditions and conduct environmental education classes for students, educators and community leaders about the importance of native landscapes. Their in-kind contribution each year for this work is valued at $10,000. We are requesting CFLR funds in the amount of $30,000 each year to support this work. CFLR funds will allow the hiring of 6-12 temporary employees and Job Corp students. The temporaries and students will work in all aspects of restoration including biological monitoring.

Vital information from these monitoring projects will allow the ONF to continue to base its management decisions upon the best available site specific science and to retain public support for large landscape restoration.

Table 1. Annual Treatment Costs and Acres Treated 2010-2019.

Year(s)	USFS Costs	Acres Treated	CFLR Request	Additional Acres Treated	Total Acres Treated	Total Costs
2010	$993,000	17,500	$100,000	1,800	19,300	$1,093,000
2011-2019	$993,000	17,500	$1,068,000	17,500	35,000	$2,061,000

Table 2. In-Kind Contributions to Monitor Restoration Effects on Wild Turkey.

Year	USFS Costs	National Wild Turkey Federation	Arkansas Game & Fish	Arkansas State University	Arkansas Audubon Society	CFLR Request	Total Project Costs
2010	$20,000	$2,000	$2,000	$2,000		$145,000	$171,000
2011	$30,000	$10,000	$77,000	$10,000	$1,500	$30,000	$158,500
2012	$30,000	$10,000	$77,000	$10,000	$1,500	$75,000	$203,500
2013	$30,000	$10,000	$77,000	$10,000	$1,500	$75,000	$203,500
Total	**$110,000**	**Partner Contribution Total $301,500**				**$325,000**	**$736,500**

Table 3. In-Kind Contributions to Monitor Status of Translocated RCW's

Year	USFS Costs	Arkansas State University	Arkansas Audubon Society	CFLR Request	Total Project Costs
2010	$125,000	$2,000		$5,000	$132,000
2011	$125,000	$10,000	$1,500	$30,000	$166,500
2012	$125,000	$10,000	$1,500	$30,000	$166,500
Total	**$375,000**	**Partner Contribution Total $25,000**		**$65,000**	**$465,000**

Funding Estimate

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2010 Funding for Monitoring	153,000
1. USFS Appropriated Funds	622,550
2. USFS Permanent & Trust Funds	515,450
3. Partnership Funds	
4. Partnership In-Kind Services Value	8,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2010 Total (total of 1-6 above for matching CFLRP request)	2,546,000
FY 2010 CFLRP request (must be equal to or less than above total)	$250,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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 2011 Funding for Implementation	$2,393,000
FY 2011 Funding for Monitoring	305,000
1. USFS Appropriated Funds	628,500
2. USFS Permanent & Trust Funds	519,500
3. Partnership Funds	
4. Partnership In-Kind Services Value	150,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2011 Total (total of 1-6 above for matching CFLRP request)	2,698,000
FY 2011 CFLRP request (must be equal to or less than above total)	$1,188,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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 2012 Funding for Implementation	$2,393,000
FY 2012 Funding for Monitoring	305,000
1. USFS Appropriated Funds	628,500
2. USFS Permanent & Trust Funds	519,500
3. Partnership Funds	
4. Partnership In-Kind Services Value	150,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2012 Total (total of 1-6 above for matching CFLRP request)	2,698,000
FY 2012 CFLRP request (must be equal to or less than above total)	$1,233,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2013 Funding for Monitoring	293,500
1. USFS Appropriated Funds	628,500
2. USFS Permanent & Trust Funds	519,500
3. Partnership Funds	
4. Partnership In-Kind Services Value	138,500
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2013 Total (total of 1-6 above for matching CFLRP request)	2,686,500
FY 2013 CFLRP request (must be equal to or less than above total)	$1,203,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2014 Funding for Monitoring	165,000
1. USFS Appropriated Funds	622,550
2. USFS Permanent & Trust Funds	495,450
3. Partnership Funds	
4. Partnership In-Kind Services Value	40,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2014 Total (total of 1-6 above for matching CFLRP request)	2,558,000
FY 2014 CFLRP request (must be equal to or less than above total)	$1,128,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2015 Funding for Monitoring	165,000
1. USFS Appropriated Funds	622,550
2. USFS Permanent & Trust Funds	495,450
3. Partnership Funds	
4. Partnership In-Kind Services Value	40,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2015 Total (total of 1-6 above for matching CFLRP request)	2,558,000
FY 2015 CFLRP request (must be equal to or less than above total)	$1,128,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2016 Funding for Monitoring	165,000
1. USFS Appropriated Funds	622,550
2. USFS Permanent & Trust Funds	495,450
3. Partnership Funds	
4. Partnership In-Kind Services Value	40,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2016 Total (total of 1-6 above for matching CFLRP request)	2,558,000
FY 2016 CFLRP request (must be equal to or less than above total)	$1,128,000
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 2016 Funding Type	Dollars Planned
USDI BLM Funds	
USDI (other) Funds	
Other Public Funding	
Private Funding	

