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Appendix A: Moonlight Fire Restoration Project Proposal Template

Moonlight Fire Restoration Project Proposal (Fiscal Year)

Project Name

Project Leader Name (Job Title): _____

Link to Restoration Strategy desired condition and goal: (state specific desired condition and goal from Strategy)

Objective: (either link to an objective from the Restoration Strategy, or develop a clearly stated objective that links to a desired condition and goal in the Strategy. Objectives are specific, narrowed statements of intentions that are measurable. Progress toward an objective can be evaluated through monitoring)

Project justification: (state how project meets 16 USC 579c criteria and criteria set by court decision; state how project meets need identified in the Fire Restoration Strategy; if project proposes work beyond the fire perimeter, clearly describe why this is necessary)

Project description: (what is being proposed, identify whether assessment, planning, implementation or monitoring. If implementation, describe how progress toward overarching objective will be measured)

Monitoring and evaluation: (State monitoring objective, methods, data to be collected and how they will address the monitoring objective, statistical design for quantitative monitoring, how frequently monitoring will be conducted, frequency of evaluation, standards used in evaluation, trigger points for success or adjustment of project)

Estimated cost and timeline: (Complete Workplan for the project. Identify whether the project will span multiple years and if so specify targets and cost by year).

Appendix B – Moonlight Fire Restoration 2014 Project Proposals

Table of Contents

Moonlight Fire Restoration Project Proposal (2014)

Moonlight Reforestation and Release for Survival Planning

Project Leader Name: Maurice Huynh (District Silviculturist)

Link to Restoration Strategy desired condition and goal:

- Restore the long-term viability of appropriate forest types and reduce the potential for vegetation type conversion.
- Restore landscape heterogeneity in terms of spatial and temporal variability, forest type and species diversity, and forest seral stages and structure.

Objective: Through proper site preparation and planting, forested areas that were converted to chaparral vegetation types can be restored to conifer stands. Planting conifers would provide for seed sources of desired species lost during the fire. Site preparation would help ensure success, long term viability of plantations and help prevent conversion of previously burned areas to montane chaparral.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Rehabilitates lands affected by the Moonlight Fire;
- Is on lands administered by the Forest Service;
- Replacement of fire-killed conifers was rendered necessary by the Moonlight Fire.

Project description: This is the first phase of a multi-year project. In FY14, project planning and NEPA analysis would be completed. This would be followed by site prep of planted areas in FY15 through a combination of mastication, hand thin and pile, or hand thin and grapple pile to reduce fuels, mitigate safety hazards and reduce competitive brush vegetation to seedlings. After site prep activities, conifer seedlings would be planted (target FY16) using a wide-space cluster design. Desired seedling density would be approximately 100 to 300 seedlings per acre. Manual release ("grubbing") may occur within five years after planting. Manual release would involve the use of a tool to remove competing vegetation in a five foot radius around seedlings. FY15 targets include FUELS-ALL & some FOR-VEG-IMP. FY16 targets include FOR-VEG-EST.

Monitoring and evaluation: Standard plantation survival exams would be used to monitor and evaluate the success of planting. Survival exams would occur on the first, third and fifth year after planting.

Estimated cost and timeline: The estimated cost of project planning and NEPA analysis (FY14 activities): $43,807.

Timeline:

- FY14: project planning and NEPA analysis completed
- FY15: implementation of site preparation activities
- FY16: planting

Moonlight Fire Restoration Project Proposal (2014)

Moonlight Precommercial Thinning, Release for Growth, and Fuel Reduction Planning

Project Leader: Maurice Huynh (District Silviculturist)

Link to Restoration Strategy desired condition and goal:

- Restore the long-term viability of appropriate forest types and reduce the potential for vegetation type conversion.
- Restore landscape heterogeneity in terms of spatial and temporal variability, forest type and species diversity, and forest seral stages and structure.
- Restore the forest landscape to one that is well-adapted to natural disturbance regimes and can respond to changes in climate and disturbance regimes

Objective: The Moonlight Fire effectively converted many forested mid to later seral stands to chaparral vegetation types. However, there are older plantations that survived the fire. Thinning these plantations these would increase long-term viability. In older plantations, thinning would also accelerate growth towards larger size classes and later seral stages.

In addition, precommercial thinning of plantations can increase stand heterogeneity. The Moonlight Fire left a fair amount of the landscape in homogenous patches of either early seral or brush vegetation types. Diversifying the forest types through proper selection of species, diameters and heights will increase stand and hence, landscape heterogeneity.

A proper reduction in stand density would increase stand vigor reduce the amount of ladder fuels. This would increase a stand's ability to respond to natural disturbances including insects, disease and fire. A healthy stand would be better adapted to respond to changes in climate as well.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire
- Is on lands administered by the Forest Service
- Improvement of existing, residual green stands is rendered necessary to retain what is left after the Moonlight Fire burned a fair amount of forested areas

Project description: This is the first phase of a multi-year project. FY14 will involve reconnaissance and NEPA planning for timber stand improvement of surviving plantations within the Moonlight Fire; implementation is anticipated in FY15. FY 15 targets include FOR-VEG-IMP and FUELS-ALL.

In older plantations, most thinning would be considered precommercial with no sawlog product being removed. Depending upon the average stand diameter, removal of trees would likely be

through use of a masticator. Plantations with larger trees may have some commercial product removal.

Monitoring and evaluation: Depending upon the contract, either sale administrators or contracting representatives (COR's) would monitor to ensure successful implementation.

Estimated cost and timeline: The estimated cost of project planning and NEPA analysis (FY14 activities): $72,219

Timeline:

- FY14: project planning and NEPA analysis completed
- FY15: project implementation

Moonlight Fire Restoration Project Proposal (2014)

Moonlight Thinning and Fuel Reduction Planning

Project Leader: Maurice Huynh (District Silviculturist)

Link to Restoration Strategy desired condition and goal:

- Restore the long-term viability of appropriate forest types and reduce the potential for vegetation type conversion.
- Restore landscape heterogeneity in terms of spatial and temporal variability, forest type and species diversity, and forest seral stages and structure.
- Restore the forest landscape to one that is well-adapted to natural disturbance regimes and can respond to changes in climate and disturbance regimes

Objective: The Moonlight Fire effectively converted many forested mid to later seral stands to chaparral vegetation types. However, there are residual mid to later seral stage conifer stands that survived the fire. Mature stands comprising of larger trees usually typify later seral stages.

Thinning these stands would increase long-term viability and generally increase vigor and improve resiliency to disturbances such as insects, disease and fire. In addition, removing trees in a stand can increase stand heterogeneity. The Moonlight Fire left a fair amount of the landscape in homogenous patches of either early seral or brush vegetation types. Diversifying the forest types through proper selection of species, diameters and heights will increase stand and hence, landscape heterogeneity.

A proper reduction in stand density would also increase stand vigor reduce the amount of ladder fuels. This would increase a stand's ability to respond to natural disturbances including insects, disease and fire. A healthy stand would be better adapted to respond to changes in climate as well.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire
- Is on lands administered by the Forest Service
- Improvement of existing, residual green stands is rendered necessary to retain what is left after the Moonlight Fire burned a fair amount of forested areas

Project description: The proposed project area is an Antelope Lake recreation site. This is the first phase of a multi-year project. FY14 will involve reconnaissance and NEPA planning for commercial thinning within the Moonlight Fire; implementation is anticipated in FY15. FY15-FY16 targets would include FUELS-ALL, FOR-VEG-IMP, and with a potential component of TMBR-VOL-SOLD.

The project area is comprised of more mature stands that would most likely be commercially thinned with an emphasis on restoring and maintaining later seral stage components. Smaller

ladder fuels and non-desired species such as true fir would also be removed. Additional considerations such as safety and aesthetics will also be highlighted.

Monitoring and evaluation: Depending upon the contract, either sale administrators or contracting representatives (COR's) would monitor to ensure successful implementation.

Estimated cost and timeline: The estimated cost of project planning and NEPA analysis (FY14 activities): $71,508

Timeline:

- FY14: project planning and NEPA analysis completed
- FY15: project implementation

Moonlight Fire Restoration Project Proposal (2014)

Wildcat Fuel Reduction and Forest Health Thinning Project

Project Leader: Maurice Huynh (District Silviculturist)

Link to Restoration Strategy desired condition and goal:

- Restore the long-term viability of appropriate forest types and reduce the potential for vegetation type conversion.
- Restore landscape heterogeneity in terms of spatial and temporal variability, forest type and species diversity, and forest seral stages and structure.
- Restore the forest landscape to one that is well-adapted to natural disturbance regimes and can respond to changes in climate and disturbance regimes

Objective: The Moonlight Fire had an indelible effect on forested vegetation within its fire perimeter, effectively converting many forested mid to later seral stands to chaparral vegetation types. However, on the external fringes of the fire perimeter, many stands experienced low fire severity. Nonetheless, as evidenced by the recent Chips Fire, these residual green stands are still at risk to vegetation conversion from fires starting inside the Moonlight Fire perimeter. The Chips Fire started within the Storrie Fire footprint. Due to the presence of heavy ground fuels, the fire grew and burned outside the original Storrie Fire footprint into green stands. Arguably, this situation could occur with Moonlight and adjacent green stands.

The Wildcat Project area is adjacent to the eastern edge of the Moonlight Fire perimeter. Thinning these stands would decrease ladders fuels, increase crown separation and generally reduce fuel loading. In the event of a future fire starting in the Moonlight Fire perimeter and burning out of it, Wildcat would serve as an effective buffer in limiting the spread of the fire toward the community of Janesville. Conversely, the Wildcat project would provide protection to plantation investments and surviving green stands within the Moonlight Fire perimeter from external fires. The Wildcat Project and its surrounding area have been referred to by Mt. Hough District fire personnel as "lightning alley". The Boulder (2006) and Antelope (2007) Complex Due is evidence to the potential fire hazard in the area. Due to the extent of high severity fires during the Moonlight Fire, it is imperative to protect the recently established plantations and surviving remnant stands from future fires. These stands are at risk of loss to fire, both from within and outside the Moonlight Fire perimeter. Increasing fire resiliency in Wildcat would help protect reforestation efforts and investments within the Moonlight Fire area.

In addition, a proper reduction in stand density would increase stand vigor. Many stands within the Wildcat project area are considered mid seral. Thinning these stands would increase stand growth and accelerate their development into larger size classes and their ability to respond to other natural disturbances such as insects and disease – such conditions would be better adapted to respond to climate change. Diversifying the forest types through proper selection of

species, diameters and heights will increase stand and hence, landscape heterogeneity; heterogeneity that was lost in the Moonlight Fire as many acres were effectively converted to shrub vegetation types or early seral stands.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire
- Is on lands administered by the Forest Service
- Improvement of existing, residual green stands is rendered necessary to retain what is left after the Moonlight Fire burned a fair amount of forested areas

Project description: The proposed project area is lies between Wildcat Ridge on the east and on the west by the Mt. Hough/Beckwourth Ranger District boundary (see map). This is the first phase of a multi-year project. FY14 will involve reconnaissance and NEPA planning for commercial and non-commercial thinning; implementation is anticipated in FY15. FY15 –FY16 targets would include FUELS-ALL, FOR-VEG-IMP, and TMBR-VOL-SOLD.

The project area is comprised of more mature stands that would most likely be commercially thinned with an emphasis on restoring and maintaining later seral stage components. Part of the area has experienced a vegetation shift away from "east side pine" which historically had much lower tree densities dominated by shade intolerant pines. Smaller ladder fuels and non-desired species such as true fir would also be removed in order to help return the area to a more east side pine condition. There is a limited amount of aspen stands within the Wildcat project area that are being proposed for treatment. Prescriptions in aspen stands will be to protect and restore vigor. Additional considerations such as safety and aesthetics will also be highlighted.

Monitoring and evaluation: Depending upon the contract, either sale administrators or contracting representatives (COR's) would monitor to ensure successful implementation.In addition, aspen stands would most likely be monitored for prescription and treatment efficacy.

Estimated cost and timeline: The estimated cost of project planning and NEPA analysis (FY14 activities): $161,594

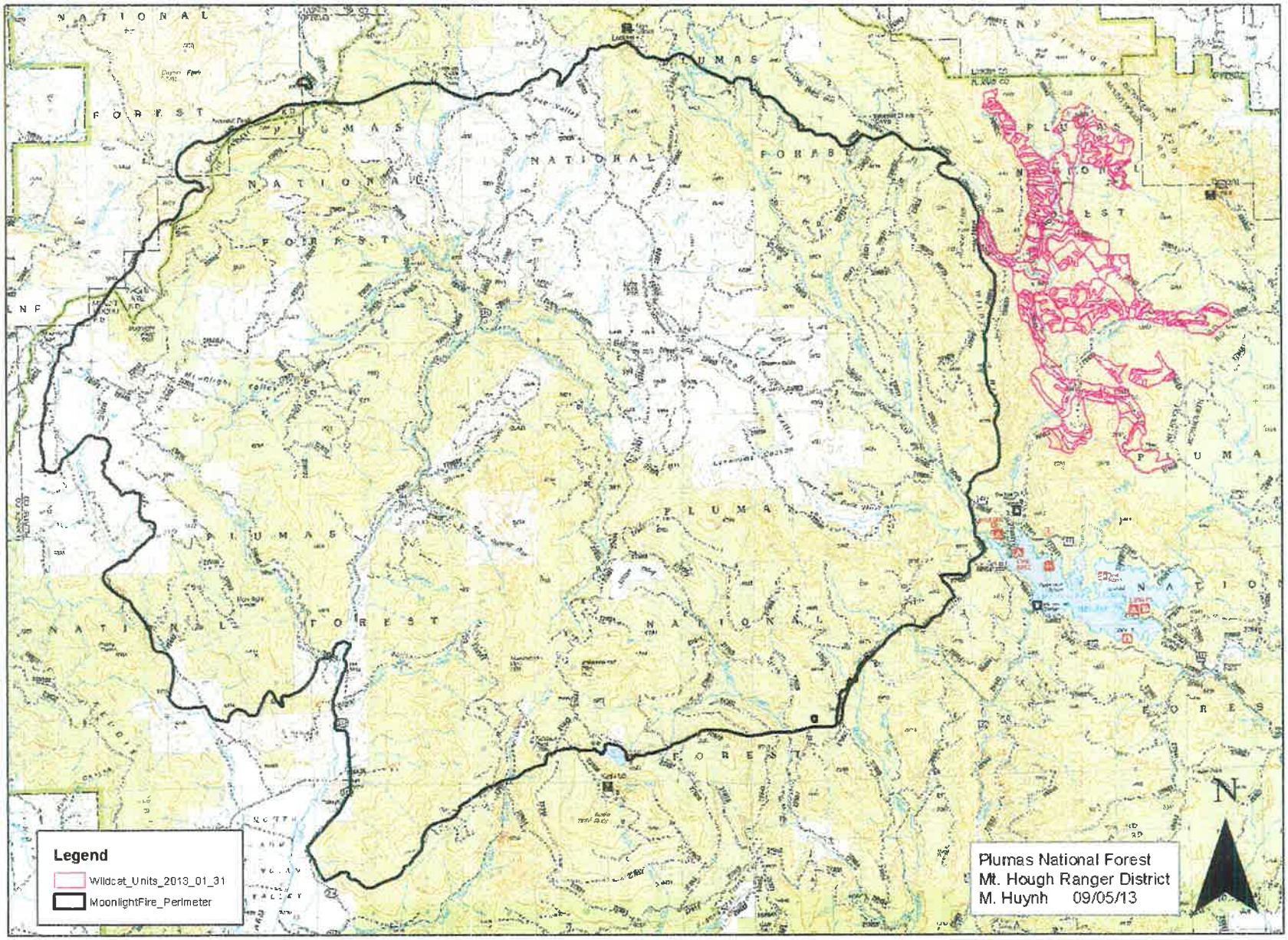
Timeline:

- FY14: project planning and NEPA analysis completed
- FY15: project implementation

Expected targets and accomplishments

- Timber volume sold
- Vegetation improvement
- Fuels reduction (both WUI and non WUI)
- Wildlife enhancement (aspen stand treatments)

Moonlight Restoration-FY14 Wildcat Project (Planning)



Moonlight Fire Restoration Project Proposal (2014)

Aspen and Meadow Inventory

Project Leader: Kyle Merriam (Sierra Cascade Province Ecologist)

Link to Restoration Strategy desired condition and goal: This project will inventory aspen stands and meadows ***within*** the Moonlight Fire area to determine if they meet desired conditions for meadows and aspen. Desired conditions from the restoration strategy for meadows include:

- Habitat supports viable populations of native and desired non-native plant, invertebrate, and vertebrate riparian and aquatic-dependent species.
- Species composition and structural diversity of plant and animal communities in riparian areas, wetlands, and meadows provide desired habitat conditions and ecological functions.
- The connections of floodplains, channels, and water tables distribute flood flows and sustain diverse habitats.
- In-stream flows are sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and keep sediment regimes as close as possible to those with which aquatic and riparian biota evolved.
- The ecological status of meadow vegetation is late seral, meaning that 50 percent or more of the relative cover of the herbaceous layer is late seral with high similarity to the potential natural community. A diversity of age classes of hardwood shrubs is present and regeneration is occurring.
- Meadows are hydrologically functional. Sites of accelerated erosion, such as gullies and headcuts are stabilized or recovering. Vegetation roots occur throughout the available soil profile. Meadows with perennial and intermittent streams have the following characteristics: (1) stream energy from high flows is dissipated, reducing erosion and improving water quality, (2) streams filter sediment and capture bedload, aiding floodplain development, (3) meadow conditions enhance floodwater retention and groundwater recharge, and (4) root masses stabilize stream banks against cutting action.

Desired conditions for aspen include:

- Conifer cover (understory and overstory) of less than 25 percent;
- Aspen canopy cover greater than 40 percent;
- Dominant aspen trees less than 100 years old;
- Aspen regeneration (stems 5 to 15 feet tall) of more than 500 stems per acre; and
- Sagebrush cover of less than 10 percent.

This project addresses restoration goals, including: a) ensure that grazing management is contributing to desired conditions; b) maintain and restore habitat for riparian and meadow associated species, c) promote fire resilience aspen stands; d) protect aspen stands from conifer encroachment, and e) protect aspen sprouts from excessive browsing.

Objective: This project implements restoration objective: "Conduct surveys to evaluate the current condition of meadows, fens, and aspen stands within the analysis area; this includes an assessment of grazing effects, hydrologic condition, and extent of conifer encroachment. Identify and prioritize sites for restoration."

Maintenance of aspen stands will also meet objectives of the cooperative Forest Service and California Department of Fish and Wildlife Deer Herd management plans. Two important deer populations, the Sloat and Doyle herds, are present in the Moonlight Fire area.

Project justification: This project meets the three key criteria from 16 USC 579c: 1) To conduct improvement, protection, or rehabilitation work; 2) On lands administered by the Forest Service; and 3) For purposes rendered necessary by the Moonlight Fire by conducting inventories of aspen and meadow condition required to prioritize and develop improvement and rehabilitation work on the Plumas NF in areas that were burned by the Moonlight Fire.

Project description: This project will inventory aspen stands and meadows that were burned during the Moonlight Fire to identify and prioritize sites for restoration as part of the Moonlight Fire Restoration Plan. This project will result in accomplishments for forest vegetation improvement, fuels reduction and terrestrial habitat enhancement. These surveys would be conducted in coordination with monitoring proposed for the Mt. Hough Range allotments. Many aspen stands that burned in the Moonlight Fire responded with prolific sprouting. Although sprouting can rejuvenate aging aspen stands, these sprouts are now highly vulnerable to excessive livestock browsing, which can eventually eliminate aspen. Meadow ecosystems may have been damaged by the Moonlight Fire in areas where high severity fire effects altered meadow hydrology or damaged meadow vegetation. The results of this inventory will be used to develop restoration projects for aspen and meadows during FY15, with project implementation in FY15 and FY16.

Monitoring and evaluation: This project will complete a baseline inventory of current aspen and meadow conditions to identify and prioritize sites for restoration. Effectiveness monitoring will begin in FY15.

Estimated cost and timeline: Total cost for project: $39,043, including personnel and fleet costs. See workplan for budget details. Restoration project planning will be conducted in FY15, with implementation to occur in FY15 and FY16. Costs for FY15 and FY16 have not yet been estimated.

Moonlight Fire Restoration Project Proposal (2014)

Mud Lake Baker Cypress Fuel Treatment Planning

Project Leader Name: Kyle Merriam (Sierra Cascade Province Ecologist)

Link to Restoration Strategy desired condition and goal: This project will occur in the Mud Lake unit of the Mud Lake Research Natural Area (MLRNA), an area that was burned during the Moonlight Fire. The project will address the following desired condition from the restoration strategy: "The short-term desired condition for Baker cypress at the Mud Lake unit of the MLRNA is a population that is allowed to mature in an environment where the risk of subsequent fires is minimized."