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2017 Funding for Monitoring	165,000
1. USFS Appropriated Funds	622,550
2. USFS Permanent & Trust Funds	495,450
3. Partnership Funds	
4. Partnership In-Kind Services Value	40,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2017 Total (total of 1-6 above for matching CFLRP request)	2,558,000
FY 2017 CFLRP request (must be equal to or less than above total)	$1,128,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2018 Funding for Monitoring	165,000
1. USFS Appropriated Funds	622,550
2. USFS Permanent & Trust Funds	495,450
3. Partnership Funds	
4. Partnership In-Kind Services Value	40,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2018 Total (total of 1-6 above for matching CFLRP request)	2,558,000
FY 2018 CFLRP request (must be equal to or less than above total)	$1,128,000
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	

(***Copy table and provide the planned funding for each additional fiscal year***). 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	$2,393,000
FY 2019 Funding for Monitoring	165,000
1. USFS Appropriated Funds	622,550
2. USFS Permanent & Trust Funds	495,450
3. Partnership Funds	
4. Partnership In-Kind Services Value	40,000
5. Estimated Forest Product Value	1,400,000
6. Other (specify)	
FY 2019 Total (total of 1-6 above for matching CFLRP request)	2,558,000
FY 2019 CFLRP request (must be equal to or less than above total)	$1,128,000
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	

Funding Plan

The National Forest System (NFS) lands in the southeastern United States offer unique opportunities for restoring the native forests and ecological systems that were once commonly found throughout the region. In many developed areas, the NFS lands are some of the few remaining large, forested landscapes in the South. Restoring and sustaining these lands and doing so in close coordination with our partners and neighboring landowners were a key part in the establishment of the Southern Region national forests and continue to be an emphasis in our management goals for today.

The Collaborative Forest Landscape Restoration Program (CFLRP) will supplement the Southern Region's work priorities very well. The Southern Region has developed a Strategic Framework to guide the important work we do. This Strategic Framework has identified restoration as one of the main areas of emphasis for developing programs of work. The goal for this region-wide focus is "ecological systems are returned to their natural resilience and sustained," which also supports intent of the CFLRP.

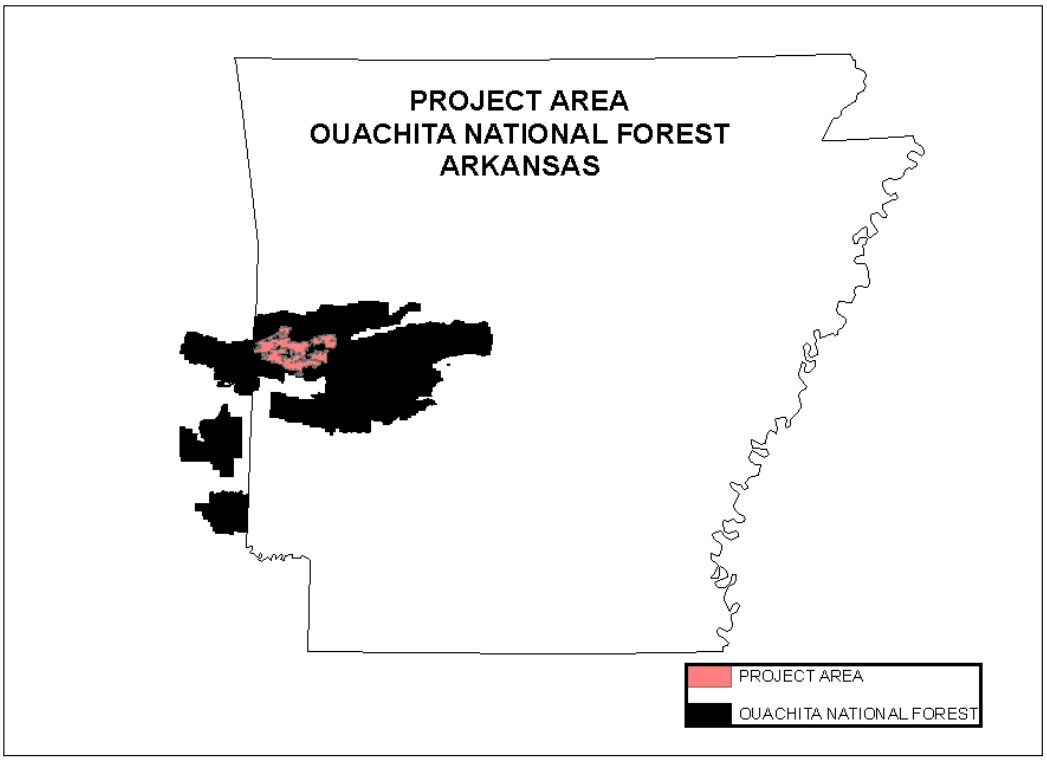
The Southern Region's program of restoration work includes a broad set of management practices designed to control the establishment, growth, composition, health, and quality of forests to meet the diverse needs and values of society on a sustainable basis. In developing our regional funding plans, the integration of multiple programs is the primary driver for budget development. Annual funding requests are made by each national forest based on their integrated capacity to accomplish needed work to support land management goals and objectives. The goals and objectives are guided by Land Management Plans, the Region's Strategic Framework, and other restoration strategies. Our regional program managers (fire, fuels, wildlife, forest health protection, vegetation, and watershed management) then work together to develop a seamless regional budget package that takes full advantage of the strengths of each individual program.