Objective: This project would implement the following goals and objectives described in the restoration strategy:

1. Fire suppression is recommended at the Mud Lake unit of the MLRNA until Baker cypress trees are able to mature and develop a canopy seed bank. Sufficient canopy seed storage will not likely occur until the stand is between 35 and 50 years old.
2. To reduce the risk of fire eliminating the Mud Lake stand, strategic fuel treatments should be implemented around the population.

Project justification: This project meets the three key criteria described in 16 USC 579c by implementing fuel treatments to protect the Baker cypress stand burned in the Moonlight Fire from subsequent fires before the population has become reproductively mature. This project would occur on lands administered by the Forest Service within the Moonlight Fire perimeter. This project is necessary because the Moonlight Fire stimulated the regeneration of a new cohort of Baker cypress by killing the senescent adult population previously found at the site.

Project description: The Mud Lake Unit of the MLRNA, containing one of only two populations of Baker cypress found on the Plumas National Forest, burned in the Moonlight Fire. Baker cypress is a serotinous species, requiring fire to regenerate. The Moonlight Fire was very successful in stimulating regeneration of this very decadent and dying stand. However, the population is now extremely vulnerable to subsequent fires, which would kill young cypress before they have matured and produced cones. A second fire would likely extirpate this population of Baker cypress. This project would plan an approximately 200 acre fuel treatment, building upon fuel treatments designed for the Diamond project, to be constructed around the 307 acre Mud Lake Unit of the MLRNA. This fuel treatment is critically needed to protect the tens of thousands of Baker cypress seedlings that currently occupy the site. Work completed in FY14 would include surveys, project planning, and development of the NEPA decision document. Implementation of this project would be planned for FY15. This project will result in accomplishments for forest vegetation improvement and fuels reduction.

Monitoring and evaluation: This project will complete a baseline inventory of conditions within and adjacent to the Mud Lake Unit of the MLRNA for use in project planning. Future monitoring to evaluate the success of this project will be conducted beginning in FY15.

Estimated cost and timeline: This project would cost $22,126 in FY14 for surveys and NEPA analysis. See workplan for additional budget details. Project implementation would occur in FY15. Implementation costshave not yet been estimated.

Moonlight Fire Restoration Project Proposal (2014)

Informing landscape-scale forest restoration using site specific historical reference conditions

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Project Leaders:
Brandon Collins, Research Forester, Pacific Southwest Research Station
Michelle Coppoletta, Associate Province Ecologist, Region 5 Ecology Program
Ryan Tompkins, Forest Silviculturist, Plumas National Forest

Link to Restoration Strategy desired condition and goal:

From Conifer Forest Vegetation section:

Desired Condition – Landscape dominated by later seral open canopy forests, particularly on the south and west facing slopes. Moist mixed conifer stands with more closed canopies would occur primarily within north and eastern aspects and at generally higher elevations. True fir stands with more closed canopy forest structure would be primarily restricted to the highest elevations with a preference for more mesic northern and easterly aspects.

Goal 2 – Restore landscape heterogeneity in terms of spatial and temporal variability, forest type and species diversity, and forest seral stages and structure.

Goal 3 – Restore the forest landscape to one that is well-adapted to natural disturbance regimes and can respond to changes in climate and disturbance regimes.

From Hardwood Forest section

Goal 1 – [Restore] a diversity of structural and seral conditions in proportions that are ecologically sustainable at the watershed scale;

Goal 1 – [Maintain] sufficient quality and quantity of hardwood ecosystems to provide important habitat elements for wildlife and native plant species.

From Montane and Mixed Chaparral section

Desired condition – Maintain montane and mixed chaparral on the landscape at the appropriate extent and patch sizes to contribute to landscape heterogeneity, biodiversity, and soil nutrients, without precluding succession to forest vegetation on appropriate sites.

Goal 1 – Maintain montane and mixed chaparral on sites where edaphic conditions preclude the establishment of other species.

Goal 4 – Promote patch size distributions of montane and mixed chaparral that maximizes landscape heterogeneity, species diversity, wildlife habitat and nutrient cycling, while minimizing the likelihood of widespread, permanent type conversion on sites that would be in dynamic equilibrium with forest dominated vegetation under an active fire regime.

Objective: Describe the distribution of vegetation types and structures in the 1941 landscape and compare that to the contemporary landscape, both prior to and following the suite of recent fires (Boulder Complex, Antelope Complex, and Moonlight fire).

Project justification: The Moonlight Fire Restoration Strategy outlines a landscape-scale approach for restoring vegetation patterns that are more consistent with what occurred in these areas historically under an intact fire regime. Based on a number of studies that have reconstructed historical forest conditions, it appears that landscapes with intact fire regimes included relatively dense, even-aged stands and shrub patches, as well as the often referenced open, park-like, multi-aged stands. Actual proportions in each vegetation type/structure are largely unknown due to the limitations of historical reconstruction studies. The proposed study would provide this information using the 1941 aerial photographs. While 1941 certainly does not capture an unperturbed forest condition, it does predate heavily mechanized fire suppression and timber harvesting.

Project description: A full set of 1:24,000 exits in hard copy for the Plumas NF. Work is underway to digitally scan and orthorectify a subset of these photos to allow for GIS analysis. This subset comprises the Moonlight and Antelope Complex fires, along with the surrounding landscape. In total, the area of interest is approximately 200,000 acres, including the ten watersheds containing the Moonlight Fire and the Antelope Complex. This is the same analysis area used in Moonlight Fire Restoration Strategy. Using aerial photo interpretation techniques, including both supervised and unsupervised image classification, we will quantify patch sizes of the different vegetation types/structures (e.g., shrub-dominated, open canopy forest, dense canopy forest). We will also explore the extent to which topography and soil type control the vegetation patterns observed in 1941. We will then assess change in vegetation patterns both prior to and following the recent large fires (Boulder, Antelope, and Moonlight). Contemporary vegetation will be determined both from CalVEG and from 2005/2009 NAIP images. This comparison to both pre- and post-fire vegetation will examine whether recent fires moved landscape vegetation patterns closer to or further away from historical patterns. The intent is to provide guidance to restoration efforts aimed at creating vegetation conditions consistent with those existing under a more intact fire regime. These conditions are often assumed to reflect more resilient landscapes that can withstand external stressors, namely fire and changing climate (Fulé 2008; Stephens et al. 2010).

This project would inform project level, site-specific planning for restoration projects, as well larger forest-level and bio-regional planning efforts. The project timelines and product development would be coordinated as best as possible to meet the Forest FY14 planning needs of ID Teams for specific restoration projects. The Wildcat Fuel Reduction project, Range NEPA, and Heritage Projects are a few that would directly use information generated from the proposed research project. The research would contribute to partnerships between the Plumas NF, PSW, and Region 5 Ecology Program and would produce a publication which would contribute to PSW fire research accomplishments (RES-PUBL, RES-FIRE-NDX, RES-FIRE-QUAL-NDX).

Archaeological and Other Cross Disciplinary Benefits: The 1941 aerial photographs of the Plumas National Forest have been a valuable tool for historians and archaeologists for many years. On occasion, single prints have been digitally scanned for interpretive uses in conjunction with historic and modern maps, and more recently with ortho-photography. Up to this point, however, there has been no means to utilize these images directly in GIS analysis. The 1941 aerial photo collection, the oldest complete over-flight photo set of the Forest, often shows historic era features such as settlements, past mining developments, past logging patterns and methods, and transportation systems. These images are particularly useful for tracing historic linear features such as ditches, trails, roads and railroads; many of which can date decades prior to the date of the aerial photos themselves. An overlay of the 1941 photo set with cultural resource data could prove exceedingly useful for predictive modeling and sensitivity assessments for site locations and understanding past human influence on the landscape. Finally, on perhaps a more practical level, digitizing would allow for enhanced preservation the photos themselves with copies being readily available for use from a digital library without having to rely on an aging, and largely irreplaceable, set of hard copy prints.

In addition to heritage resources, we anticipate the GIS products from this project proposal would have cross disciplinary benefits for Interdisciplinary teams planning restoration projects for vegetation, wildlife, watershed, and range resources.

Monitoring and evaluation: The fact that staff from both the R5 Ecology Program and the Plumas NF is co-principal investigators will insure a direct communication link between the researchers and the end-users, Plumas NF resource staff. This will provide an accessible and efficient process for updating forest staff on progress and review of draft products (see products below).

Estimated cost and timeline: The proposed project will be a collaborative effort between the Plumas NF, R5 Ecology Program, and PSW. The majority of the image analysis and write-up of the final report will be conducted by Collins and other PSW staff. The contribution from the Plumas NF and the Ecology Program will consist of local expertise in developing vegetation classes and evaluating draft vegetation maps, in addition to writing the final report. Deliverables will be: 1) final report detailing vegetation patterns in 1941, 2005, and 2009; 2) vector maps available in GIS format of the classified vegetation in 1941, 2005, 2009, and 3) a journal publication.

The duration of the project is 1.5 years. We anticipate the processing of the aerial photography and the vegetation classification will take approximately 10 months. Analysis of landscape vegetation patterns and comparison among the three time periods will take approximately 4 months. The write-up of the final report and preparation of a journal manuscript will take an additional 4 months. Funding requested includes: 12 months of salary plus benefits for a GS-9/3 Biological Science Technician at PSW ($72k), 1.5 months of salary plus benefits for the associate province ecologist - Coppoletta ($9k), use of computer facilities for image processing at UC Davis Information Center for the Environment ($2k), and travel ($2k). The total funding requested is $85,000. Contributed funds include salary plus benefits for Collins (3 months -

$29k), Coppoletta (3 weeks - $4.5k), Tompkins (2 weeks - $4k), and Dan Elliot, Plumas NF Heritage Program Manager (1 week - $2K).

Moonlight Fire Restoration Project Proposal (2014)

Cliff Nesting Raptor Habitat Enhancement

Project Leader Name: Colin Dillingham (Wildlife Biologist, Mt Hough Ranger District)

Link to Restoration Strategy desired condition and goal:

Desired conditions for golden eagles and prairie falcons include adequate levels of open foraging habitat as well as suitable nesting structure, which may be either late-seral forests or tall cliff sites with suitable platforms for nests.

Goals are to maintain species viability of golden eagles and prairie falcons (LRMP 4-33). Maintain suitability of prairie falcon and golden eagle territories. Provide suitable nesting structure to allow continued nesting of golden eagles.

Objective: Restore nesting habitat for golden eagle habitat as replacement habitat lost when the Moonlight Fire destroyed late-seral nesting habitat for golden eagles. Identify 2-3 cliff sites within the Moonlight Fire area that may support nesting eagles and create a suitable ledge inaccessible by predators to compensate for habitat lost in the Moonlight Fire.

Project justification: This project meets all criteria set forth by 16 USC 579c because it: 1) Improves and restores lands affected by the Moonlight Fire; 2) Is on lands administered by the Forest Service; and 3) Replace habitat lost during Moonlight Fire burned majority of suitable nesting habitat.

Project description: Plan project and award contract for two cliff site enhancement sites. The Moonlight Fire destroyed thousands of acres of suitable raptor habitat, including habitat for Golden Eagles, which also nest on cliffs. As compensation for lost nesting habitat, find and develop two cliff sites to sustain long term nesting capability through eyrie development (potentially blasting to create cliff platform and install pea gravel for nesting substrate through contract). This would require surveys for project development, NEPA planning to clear project through environmental process, and contract development.

Monitoring and evaluation: Monitoring of project development would be through surveys of cliff enhancement sites and determining occupancy. Data would be collected 1-2 times annually to determine if cliff enhancement sites are being using by raptors. If cliff sites are used within 10 years, site will be considered a success.

Estimated cost and timeline: Total cost for project: $23,479, including personnel and fleet costs. See work plan for budget details.

Fall 2013 – conduct surveys to locate potential cliff nesting sites
Winter 2013 – complete NEPA and write contract
Spring 2013 – award contract
Summer 2013 – Implement contract

Moonlight Fire Restoration Project Proposal (2014)

Wildlife Habitat Improvement (Guzzler) Replacement

Project Leader Name: Colin Dillingham (Wildlife Biologist, Mt Hough Ranger District)

Link to Restoration Strategy desired condition and goal:

Desired conditions for deer habitat is to contribute to the stability of deer populations and/or habitat status trend for these habitats across the Sierra Nevada bioregion. Maintain a diversity of available water, forage habitat, hiding cover, and thermal cover.

Goals are to protect and improve habitat for harvest species (LRMP 4-34). Provide resources where gaps exist in habitat (such as provide water in wildlife guzzlers).

Objective: Replace deer habitat enhancement structures, such as water catchment guzzlers, lost during Moonlight Fire. Eight of the 9 guzzlers destroyed by the Moonlight fire should be replaced. In addition, 3 additional guzzlers were destroyed by the Wheeler Fire within the analysis area.

Project justification: This project meets all criteria set forth by 16 USC 579c because it: 1) Improves and restores lands affected by the Moonlight Fire; 2) Is on lands administered by the Forest Service; and 3) Replaces habitat improvement structures lost during Moonlight Fire.

Project description: The Moonlight Fire burned nine wildlife guzzlers. The objective of the project proposal is to gradually replace these deer habitat structures. Past wildlife habitat investments were lost when the Moonlight Fire destroyed the guzzlers. A cooperative agreement with the Mule Deer Foundation would be used to implement this project using volunteer labor.

Monitoring and evaluation: Monitoring of guzzlers would be done using remote wildlife cameras on two survey periods per guzzler. Data would be reviewed to determine if deer and other species of wildlife are using guzzlers and to determine if they are functional. If guzzlers are being used by wildlife, project will be considered a success.

Estimated cost and timeline: Total cost for project: $15000, including personnel and fleet costs for 2014. See work plan for budget details. Cost estimate includes plan to use volunteer effort from Mule Deer Foundation for guzzler installation.

2014 – Replace 2 guzzlers and monitor success
2015 – Replace 2 guzzlers and monitor success
2016-2017 – consider replacing 4 additional guzzlers pending monitoring results.

Moonlight Fire Restoration Project Proposal (2014)

Invasive Plant Treatments and Inventory

Project Leader Name: Jim Belsher-Howe (Botanist, Mt Hough Ranger District)

Link to Restoration Strategy desired condition and goal: The desired condition for the Moonlight Fire area is a diverse and resilient native plant community free of invasive plant species. Within and adjacent to the fire, new introductions of invasive plants are prevented, new infestations are rapidly treated, and established infestations are contained and controlled where they threaten wildland values or pose a high risk of spread to uninfested areas.

Objective: This project will contribute to the following goals and objectives, which were identified in the Moonlight Fire Restoration Strategy:

- Detect new infestations of invasive species promptly by creating and maintaining complete, up-to-date inventories of infested areas, and proactively identifying and inspecting susceptible areas that are not infested.
- Use an integrated approach to treat invasive plant infestations. Use the best available information to select the most effective combination of treatment methods, including manual, cultural, chemical, and biological controls.
- Control new infestations promptly. Where control is not feasible, suppress or contain expansion of infestations. Refer to **Error! Reference source not found.** (in the strategy) for species-specific management goals.
- Assess the efficacy of control treatments. Conduct follow-up inspection of treated sites to prevent reestablishment.

Project justification: Invasive plant management is an important component of restoration in the Moonlight Fire area. Increased activity from restoration activities, as well as the large number (~ 74%) of infestations situated in close proximity to roads or trails, increases the risk of introduction and spread into less-invaded portions of the Moonlight fire area. At present, over 750 infestations, covering about 240 acres, have been documented within and adjacent to the fire; 444 sites (~125 acres) occur within the boundary of the Moonlight fire. Although some post-fire surveys have been conducted, the majority of these sites have not been accurately assessed since prior to the fire.

Manual control treatments of some infestations have occurred on an annual basis since 2002. The total acreage treated each year is less than five percent of the total present due to a lack of funding and completed environmental analysis for herbicide treatment. Although treatments have been limited in scope, they have been successful in eradicating a few small populations and reducing the size or preventing the spread of several others.

Project description: In 2014, manual eradication and control efforts will continue on approximately 7.5 acres of invasive plant infestations. In addition, an inventory of weed sites

will be conducted to document changes in the size of infestations, number of individuals, and any existing or potential threats to native plant communities or sensitive resources. Many of the weed sites in the Moonlight Fire area have not been revisited since they were first documented prior to the fire; over 200 new infestations were discovered after the fire. This baseline information will be used to prioritize treatment of weed sites across the Moonlight Fire area and to develop a large-scale weed treatment project (target FY15).

Future invasive plant projects that are tied to this:

- Treatment of invasive plants in the Moonlight Fire area using an integrated approach
- Identification of weed-free locations for future fire camps. These will be mapped and resurveyed annually.

Monitoring and evaluation: Invasive plant monitoring within the Moonlight Fire area will focus on the effectiveness of treatment activities. Managers will use monitoring results to evaluate changing conditions and new information on an ongoing basis and then assess the need to refine site-specific treatment strategies. The length of time for monitoring and the level of intensity needed will vary depending on the species; for example, a plant that reproduces vegetatively may need to be monitored longer than an annual that reproduces exclusively from seed. In the short-term, control efforts will be evaluated with follow-ups approximately one to two months following treatment to assess the efficacy of controls and to check for the presence of seedlings. In the long-term, a site should be monitored annually for at least the first three to five years following treatment. If no plants are found, the monitoring frequency can decrease to every other year for the next five to ten years or until the seed bank has been exhausted and no new germination is taking place.

Estimated cost and timeline: Cost of inventory and limited treatment: $26,231 (FY14)

Moonlight Fire Restoration Project Proposal (2014)

Geomorphic Road Assessment and Inventory Package (GRAIP) Road Inventory

Project Leader Name: Kurt Sable (Hydrologist, Mt Hough Ranger District)

Link to Restoration Strategy desired condition and goal: Desired conditions from the Hydrology and Transportation sections include: (a) meeting water quality goals of the Clean Water Act; (b) keeping sediment regimes as close as possible to those which aquatic and riparian biota evolved; and (c) having a sustainable transportation network that has minimal impact to water quality and aquatic resources.

Goals from the Hydrology and Transportation sections include:

- Protect the desirable hydrologic characteristics that exist, or that are recovering from the fire, from management actions.
- Evaluate known problem areas to see if they represent a cost effective opportunity to enhance or restore hydrologic function.
- Locate new opportunities for enhancement or restoration. Collect robust data across the entire analysis area to ensure that the most egregious sites are located and that priorities for enhancement and restoration are cost effective and make sense at a watershed scale.
- Long term management and restoration of the Moonlight Fire area is dependent on access. The primary transportation goal is to provide reasonable access through a passable, stable, minimal, and safe transportation system with functioning hydrologic drainage features and structures.

Objective: The objective is to inventory and evaluate the existing transportation system in the Moonlight Analysis area for impacts to water quality and aquatic resources. An added benefit will be an inventory of the condition and drivability of the transportation system.

Project justification: To meet objectives for both hydrology and transportation an analysis of the transportation system is needed to prioritize and plan restoration projects in the analysis area.

The HUC 6 watersheds that contain the Moonlight Fire will be used to identify opportunities for restoration. This area allows for the evaluation of hydrologic or watershed resources both inside and outside the perimeter of the fire, but within the same watershed. Areas with high quality characteristics that may have been lost or degraded in the fire area may exist within the watershed, but adjacent to the fire boundary; therefore, it may be possible to protect or restore some hydrologic resources that are impractical or impossible to restore within the fire area at less than decadal or greater time scales. Also roads located outside the perimeter that impact resources may be needed to access the fire area. These roads should be brought up to BMP standards.

Project description: Geomorphic road analysis to cover ~400 miles of roads and motorized trails in the Moonlight Analysis Area. The Geomorphic Road Assessment and Inventory Package (GRAIP) is a process and a set of tools for analyzing the impacts of roads on forested watersheds. GRAIP combines a detailed road inventory with a powerful GIS analysis tool set to predict road sediment production and delivery, mass wasting risk from gullies and landslides, and road hydrologic connectivity.

Monitoring and evaluation: This project is in itself a baseline monitoring effort. It will be used to examine the efficacy of future watershed enhancement and road stormproofing, and decommissioning projects.

Estimated cost and timeline: Cost projection is based on estimates from the Rocky Mountain Research Station specialists who will be brought in to do the GRAIP survey. It is $150,500 and the work is expected to be completed during the 2014 fiscal year.