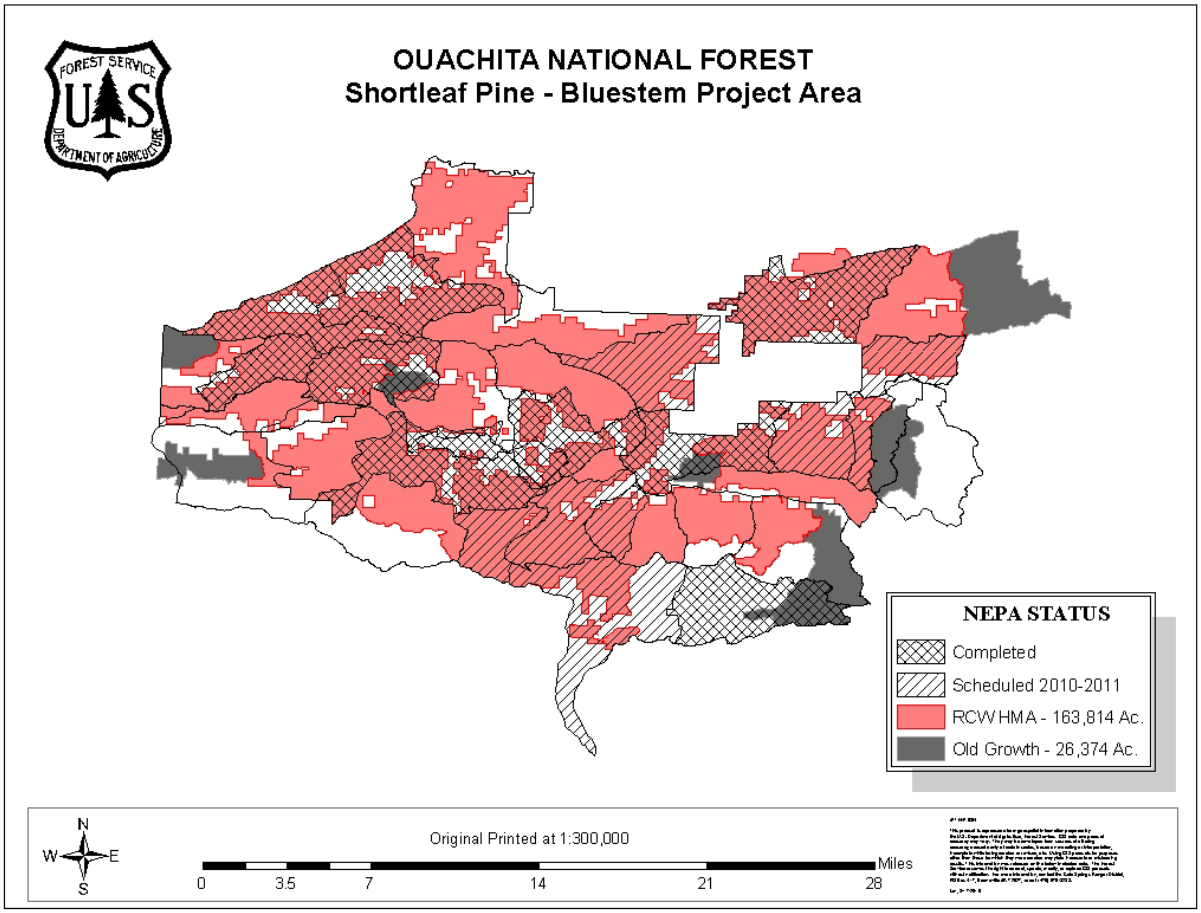
Vegetation treatment activities for restoration are designed to protect and restore ecosystems, address energy and other social needs, and protect human communities. The funding identified through the process above is used to plan, implement, and monitor the work activities to be accomplished in each fiscal year. The Southern Region will continue to utilize this process to inform allocation decisions in support of CFLRP requirements and to assure that CFLRP funding allocated in FY2010 and FY2011 will be used on this proposal in the year transferred. The Region has also committed to assuring that funding will be available to support the long-term multiparty monitoring requirement for this proposal. The Southern Region has a proven track record for delivering a very efficient program of work with high integrity for producing results.

SHORTLEAF PINE BLUESTEM PROJECT

UNRESTORED CONDITION

DESIRED CONDITION


PROJECT AREA
OUACHITA NATIONAL FOREST
ARKANSAS
PROJECT AREA
OUACHITA NATIONAL FOREST


OUACHITA NATIONAL FOREST
Shortleaf Pine - Bluestem Project Area
NEPA STATUS
Completed
Scheduled 2010-2011
RCW HMA - 163,814 Ac.
Old Growth - 26,374 Ac.
N
W
E
S
Original Printed at 1:300,000
0
3.5
7
14
21
28
Miles

Landscape Strategy

Perhaps the best way to describe the landscape strategy for this project proposal is through the following paper presented in 1997 at the 62nd North American Wildlife and Natural Resources Conference by the senior author. The paper was published in the transactions of that meeting.

Shortleaf Pine/Bluestem Renewal

George A. Bukenhofer
USDA Forest Service
Heavener, Oklahoma

L. D. Hedrick
USDA Forest Service
Hot Springs, Arkansas

Presettlement and Current Ecological Conditions

The 8 million-acre (3,237,600 ha) Ouachita mountain physiographic region is located in west central Arkansas and southeastern Oklahoma. The mountains are east to west trending and range in elevation from 500 to 2,700 feet (150-820 in). Travelers in this region prior to European settlement described the landscape as dominated by pine (*Pinus echinata*), pine-hardwood and mixed-oak (*Quercus spp.*) forest communities with fire-dependent and floristically rich grass and forb understories (Du Pratz 1774, Nuttal 1821, Featherstonhaugh 1844). Large grazing herbivores including elk (*Cervus elaphus*), bison (*Bison bison*) and white-tailed deer (*Odocoileus virginianus*) found suitable habitat there (Smith and Neal 1991). Fire return intervals averaged less than 10 years for most sites (Masters et al. 1995). Tree densities averaged 170 trees per acre (420/ha), and the mean diameter was 11.4 inches (29 cm) (Kreiter 1995).