Moonlight Fire Restoration Project Proposal (2014)

Range Allotment Analysis

Project Leader Name: Scott Lusk (Plumas NF Range Specialist)

Link to Restoration Strategy desired condition and goal: Silviculture projects are planned that will restore the existing timbered areas to its more natural historic range of variation, being a more open, less dense fire resistant forested canopy. Restoring the understory vegetation restores forage for livestock (<40% meadow use) and wildlife (60%).

Objective: The Fire Ecologist report discusses the historic fire regime as 10 to 20 year interval. The 10 to 20 year historic frequent low intensity fire regime pre-European settlement around the 1830's, maintained the area in an east side pine type with a bitterbrush-mahogany shrub/bunch grass/Ross sedge forage understory. Historic and current Plant Associations layers are mapped in the Silviculture Report. This area was historically a drier east side pine type, with moist mixed conifer on the north slopes. With fire suppression, plant associations have changed to a more moist mixed conifer plant association over the past 100 years. Forested canopies have closed in which have shaded out the understory vegetation and allowed accumulation of ladder fuels with increased potential for ever increasing catastrophic wildfires. An objective of Forest restoration is to restore the forest to a plant association in line with it's historic fire regime to reduce future catastrophic wild fires.

Creating less dense tree stands in the unburned areas through Silviculture fire restoration practices will draw livestock out of the riparian areas (<20% use on riparian shrubs and <20% bank alteration) and disperse them across the allotments (40% meadow use).

Project justification: 16 USC 579c requires fire restoration projects to restore areas burned in wildfires. 36 CFR 222.2 requires Forest Service to manage forage producing National Forest System lands for livestock grazing. The area of analysis is the allotments that intersect with the Silviculture layer. The Silviculture layer consists of watersheds with similar historic east side pine plant associations, historic 10 to 20 year fire regime, and time of burn with the Moonlight, Antelope, Wheeler, Boulder and Stream fires. Allotment boundaries were chosen for the Range analysis area because grazing is permitted and administered by the allotment. Active allotments within the analysis area are: Lights Creek, Lone Rock, Antelope, Antelope Lake, Clarks Creek, Bass, Jenkins, and Doyle. Vacant Allotments, allotments without current livestock, are also considered in this analysis for comparison and for potential restocking. The vacant allotments are: Hungry Creek and Taylor Lake. (see Range Map).

Project description: The 1995 Recessions Act says no changes to grazing, that is, reducing number, season, or changing grazing system, can be made with expiring permits until NEPA analysis is completed. This analysis helps the Plumas National Forest keep on track to meet the 1995 Recessions Act. Analysis will consist of condition and trend of meadows, fens, creek, springs, upper and understory vegetation. The decision will be made on number, kind, class of

livestock, season of use, use standards and guides, allowable use, monitoring areas, pasture rotation, range improvements, and areas of concerns.

Monitoring and evaluation: Meadow monitoring will use R5 Wiexleman's Long Term Meadow Plots, T. Frolli's Rapid Meadow Assessment. National Riparian Team's 'Proper Function Condition' assessment guide will be used on Creeks (TR 1737-9 1993), Springs (TR 1737-16 2003), and Fens (R5-TP-028). Multiple Indicator Monitoring (MIMs) TR 1737-23 2011 will be used to assess stream channels and streamside vegetation.

Estimated cost and timeline: Allotment NEPA is a two year process. The first year data is collected. The second year the environmental analysis, including scoping and the Decision, is written. The following is an outline of the tasks associated with allotment analysis as well as their estimated costs and timeline.

Year	Task	Cost
2014	Data collection: meadow ecological seral stage; Parker Three Step Rereads, and Wiexleman Plots; stream, spring and fen PFC; wildlife and heritage surveys on Lights Creek, Lone Rock, Antelope, and Antelope Lake Allotments	$ 90,500
2015	Write NEPA analysis and decision on Lights Creek, Lone Rock, Antelope, Antelope Lake	$120,000
	Install drift fence to tie in with NRCS private land drift fence	$ 20,000
	Data collection: meadow ecological seral stage; Parker Three Step Rereads, and Wiexleman Plots; stream, spring and fen PFC; wildlife and heritage surveys on Clarks Creek and Doyle Allotments	$ 90,500
	Permit Use compliance with <20% bank alteration, <20% riparian shrub use, and <40% meadow use: Lights Creek, Lone Rock, Antelope, Antelope Lake	$ 35,000
	Install Range Restoration/Multiple Use Educational Kiosk	$ 20,000
	Crush 40 acres White Thorn/Buck brush in Lone Rock and seed	$150,000
2016	Write NEPA analysis and decision on Clark's Creek and Doyle Allotment	$120,000
	Replace Clark's Creek eight miles of fence galvanization burned off in fire and wire beginning to rust through	$80,000
	Install Clarks' Creek three off site water developments	$ 15,000
	Data collection: meadow ecological seral stage; Parker Three Step Rereads, and Wiexleman Plots; stream, spring and fen PFC; wildlife and heritage surveys on Bass and Jenkins Allotments	$ 110,000
	Permit Use compliance with <20% bank alteration, <20% riparian shrub use, and <40% meadow use on Lights Creek, Lone Rock, Antelope, Antelope Lake, Clark's Creek and Doyle Allotments	$45,000
	Crush 100 acres White Thorn/Buck brush in Lone Rock and seed	$300,000
2017	Write NEPA analysis and decision on Bass and Jenkins Allotment	$120,000
	Install Jenkins' four off site water developments	$20,000
	Data collection: meadow ecological seral stage; Parker Three Step Rereads, and Wiexleman Plots; stream, spring and fen PFC; wildlife and heritage surveys on Hungry Creek and Taylor Lake Allotments	$110,000

	Permit Use compliance with <20% bank alteration, <20% riparian shrub use, and <40% meadow use: Lights Creek, Lone Rock, Antelope, Antelope Lake, Clark's Creek, Doyle, Bass and Jenkins Allotments	$65,000
2018	Write NEPA analysis and decision on Hungry Creek and Taylor Lake Allotment	$120,000
	Permit Use compliance with <20% bank alteration, <20% riparian shrub use, and <40% meadow use: Lights Creek, Lone Rock, Antelope, Antelope Lake, Clark's Creek, Doyle, Bass, Jenkins, Hungry Creek, and Taylor Allotments	$115,000

Moonlight Fire Restoration Project Proposal (2014)

Annual National Register of Historic Places (NRHP) of Ten Cultural Resource Sites

Project Leader Name: Cristina Weinberg, Mt. Hough Ranger District Archaeologist

Link to Restoration Strategy desired condition and goal:

Objective: This project was listed as a specific objective in the Moonlight Restoration Strategy

Project justification: 368 cultural resource sites are located within the larger Analysis Area. However, however, 153 sites are located within the 2007 Moonlight Fire perimeter. The 2007 Moonlight Fire devastated many acres of natural and cultural resources. Through a combination of documentation, stabilization and evaluation Plumas National Forest archaeologists will be able to glean much valuable scientific data and attempt to preserve the remaining eligible heritage resources that were affected by the fire.

Project description: Ten cultural resource sites will be evaluated for NRHP eligibility annually in accordance with the PA (2013). In addition, cultural resources sites will be interpreted for public education and enjoyment as opportunities emerge as appropriate. Those cultural resource sites that are categorically determined not eligible as outline in the PA (2013) can be released from active cultural resource management. Any interpretation of NRHP eligible cultural resources will be accomplished in partnership with the Mt. Hough Recreation Staff, & local Native American parties and the Plumas County Museum as appropriate.

Monitoring and evaluation: N/A

Estimated cost and timeline: Multi-Year project. National Register of Historic Places evaluation of 10 sites per year at an average of 2,500 per site = $25,000 per year. First year planned for FY 2014.

Moonlight Fire Restoration Project Proposal (2014)

Cold Stream Historic Trail Enhancement

Project Leader Name: Cristina Weinberg, Mt. Hough Ranger District Archaeologist

Link to Restoration Strategy desired condition and goal:

Objective: Enhanced recreation experience for hikers on the Historic Cold Stream Trail. This project was listed as a specific objective in the Moonlight Restoration Strategy

Project justification:

Project description: FS Site #05-11-52-338 (Cold Stream Trail) consists of a Forest Service system trail that was blazed and mapped by the CCC as early as the 1930s. This trail was affected by the 2001 Stream Fire and sections of the trail were heavily brushed in during monitoring for the Antelope Hazard Tree Removal (2007). This trail was brushed and tread work was done on this trail by Sierra Buttes Trail Stewardship. However, trees continue to fall on the trail obstructing access and whitethorn grows annually. Proposal is to install interpretive signage at the beginning and end of the trail. Any interpretation and signing of cultural resources will be accomplished in partnership with the Mt. Hough Recreation Staff & local Native American parties as appropriate.

Monitoring and evaluation: Monitor annually to determine whether signs require replacement.

Estimated cost and timeline: Cost of two signs = $3,000.00. Accomplishment planned in FY 2014. Proposal to maintain trail tread and brush the trail annually (4 people for 5 days = $4,000.00 annually). First year of maintenance in planned for FY 2014.

Moonlight Fire Restoration Project Proposal (2014)

Peters Creek Historic Trail Enhancement

Project Leader Name: Cristina Weinberg, Mt. Hough Ranger District Archaeologist

Link to Restoration Strategy desired condition and goal:

Objective: Enhanced recreation experience for hikers on the Historic Peters Creek Trail. This project was listed as a specific objective in the Moonlight Restoration Strategy

Project justification:

Project description: FS site #05-11-52-341 (Peters Creek Trail) consists of a historic trail 4 miles long linking the Peters Ranch to the south to the Lucky S Mine to the north. Rehabilitation was done for about a mile under a RAC grant in 2008. The section of trail approximately 0.5 miles below NFS Rd. 27N51 and section above NFS Rd. 27N51 leading to the Lucky S Mine is no longer visible. Proposal is to reconstruct approximately 3-3.5 miles of trail (section that has not been reconstructed). Any interpretation and signing of cultural resources will be accomplished in partnership with the Mt. Hough Recreation Staff and local Native American parties as appropriate.

Monitoring and evaluation: Monitor annually to determine whether signs require replacement.

Estimated cost and timeline: 10 days for 4 people - $8,000.00 for trail reconstruction, planned for 2015. Installation of interpretive signs at both ends (southern end and northern end). Cost of two interpretive signs = $3,000.00. Grand total of $11,000.00. Installation planned for 2016.