Today the Ouachita mountain landscape is still dominated by forests, but the structure and composition of these forests have changed dramatically. The density of trees has increased to 200 to 250 trees per acre (494-618/ha) and the mean diameter is now 9 inches (23 cm) (Kreiter 1995). Understories are now dominated by woody vegetation and certain once-dominant grasses and forbs are uncommon (Fenwood et al. 1984, Masters 1991, Sparks 1996). Elk and bison have been extirpated. Other species, such as Bachman's sparrow (*Aimophila aestivalis*) and the brown-headed nuthatch (*Sitta pusilla*), have been affected negatively by habitat loss (Jackson 1988) and the red-cockaded woodpecker (RCW) (Picoides borealis) is endangered (Neal and Montague 1991). Average fire return intervals now range from 40 to more than 1,200 years (Masters et al. 1995).

Historical and present-day ecological communities of the 1.7 million-acre (690,000 ha) Ouachita National Forest (ONF) are illustrative of the above descriptions. Present day forests developed

largely in response to two factors: commercial exploitation of the original forests and suppression of fires. Large-scale harvest of trees commenced in the 1910s and by 1940 most of the virgin forests had been cut (Smith 1986). With USDA Forest Service (FS) stewardship, the period of forest regeneration that followed was marked by a strict policy of wildfire suppression. That policy has largely remained in effect to the present. The recent use of prescribed fire by managers, averaging 25,000 acres (10,100 ha) annually over the last decade (R. Miller personal communication: 1995), has been insufficient to maintain a woodland (i.e., tree/grass) ecosystem. The result is that such ecosystems have all but disappeared from the Ouachita mountain landscape (Foti and Glenn 1991).

Desired Ecological Condition in the Context of a Contemporary Landscape

National forest lands are now subject to the philosophy of ecosystem management. Ecosystem management has been variously defined, but most definitions have two attributes in common: an overriding goal to protect ecosystem integrity, sometimes called ecosystem health, and an allowance for human uses that do not compromise ecosystem integrity. The following are key elements of a large-scale ecosystem management project on the ONF to restore the shortleaf pine-bluestem grass ecosystem on 155,010 acres (62,730 ha), and in the process provide sufficient habitat for a recovered population of the endangered RCW and a sustainable supply of wood products (FS 1996).

Elements of Ecosystem Management

Increasing the use of prescribed fire and using tree cutting to simulate natural disturbance patterns. Reduction of basal area is accomplished by commercial thinning. Stand regeneration is accomplished by commercial timber sales using irregular seed tree and irregular shelterwood methods. With either regeneration method, some of the seed trees are retained indefinitely. The size of prescribed burning units encompasses landscapes rather than smaller stand-sized blocks. The average size of prescribed burning units has increased from 200 to 600 acres (81-243 ha), with some units as large as 8,000 acres (3,230 ha) (R. Miller personal communication: 1997). In the past, most prescribed burning occurred during the dormant season from October to March. We now include some burning during the growing season to emulate fire patterns described in Foti and Glenn (1991) and Masters et al. (1995).

Using a modified control strategy for wildfires. Traditional FS policy has been to suppress all wildfires and minimize the area burned regardless of whether the fire was beneficial to resources. We found that a modified control strategy for wildfires, which recognizes that some wildfires are beneficial and should be allowed to burn, helps increase the area affected by fire each year. In those instances where wildfires are burning within prescription, occurring in areas determined to be desirable and not threatening human safety or property, wildfires can be allowed to burn to the nearest man-made or natural barrier. This change is an example of "FIRE 2 1," a new effort initiated by FS leadership to embrace the changing responsibilities in wildland fire management in the 21st century (Apicello 1996). Goals for FIRE 21 include contributing to restoring, maintaining and sustaining ecosystem function for healthier forests and rangelands, and integrating wildland fire management concerns and the role of fire into all agency management programs, where appropriate.

Increasing rotation age. The minimum time between regeneration cutting, or rotation age, has been increased from 70 to 120 years for shortleaf pine forest types. This allows for a greater number of acres of older trees and results in increased mast production from hardwoods retained in these pine stands. The older trees are also required for RCW and other cavity-dependent species. Cavity development is associated with a fungal heart rot (*Phellinus pinii*) infection that usually does not occur in stands less than 70 years of age.

Maintaining mixtures of native pines and hardwoods. An important part of the restoration process is to replace non-native trees when possible and retain mixtures of pines and hardwoods on the landscape both among and within stands. Retention of mast-producing trees has been a significant issue for the ONF

Developing and maintaining forested linkages among mature forest habitats. Minimizing ecotonal differences between contiguous stands and reducing habitat fragmentation is important to many bird species. Each timber harvest proposal is examined for ways to keep forest regeneration localized, which maximizes the size of areas that support mature stands. We have increased the size of regeneration areas from 40 to 80 acres (16-32 ha). Because the total amount of regeneration per year or decade is fixed by the rotation age, achieving it on fewer, larger areas rather than many smaller areas reduces the total edge between dissimilar conditions. This also maximizes the area of contiguous mature habitat.

Recognizing that people are an important part of this ecosystem. Traditional uses of forest, such as timber harvesting, hunting, firewood gathering, bird watching and fishing, continue while we work to restore ecological (historical) conditions. No special limitations are placed on the public while using the area. Project planning incorporates local values through an extensive public involvement program. Information from monitoring the effects of restoration has been gathered through close collaboration with university researchers. Detailed information is used to monitor the effectiveness of our projects and guide the restoration effort.

Assessing Ecological Health

There are three areas by which the ONF can measure success at attaining ecosystem health. Biodiversity, recreation opportunities and timber supplies are used as "yardsticks" because all were significant issues in recent planning efforts.

Biodiversity

Wilson et al. (1995) examined the breeding bird response to this restoration effort. They found that 10 species of ground/shrub-foraging species (yellow-breasted chat [*Icteria virens*], brown-headed cowbird [*Molothrus ater*], Carolina wren [*Thryothorus ludovicianus*), northern cardinal [*Cardinal cardinalis*], wild turkey [*Meleagris gallipavo*], indigo bunting [*Passerina cyanea*], northern bobwhite [*Colinus virginianus*], chipping sparrow [*Spizella passerina*]) and shrub nesting species (American goldfinch [*Caruelis tristis*], prairie warbler [*Dendroica discolor*]) were favored by thinning and prescribed burning, as compared with controls. Two ground-nesting species, the ovenbird (*Seiuris aurocapillus*) and black-and-white warbler (*Mniotilta varia*), declined in the same restoration areas. Small mammals were found to have increased in

numbers and species on the same restored sites (Lochmiller et al. 1993). Sparks (1996) found that prescribed burning produced higher herbaceous species richness and diversity, and forb and legume abundance in the project area.

Recreation Opportunities

Outdoor recreationists, including hunters and bird watching enthusiasts, are attracted to these restored lands. In A Birder's Guide to Arkansas, White (1995) featured the project area as a unique opportunity to view RCW, brown-headed nuthatch and Bachman's sparrow. Discussing the decline of the northern bobwhite, Brennan (1991) provided some evidence that the forest-management techniques used here (reduction of tree basal area, reduction of midstory and prescribed burning every one to three years) resulted in higher bobwhite numbers. Masters et al. (1996) examined whitetailed deer forage production on the project area. They found that restoration efforts increased preferred deer forage sixfold.

Timber Supply

Timber harvesting is an essential part of these restoration efforts. The environmental impact statement for the FS long-term strategy for RCW recovery (USDA 1995) in the Southern Region concluded that this region-wide restoration effort would result in a gradual long-term increase of timber supplies after an initial decline. The ONF implementation of this strategy, because of favorable age class distribution, projected that timber harvest volumes would remain constant in the next two decades, and decline slightly from 29.2 to 27.5 million cubic feet of wood by the fifth decade (Bukenhofer et al. 1994). The decline in long-term sustained yield is largely a function of increasing the rotation age from 70 to 120 years.