Moonlight Fire Restoration Project Proposal (2014)

Installation of Interpretive/Information/Protection Signs at 4 Sites

Project Leader Name: Cristina Weinberg, Mt. Hough Ranger District Archaeologist

Link to Restoration Strategy desired condition and goal: This was recommended in both the 2007 BAER Assessment and in 2010 Moonlight Fire Valuation. The goal is to enhance the visitor experience through education and interpretation.

Objective: This project was listed as a specific objective in the Moonlight Restoration Strategy

Project justification:

Project description: Interpretive/Information/Protection signing (4 Sites):
Lucky S Mine Complex (Sites 05-11-52-255 & 05-11-52-318 & 05-11-52-350) and
FS Site #05-11-52-351.

Monitoring and evaluation: Monitor the four sites annually in the fall to determine whether signs were effective in preventing vandalism and looting and whether signs require replacement.

Estimated cost and timeline:

- Lucky S Mine Complex (Sites 05-11-52-255 & 05-11-52-318 & 05-11-52-350): $1887.57 (FY 2014)
- FS Site #05-11-52-351: $629.19. (FY 2015)
- Grand total for signing: $2516.76

Moonlight Fire Restoration Project Proposal (2014)

Moonlight Fire Restoration Conservation Education

Project Leader Name: Michele Jimenez-Holtz (Education Liaison)

Link to Restoration Strategy desired condition and goal: Enhance Moonlight Fire restoration efforts by supporting student participation and promoting critical thinking skills while establishing links to the California State Content Standards and Curriculum. Well-educated students become ambassadors/stewards and educate our local communities. Visitors and our local communities are knowledgeable about fire-adapted ecosystems via interpretive signage, brochures, website, podcasts, and other social media venues.

Goals for community integration into fire restoration:

1. Build upon and expand the successful partnership agreement between the Plumas National Forest and PUSD; utilize the existing model of the PUSD/Storrie Fire Restoration Project.
2. Build on the successful partnership among Greenville High School, Sierra Institute, and the Plumas NF for the monitoring and restoration program in the Moonlight Fire area. Utilize the pilot work on the Moonlight Fire done by the Greenville High School Natural Resource Academy at Greenville High School as a model.
3. Create additional opportunities for PUSD students to participate in restoration activities while supporting the California State Content Standards and Curriculum and advance critical thinking skills.
4. Local communities understand concepts of fire ecology and fire-adapted ecosystems; awareness provides support for fuel treatments, fuels reduction projects, and prescribed burn projects.
5. Opportunities for partnerships with local organizations, tribes, and urban schools are expanded.

Objective:

1. Demonstrate student role in restoration by developing a Moonlight Fire Restoration Project section on the Plumas NF webpage. Ensure project status and successes are updated.
2. Expand restoration by developing a PUSD/Moonlight Strategic Plan for related budget, curriculum support, and learning opportunities for local students.
3. Create employment opportunities with restoration work for local youth utilizing Youth Conservation Corps (YCC) or other model. Youth crew to be comprised of local and urban youth.
4. Further restoration by developing partnerships with urban schools, local organizations, and tribes for student exchange of knowledge/restoration practices and Traditional Ecological Knowledge (TEK).

5. Incorporate student participation in appropriate restoration activities such as monitoring, planting of trees and plants, native plant propagation, and recreation projects.
6. To support Moonlight Fire Restoration efforts, develop an education, outreach, and interpretive plan for the Moonlight Fire and adjacent Antelope Lake Recreation Area.

Project justification: "Funds appropriated and made available until expended to cover the cost to the U.S. of any improvement, protection, or rehabilitation works on lands under the administration of the FS rendered necessary by the action which led to the settlement." Student participation in restoration and rehabilitation projects: this project enhances and improves upon the progress of existing partnership agreements to complete on-the-ground restoration work.

Project description: Planning and pre-implementation. Project funds fire ecology education and student projects to include wildlife and vegetation monitoring, tree planting, native plant propagation, trail improvements, and expansion/operation of Greenville HS greenhouse (native and rare plants for restoration).

Monitoring and evaluation: Determine student and community understanding of fire ecology, fuel treatments/fuels reduction projects, restoration efforts and success of student restoration projects by obtaining a baseline online survey at beginning and end of the school year. Students, teachers, and parents are to be surveyed.

Estimated cost and timeline: FY14 $57,178; $10,000 for GHS greenhouse expansion; $40,000 for Moonlight/PUSD Partnership Agreement (planning and pre-implementation to include initial school fieldtrips into fire area, teacher education and preparation). A multi-year partnership agreement cost is to be determined pending approval of this restoration strategy and appropriate project proposals to involve student participation.

Moonlight Fire Restoration Project Proposal (2014)

Off-Channel Water Sources

Project Leader Name: Ryan Nupen

Link to Restoration Strategy desired condition and goal:

Adjunct to the primary goal of stabilizing and maintaining the identified transportation system needed to support the general Moonlight Fire Restoration effort.

Adjunct to a secondary goal of supporting the specific re-construction or construction of identified wildlife, hydrologic and recreation facilities and structures.

Objective: To insure adequate and appropriate water source primarily for use in the maintenance or re-construction of system roads and trails. A secondary use will be for the construction of identified features such as AOPs and Recreational Facilities. This project consists of the installation of the first of several planned closed, seasonal water storage units. This first one will provide a limited supply of water for mid-term (2-4 years) work.

Project justification: Currently, within the Moonlight Fire Recovery area, there is a scattered collection of in-channel and off-channel water sources in varying conditions of accessibility. In anticipation of restrictions on the continued use of existing in-channel water sources or the use or construction of traditional off-channel ponds due to threatened and/or endangered wildlife issues, we plan to install several off-channel closed water storage units.

Project description: Installation of the first of several closed, off-channel, water sources. We are examining several types and designs. The first is to be an enclosed, partially buried 3,500 gallon tank with controlled inlet and drain and drafting access. As the work is near to, but not within, the stream channel, it is expected that minimal review for a CE will be required.

Monitoring and evaluation: Maintenance requirements will be monitored to evaluate the long-term viability of the design and system.

Estimated cost and timeline: Cost projection is estimated to be $30,000. It is expected this will adequately substitute for a traditional open drafting pond.

The project will be completed in FY 2014 under the condition that minimal review for a CE will be required.

Moonlight Fire Restoration Project Proposal (2014)

Aggregate Material Source Development

Project Leader Name: Jonathan Berry

Link to Restoration Strategy desired condition and goal:

Adjunct to the primary goal of stabilizing and maintaining the identified transportation system needed to support the general Moonlight Fire Restoration effort.

Adjunct to a secondary goal of supporting the specific re-construction or construction of identified wildlife, hydrologic and recreation facilities and structures.

Objective: : To insure adequate and appropriate aggregate material for use in the maintenance or re-construction of system roads and trails, and the construction of identified features such as AOPs and Recreational Facilities. This project will provide material for mid-term (2-6 years) work.

Project justification: Current local non-government sources appear adequate for the near-term needs; however their ability to supply the quantity and quality of material for mid and long-term requirements is not assured. Other sources, both private and government, are located a considerable distance away, thus incurring significant transportation costs. This project (and another to follow) will insure an adequate supplemental supply of aggregate material available as needed during the recovery process.

Project description: Additional development of an existing Forest Service aggregate source within the currently approved development plan. As the work is to remain within the scope of the existing Approved Development Plan, it is expected that minimal review for a CE will be required.

Monitoring and evaluation: Maintenance of records and allocation of material to insure that priority of use is directed to Moonlight Fire Recovery needs.

Estimated cost and timeline: Cost projection is estimated to be $120,000. It is expected this will produce a minimum of 10,000 cubic yards (15,500 tons) of aggregate material.

The project will be completed in FY 2014 under the condition that minimal review for a CE will be required.

Moonlight Fire Restoration Project Proposal (2014)

Cadastral Surveys

Project Leader Name: Forest Engineer

Link to Restoration Strategy desired condition and goal: Adjunct to the primary goal of stabilizing and maintaining the identified transportation system needed to support the general Moonlight Fire Restoration effort. Also to support the specific re-construction or construction of identified wildlife (AOPs) and hydrologic structures.

Objective: To obtain the necessary data and other information required to identify and adequately mark the forest boundaries in areas where preexisting markers and other demarcations are compromised or missing. Work will be done in areas where roads or trails are to be re-located, re-constructed, decommissioned, or whose designated use is to be significantly changed.

Project justification: The Moonlight Fire destroyed many of the Forest Boundary markers. Accurate surveys are needed to ensure that actual boundaries and land ownership are identified before projects are designed or site work commences.

Project description: Contract cadastral (boundary) surveys within the Moonlight Fire area.

Monitoring and evaluation: Monitoring and/or evaluation will be in accordance with contract or agreement provisions.

Estimated cost and timeline: Cost projection is estimated to be $30,000 to $40,000. It is expected this work will continue through FY 2014 as needed.

Moonlight Fire Restoration Project Proposal (2014)

Aquatic Organism Passage, 27N09 at East Branch Lights Creek

Project Leader Name: Ryan Nupen

Link to Restoration Strategy desired condition and goal:

Stabilize and maintain the identified transportation system needed to support the general Moonlight Fire Restoration effort.

To provide viable and sustainable aquatic organism passages as part of the Moonlight Fire Restoration, Wildlife Recovery, strategy and goals.

Objective: : To correct and mitigate for the adverse effects of accelerated run-off and debris collection that has effectively blocked passage of many aquatic organisms past the 27N09 crossing of East Branch Lights Creek

Project justification: This project is within the Moonlight Fire perimeter.The damage to the stream channel at, and adjacent to, the 27N09 crossing has effectively blocked passage of many AOs, particularly fish, due to debris and stream-bed degradation. Construction of a bottomless arch will allow the reestablishment of a more natural stream channel at the crossing. Surveys will be completed in FY13; it is expected that a moderate amount NEPA work will be required in FY14.

Project description: Construct a bottomless arch structure to carry the road over the stream.

Monitoring and Evaluation: Monitoring and evaluation will be accomplished by the hydrology and biology specialists as part of their continued activities within the recovery area.

Estimated cost and timeline: Cost projection is estimated to be $125,000.

The project will be completed in FY 2014 under the condition that surveys and NEPA are completed.

Moonlight Fire Restoration Project Proposal (2014)

Lone Rock Creek Cattle Exclosure (TES, Sierra Nevada Yellow-legged Frog)

Project Leader Name: Tina Hopkins (Fisheries Biologist, PNF)

Link to Restoration Strategy desired condition and goal:

- Identifying potential impacts of grazing on riparian habitats and mitigating negative impacts;
- Determining the distribution and abundance of SNYLFs across the restoration analysis area, in and outside of proposed critical habitat;
- Assessing habitat condition for SNYLF across the restoration analysis area and restoring degraded habitat;

Objectives: Restore riparian and meadow habitat along Lone Rock Creek. Protect Sierra Nevada yellow-legged frog populations from potential adverse impacts of cattle grazing.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire
- Is on lands administered by the Forest Service
- Post fire fuels levels coupled with grazing impacts within this watershed of concern necessitates management to maintain and restore habitat and protect a Sierra Nevada yellow-legged frog population.

Project description: Collect, propagate, and plant native riparian vegetation to provide shade and bank stabilization to trampled banks and construct a temporary cattle exclosure. Exclosure will consist of two sections of electric fence along Lone Rock Creek with known population of Sierra Nevada yellow-legged frogs.

Monitoring and evaluation:

1. Couple ongoing survey efforts within range allotments (proper functioning condition and end of season use surveys) with additional riparian monitoring to evaluate grazing impacts on riparian communities and to develop appropriate management priorities and projects to address any negative impacts from grazing.
2. Conduct surveys to determine the distribution and size of SNYLF populations and assess habitat condition for SNYLF across the restoration analysis area.
3. Monitor SNYLF populations with sufficient frequency to identify significant changes in population size.

Estimated cost and timeline: The project will be implemented in FY14 at an estimated cost $14,000 (personnel time and propagation and fencing materials).

Moonlight Fire Restoration Project Proposal (2014)

Aquatic Organism Passage (AOP) Surveys, Database, Project Prioritization, Report

Project Leader Name: Tina Hopkins (Fisheries Biologist, PNF)

Link to Restoration Strategy desired condition and goal:

- Quantify the level of aquatic habitat connectivity within the restoration analysis area and reducing fragmentation where appropriate (e.g., avoid increasing aquatic organism passage where non-native species may negatively impact native species);
- Identifying sedimentation, channel degradation, and contamination issues resulting from mining activities that occurred across the analysis area and implementing reasonable mitigations;
- Identifying first and second order streams most deficit in LWD and restoring this habitat component when feasible;
- Determining the number and location of improperly maintained forest roads, prioritizing reconstruction or decommission for those roads causing relatively higher resource damage, and coordinating road restoration work with AOP assessment and mitigation measures;

Objective: Collate, standardize and QA/QC existing AOP data in the Natural Resource Manager database, prioritize additional AOP surveys, conduct necessary AOP surveys, and prioritize NEPA and implementation for AOP projects in a report to the District Ranger.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire
- Is on lands administered by the Forest Service
- Corrects and mitigates adverse effects of accelerated run-off and debris collection that has effectively blocked passage of many aquatic organisms.

Project description: Collate, standardize and QA/QC existing AOP data in the Natural Resource Manager database, prioritize additional AOP surveys, conduct necessary AOP surveys, and prioritize NEPA and implementation for AOP projects in a report to the District Ranger.

Monitoring and evaluation:

1. Conduct AOP surveys to assess aquatic habitat connectivity. When barriers to AOP are removed or mitigated, assess aquatic community composition and species abundance above and below barriers before and after restoration activity. Populate and maintain USDA corporate AOP database.
2. Quantify sedimentation, channel degradation, and contamination issues resulting from mining activities before and after restoration activity.

3. Monitor retention of LWD in first and second order streams after restoration activities.

Estimated cost and timeline:

This project will be completed in FY14 at an estimated cost $34,000 (personnel time and vehicles).

Moonlight Fire Restoration Project Proposal (2014)

Aquatic Organism Passage (AOP) NEPA

Project Leader Name: Tina Hopkins (Fisheries Biologist, PNF)

Link to Restoration Strategy desired condition and goal:

- Quantify the level of aquatic habitat connectivity within the restoration analysis area and reducing fragmentation where appropriate (e.g., avoid increasing aquatic organism passage where non-native species may negatively impact native species);
- Identifying sedimentation, channel degradation, and contamination issues resulting from mining activities that occurred across the analysis area and implementing reasonable mitigations;
- Identifying first and second order streams most deficit in LWD and restoring this habitat component when feasible;
- Determining the number and location of improperly maintained forest roads, prioritizing reconstruction or decommission for those roads causing relatively higher resource damage, and coordinating road restoration work with AOP assessment and mitigation measures;

Objective: Complete NEPA process (categorical exclusions) for two AOP projects within the Moonlight Fire footprint. One project, along Moonlight Creek, has already been identified. Ongoing survey efforts in 2013 will prioritize a second project within the fire footprint.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire
- Is on lands administered by the Forest Service
- Corrects and mitigates adverse effects of accelerated run-off and debris collection that has effectively blocked passage of many aquatic organisms.

Project description: The NEPA process (categorical exclusions) for two AOP projects within the Moonlight Fire footprint will be completed. One project, along Moonlight Creek, has already been identified. Ongoing survey efforts in 2013 will prioritize a second project within the fire footprint.

Monitoring and evaluation:

1. Conduct AOP surveys to assess aquatic habitat connectivity. When barriers to AOP are removed or mitigated, assess aquatic community composition and species abundance above and below barriers before and after restoration activity. Populate and maintain USDA corporate AOP database.

2. Quantify sedimentation, channel degradation, and contamination issues resulting from mining activities before and after restoration activity.
3. Monitor retention of LWD in first and second order streams after restoration activities

Estimated cost and timeline: The NEPA process will be completed in FY14 at an estimated cost $19,000 (personnel time and vehicles).

Moonlight Fire Restoration Project Proposal (2014)

Amphibian and Aquatic Invasive Species Surveys

Project Leader Name: Colin Dillingham (Wildlife Biologist, Mt Hough Ranger District)

Link to Restoration Strategy desired condition and goal:

- Identifying potential impacts of grazing on riparian habitats and mitigating negative impacts;
- Determining the distribution and abundance of Sierra Nevada yellow-legged frogs across the restoration analysis area, in and outside of proposed critical habitat;
- Assessing habitat condition for Sierra Nevada yellow-legged frogs across the restoration analysis area and restoring degraded habitat;
- Identifying sedimentation, channel degradation, and contamination issues resulting from mining activities that occurred across the analysis area and implementing reasonable mitigations;
- Identifying first and second order streams most deficit in LWD and restoring this habitat component when feasible;
- Manage aquatic invasive species and pathogens to protect, restore, and sustain aquatic ecosystems, ecological functions and values; protect and improve the biodiversity; improve and protect public recreational opportunities and wilderness integrity; prevent negative impacts to human health and the economy, and protect and restore fish and wildlife populations and habitats. Three sets invasive species activities are desirable within the analysis area: Invasive Species Control (Treatments and Treatment Monitoring), Invasive Species Detection (Surveys, Inventories, and Mapping), Invasive Species Prevention (All Prevention Activities, including outreach and education).

Objective: Survey priority perennial and intermittent streams and waterbodies for Foothill and Sierra Nevada yellow-legged frogs and the Western Pond Turtle following to Regional Protocols, and assess aquatic invasive species (e.g., *Pacifastacus leniusculus*, *Rana catesbeiana*) across the restoration analysis area. These surveys also will directly inform other riparian restoration activities in the Moonlight Fire footprint and is necessary to develop Sierra Nevada yellow-legged frogs centric projects in FY15, and beyond.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire
- Is on lands administered by the Forest Service
- and will determine the distribution and abundance of Sierra Nevada yellow-legged frogs across the restoration analysis area, in and outside of proposed critical habitat for the species

Project description: Survey priority perennial and intermittent streams and waterbodies for Foothill and Sierra Nevada yellow-legged frogs and the Western Pond Turtle following to Regional Protocols, and assess aquatic invasive species (e.g., *Pacifastacus leniusculus*, *Rana catesbeiana*) across the restoration analysis area. These surveys also will directly inform other riparian restoration activities in the Moonlight Fire footprint and is necessary to develop Sierra Nevada yellow-legged frogs centric projects in FY15, and beyond.

Monitoring and evaluation:

1. Assess aquatic invasive species (e.g., Pacifastacus leniusculus, Rana catesbeiana) and disease threats (e.g., whirling disease, caused by a myxozoan parasite, Myxobolus cerebralis) across the restoration analysis area.
2. Coordinate with governmental and non-government organizations to develop and implement aquatic invasive species education and prevention programs.
3. Couple ongoing survey efforts within range allotments (proper functioning condition and end of season use surveys) with additional riparian monitoring to evaluate grazing impacts on riparian communities and to develop appropriate management priorities and projects to address any negative impacts from grazing.
4. Conduct surveys to determine the distribution and size of SNYLF populations and assess habitat condition for SNYLF across the restoration analysis area.
5. Monitor SNYLF populations with sufficient frequency to identify significant changes in population size.
6. Quantify sedimentation, channel degradation, and contamination issues resulting from mining activities before and after restoration activity.
7. Monitor retention of LWD in first and second order streams after restoration activities.
8. Monitor for non-target effects on riparian systems when herbicides are used during restoration activities.
9. Monitor wildlife use of springs and surrounding habitat before and after spring restoration or improvement activities are accomplished.

Estimated cost and timeline: This project will be completed in FY14 at an estimated cost $41,000 (personnel time and vehicles).

Moonlight Fire Restoration Project Proposal (2014)

Lone Rock Creek integrated management planning and surveys (Range, Watershed, Fuels, Wildlife)

Project Leader Name: Matthew Johnson (WFRP program manager, PNF)

Link to Restoration Strategy desired condition and goal:

- Quantify the level of aquatic habitat connectivity within the restoration analysis area and reducing fragmentation where appropriate (e.g., avoid increasing aquatic organism passage where non-native species may negatively impact native species);
- Identifying potential impacts of grazing on riparian habitats and mitigating negative impacts;
- Determining the distribution and abundance of SNYLFs across the restoration analysis area, in and outside of proposed critical habitat;
- Assessing habitat condition for SNYLF across the restoration analysis area and restoring degraded habitat;
- Identifying sedimentation, channel degradation, and contamination issues resulting from mining activities that occurred across the analysis area and implementing reasonable mitigations;
- Identifying first and second order streams most deficit in LWD and restoring this habitat component when feasible;
- Determining the number and location of improperly maintained forest roads, prioritizing reconstruction or decommission for those roads causing relatively higher resource damage, and coordinating road restoration work with AOP assessment and mitigation measures;
- Restoration of more frequent, low intensity fires and a mosaic of open eastside pine and mixed conifer forest types will promote productive understory plant communities; this is an essential component of sustainable range systems. Development of understory forage will help to draw livestock away from riparian areas and disperse use across the landscape. A mosaic of habitats that include forest, shrubland, forest openings, meadows, and riparian areas will create a heterogeneous and diverse landscape that can support livestock and reduce future fire risk (Calvo et al. 2012).
- Implement a landscape-scale system of fuels treatments that function to slow fire spread and reduce fire intensity with an emphasis in the wildland urban interface.
- Fuel treatments should reduce surface and ladder fuels and maintain large fire resilient trees.
- Habitat supports viable populations of native and desired non-native plant, invertebrate, and vertebrate riparian and aquatic-dependent species.