Other Considerations

Another measure of ecosystem health is the potential for reintroduction of extirpated species. The elk has been successfully reintroduced to three nearby locales, the Buffalo National River in northern Arkansas, and the Pushmataha and Cookson Hills wildlife management areas in eastern Oklahoma. Earlier attempts at reintroduction failed due to brain worm (*Parelaphostrongylus tenuis*) infestation (Carpenter 1973). Recent studies (Raskevitz 199 1) determined that the intermediate hosts for the brain worm were snails (Gastropidae) that were dependent on moist forest conditions where tree densities were high, including a well-developed mid-story. They found that elk preferred habitat that included open, drier forest conditions unfavorable to the snails, and this preference yielded elk with no clinical signs of brain worm infestation. In the future, we expect that the drier forest conditions provided by shortleaf pine/bluestem grass ecosystem renewal will supply a sufficient quantity of suitable habitat capable of supporting a reintroduction of elk in the ONF.

Summary

The most influential laws relating to and governing FS land management activities include the Multiple Use-Sustained Yield Act, Endangered Species Act, National Forest Management Act,

Clean Water Act and, to a lesser extent, the Clean Air Act. For many, these laws present conflicting direction and create an insurmountable operational, regulatory and judicial tangle.

All of these laws predate direction issued by FS Chief Dale Robertson to Regional Foresters in June 1992 in which he admonished them to follow a philosophy of ecosystem management in their stewardship of national forest lands. All of these legal mandates remain in full force. Collectively, these laws can be summarized as requiring that national forests be managed to allow for sustainable human uses, both economic and non-economic, without compromising land health. The role of the ecosystem management policy adopted by the FS is to provide a single, all-inclusive philosophical context for management that integrates the spirit and letter of these laws. It puts sustaining land health first. We think this is appropriate, for over the long term, it will be impossible to sustain human uses without first sustaining the health of the land.

Our project is one example of ecosystem management. It embodies elements of landscape ecology, restoration ecology and endangered species recovery. It seeks to restore an entire ecosystem on portions of today's Ouachita mountain landscape. This is not so much because the landscape was prominent in pre-European settlement times, but rather because it had almost disappeared along with its unique flora and fauna. The project is mindful of Aldo Leopold's (1949) famous dictum that saving all parts and pieces of the ecosystem is the first precaution of intelligent tinkering. At least in this case, we have demonstrated that managing for ecosystem integrity (health) need not result in significant reductions in timber resources for traditional human uses. This, coupled with the increased recreation opportunities enumerated above, is a "win win" situation.

Acknowledgments

We wish to thank W. G. Montague and J. C. Neal for their useful comments on an earlier draft of this manuscript.

References

Apicello, M.G. 1996. FIRE 21-Fire management in the 21st century. Fire Manage. Notes 56(3): 4-5.

Brennan, L.A. 1991. How can we reverse the northern bobwhite population decline? Wildlife Soc. Bull. 19: 544-555.

Bukenhofer, G.A., J.C. Neal and W.G. Montague. 1994. Renewal and recovery: Shortleaf pine/bluestem grass ecosystem and red-cockaded woodpeckers. Proc. Arkansas Acad. Sci. 48: 243-245.

Carpenter, J. W., H. E. Jordan and B. C. Morrison. 1973. Neurologic disease in wapiti naturally infected with meningeal worm. J. Wildl. Dis. 9: 148-153.

Du Pratz, L.P. 1774. The history of Louisiana. T. Becket, ed., Facsimile repro. 1975, Louisiana St. Univ. Press, Baton Rouge. 405 pp.

Featherstonhaugh, G.W. 1844. Excursion through the slave states. Harper and Bros., New York. 168 pp.

Fcnwood, J. D., D. F. Urbston and R. F. Harlow. 1984. Determining deer habitat capability in Ouachita National Forest pine stands. Proc. Annu. Conf. Southeast Assoc. Fish and Wildl. Agen. 38: 13-22.

Foti, T.L. and S.M. Glenn. 1991. The Ouachita Mountain landscape at the time of settlement. Pages 49-66 in D. Henderson and L.D. Hedrick, eds., Restoration of old growth forests in the Interior Highlands of Arkansas and Oklahoma. Ouachita Nat. For. and Winrock Int. Inst., Morrilton, AR. 190 pp.

Jackson, J. A. 1988. The southeastern pine forest ecosystem and its birds: Past, present, and future. Pages 119-159 in J. Jackson, ed., Bird conservation 3. Univ. Wisconsin Press, Madison.

Kreitcr, S.D. 1992. Dynamics and spatial pattern of a virgin old-growth hardwood pine forest in the Ouachita Mountains, Oklahoma, from 1896 to 1994. M.S. thesis, Oklahoma St. Univ., Stillwater. 141 pp.

Leopold, A. 1949. A sand county almanac with essays on conservation from Round River. Ballentine Books, New York. 249 pp.

Lochmiller, R.L., R.E. Masters and S.T. McMurry. 1993. Wildlife stand improvement: Effects of midstory vegetation removal and fire on small mammals. Summary of winter 1993 survey. Annu. Rept., USDA For. Serv., Hot Springs, AR. 15 PP.

Masters, R.E. 1991. Effects of timber harvest and prescribed fire on wildlife habitat and use in the Ouachita Mountains of eastern Oklahoma. Ph. D. diss., Oklahoma St. Univ., Stillwater. 351 pp.

Masters, R.E., J.E. Skeen and J. Whitehead. 1995. Preliminary fire history of McCurtain County Wilderness Area and implications for Red-cockaded Woodpecker management. Pages 290-302 in D.L. Kulhavy, R.G. Hooper and R. Costa, eds., Redcockadcd woodpecker: Recovery, ecology and management. Ctr. for Appl. Studies, Coll. of Forest., Stephen F. Austin St. Univ., Nacogodoches, TX

Masters, R.E., CW. Wilson, G.A. Bukenhofer and M.E. Payton. 1996. Effects of pine-grassland restoration for red-cockaded woodpeckers on white-tailed deer forage production. Wildl. Soc. Bull. 24(l): 77-84.

Neal, J.C. and W.G. Montague. 1991. Past and present distribution of the Red-cockaded Woodpecker and its habitat in the Ouachita Mountains in Arkansas. Proc. Arkansas Acad. Sci. 45: 71-75.

Nuttal, T. 1821. A journal of travels into the Arkansas Territory, during the year 1819. T.W. Palmer, Philadelphia, PA. 296 pp.

Raskevitz, R. F., A. A. Kocan and J. H. Shaw. 1991. Gastropod availability and habitat utilization by wapiti and white-tailed deer sympatric on range enzootic for meningeal worm. J. Wildl. Dis. 27(l): 92-101.

Sparks, J.C. 1996. Growing season and dormant season fire behavior and effects on vegetation in the Ouachita Mountains, Arkansas. M.S. thesis, Oklahoma St. Univ., Stillwater. 186 pp.

Smith, K.L. 1986. Sawmill, the story of the cutting of the last great virgin forest east of the Rockies. Univ. Arkansas Press, Fayetteville. 246 pp.

Smith, K.G. and J.C. Neal. 1991. Pre-settlement birds and mammals of the interior highlands. Pages 77-104 in D. Henderson and L.D. Hedrick, eds., Restoration of old growth forests in the Interior Highlands of Arkansas and Oklahoma. Ouachita Nat. For. and Winrock Int. Inst., Morrilton, AR. 190 pp.

U.S. Department of Agriculture. 1995. Environmental impact statement for the man-agement of the red-cockaded woodpecker and its habitat on National Forests in the Southern Region. USDA For. Serv., Atlanta, GA. 407 pp.

U.S. Department of Agriculture. 1996. Environmental impact statement for the renewal of the shortleaf pine/ bluestem grass ecosystem and recovery of the red-cockaded woodpecker. USDA For. Serv., Hot Springs, AR. 48 pp.

White. M. 1995. A birder's guide to Arkansas. Am. Bird. Assoc. Inc., Colorado Springs, CO. 259 pp.

Wilson, C.W., R.E. Masters and G.A. Bukenhofer. 1995. Breeding bird response to pine-grassland community restoration for red-cockaded woodpeckers. J. Wildl. Manage. 59: 56-67.