- Species composition and structural diversity of plant and animal communities in riparian areas, wetlands, and meadows provide desired habitat conditions and ecological functions.
- Spatial and temporal connectivity for riparian and aquatic-dependent species within and between watersheds provides physically, chemically and biologically unobstructed movement for their survival, migration and reproduction.
- The connections of floodplains, channels, and water tables distribute flood flows and sustain diverse habitats.
- Soils with favorable infiltration characteristics and diverse vegetative cover absorb and filter precipitation and sustain favorable conditions of stream flows.
- In-stream flows are sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and keep sediment regimes as close as possible to those with which aquatic and riparian biota evolved.
- The physical structure and condition of stream banks and shorelines minimizes erosion and sustains desired habitat diversity.
- The ecological status of meadow vegetation is 50 percent or more of the relative cover of the herbaceous layer with high similarity to the potential natural community. A diversity of age classes of hardwood shrubs is present and regeneration is occurring.
- Meadows are hydrologically functional. Sites of accelerated erosion, such as gullies and headcuts are stabilized or recovering. Vegetation roots occur throughout the available soil profile. Meadows with perennial and intermittent streams have the following characteristics: (1) stream energy from high flows is dissipated, reducing erosion and improving water quality, (2) streams filter sediment and capture bedload, aiding floodplain development, (3) meadow conditions enhance floodwater retention and groundwater recharge, and (4) root masses stabilize stream banks against cutting action.
- Water quality meets the goals of pertinent laws such as the Clean Water Act.
- The connections of floodplains, channels, and water tables distribute flood flows and sustain diverse habitats.
- Sediment regimes are kept as close as possible to those in which aquatic and riparian biota evolved.
- The physical structure and condition of stream banks and shorelines minimizes erosion and sustains desired habitat diversity.

Objective: Conduct necessary analyses and surveys to develop a Lone Rock Creek integrated management plan (Range, Watershed, Fuels, Wildlife). Restoration plan should reduce fuels, improve range and watershed condition, and restore aquatic (Sierra Nevada yellow-legged frog) habitat.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire;
- Is on lands administered by the Forest Service; and
- will prepare an integrated management strategy along Lone Rock Creek (range, watershed, fuels, wildlife), an area managers have expressed concerns over resource condition before, during and after the Moonlight Fire.

Project description: Managers expressed concern for the condition of aquatic habitats in the Moonlight Fire area prior to the fire; and although some areas appear to be recovering quickly (e.g., Moonlight Creek), riparian zones across much of the restoration analysis area (e.g., Lone Rock Creek) have and will continue to merit attention from land managers. Lone Rock Creek was impacted through accelerated erosion and sedimentation post-fire, contains numerous headcuts, and monitoring results indicated less than desirable conditions both before and after the Moonlight Fire.

Monitoring and evaluation:

1. Improve mapping of aspen stands, meadows, stream corridors, and riparian vegetation using remote sensing datasets, such as LiDAR, aerial imagery, and field surveys.
2. Conduct baseline surveys to evaluate the current condition of meadows, fens, and aspen stands within the analysis area; this includes an assessment of grazing effects, hydrologic condition, and the extent of conifer encroachment.
3. Evaluate riparian condition throughout the analysis area, including areas identified as potentially at-risk such as Upper Indian Creek, Boulder Creek, Lone Rock Creek, and parts of Lights Creek.
4. Monitor meadow, fen, aspen, and riparian areas to assess the status and trend of these habitats.
5. Inventory and establish stand exam plots in adjacent early successional forest stands that may provide replacement old forest habitat in the future with applied treatments.
6. Hydrology monitoring will first focus on a highly detailed survey of the transportation network in the analysis area. The Geomorphic Road Analysis and Inventory Package (GRAIP) will be used to predict road sediment production and delivery, mass wasting risk, and road connectivity to water bodies. This product will then be used to prioritize watershed enhancement projects and to evaluate these projects efficacy into the future.
7. Past inventory information on stream and riparian condition will be used to prioritize areas for follow up surveys. These efforts will likely be a joint effort with aquatics and range resources also evaluated.
8. Stream crossing will be evaluated for capacity, risk of failure, and aquatic passage. This will be a joint effort with engineering and aquatics.

9. Improve mapping stream corridors using remote sensing datasets, such as LiDAR, aerial imagery, and field surveys.
10. Conduct quantitative monitoring, using methods such as the Multiple Indicator Monitoring (MIM) protocol, in streams that are at identified to be at risk, contain sensitive or listed species, or have potential conflicts with livestock grazing.
11. All projects will be monitored for best management practices to ensure compliance under the Clean Water Act (R5 FSH 2509.22, Chapter 10, Water Quality Management Handbook, 2011).
12. Conduct AOP surveys to assess aquatic habitat connectivity. When barriers to AOP are removed or mitigated, assess aquatic community composition and species abundance above and below barriers before and after restoration activity. Populate and maintain USDA corporate AOP database.
13. Assess aquatic invasive species (e.g., Pacifastacus leniusculus, Rana catesbeiana) and disease threats (e.g., whirling disease, caused by a myxozoan parasite, Myxobolus cerebralis) across the restoration analysis area.
14. Survey meadows to determine use by willow flycatcher. Evaluate habitat quality and investigate opportunities for restoration.
15. Couple ongoing survey efforts within range allotments (proper functioning condition and end of season use surveys) with additional riparian monitoring to evaluate grazing impacts on riparian communities and to develop appropriate management priorities and projects to address any negative impacts from grazing.
16. Conduct surveys to determine the distribution and size of SNYLF populations and assess habitat condition for SNYLF across the restoration analysis area.
17. Monitor SNYLF populations with sufficient frequency to identify significant changes in population size.
18. Quantify sedimentation, channel degradation, and contamination issues resulting from mining activities before and after restoration activity.
19. Monitor retention of LWD in first and second order streams after restoration activities.

Estimated cost and timeline: Anticipate beginning NEPA process in FY14, after specialists conduct preliminary assessments of the treatment area and analyses in their field of expertise. The team will begin formally developing the restoration strategy at the end of FY14, and complete the NEPA process for the Lone Rock Creek restoration project in FY15. Estimated cost for FY14 is $30,000.00 (personnel time and vehicles).

Moonlight Fire Restoration Project Proposal (2014)

Moonlight Fire Bat Monitoring

Project Leader Name: Colin Dillingham (Wildlife Biologist, Mt Hough Ranger District)

Link to Restoration Strategy desired condition and goal: Restoration efforts should identify resource selection by sensitive bat species and use this information to direct restoration activities within the fire footprints and across the analysis area.

Objective: Monitor habitat occupancy by bats to determine habitat selection throughout the annual cycle to direct restoration activities within the analysis area and promote viable bat communities.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire;
- Is on lands administered by the Forest Service; and
- will determine the distribution and abundance of FS sensitive species within the Moonlight Fire footprint and inform restoration across the restoration analysis area

Project description: Recently acquired remote bat monitoring stations will be deployed throughout the Moonlight Fire restoration analysis area to determine habitat selection throughout the annual cycle and direct restoration activities within the analysis area and promote viable bat communities.

Monitoring and evaluation: Monitor habitat occupancy by bats to determine habitat selection throughout the annual cycle to direct restoration activities within the analysis area and promote viable bat communities.

Estimated cost and timeline: This project will be completed in FY14 at an estimated cost $19,000 (personnel time, vehicles, software).

Moonlight Fire Restoration Project Proposal (2014)

Moonlight Fire California Spotted Owl Monitoring

Project Leader Name: Colin Dillingham (Wildlife Biologist, Mt Hough Ranger District)

Link to Restoration Strategy desired condition and goal:

- Maintain an abundance of late seral forest habitat types to provide for viable wildlife populations.
- Response by spotted owls from fuels management is not well studied. Monitoring of spotted owl PACs is necessary to determine occupancy and productivity both before and after treatments.
- Provide a diversity of vegetation types and habitat to support viable populations of all wildlife species.
- Maintain viability of snag-dependent wildlife.
- Maintain viability of species dependent upon dead and down material.
- Maintain burned forest habitat as an ecological component of the forest.
- Remaining burned forest habitat is accessible to California spotted owls

Objective: Monitor California spotted owls nesting activity near burned forest habitat. Estimate spotted owl use of burned forest habitats (e.g., telemetry) in and out of the Moonlight Fire footprint to better inform post fire restoration activities within the fire footprint and across the analysis area.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire;
- Is on lands administered by the Forest Service; and
- will determine the distribution, abundance, and resource selection by California spotted owls across the restoration analysis area.

Project description: Collaborative study with USDA Pacific Southwest Research Station to monitor California spotted owls nesting activity near burned forest habitat. Estimate spotted owl use of burned forest habitats (e.g., telemetry) in and out of the Moonlight Fire footprint to better inform post fire restoration activities within the fire footprint and across the analysis area.

Monitoring and evaluation:

1. Late Seral Forests - Survey for California spotted owl occupancy in existing territories. Determine if proposed spotted owl PAC treatments negatively impact owls or habitat

suitability; Survey for northern goshawk occupancy in existing territories. Determine if proposed goshawk PAC treatments negatively impact owls or habitat suitability.

2. Monitor California spotted owl use of burned forests to retain key remnant burned forest patches within the analysis area. Monitoring directed at improving our understanding of owl use of burned forest habitat would benefit from sampling owl behavior in recently burned patches on the forest (i.e., Chips Fire landscape) as well as within the Moonlight and Antelope Complex fire footprints to better inform post fire restoration activities.
3. Shrublands and Early and Mid Seral Forests – Conduct avian and mammalian surveys prior to and post restoration to quantify impacts of activities (e.g., thinning, mastication, and prescribed fire) on avian and mammalian communities.

Estimated cost and timeline: This project will be initiated in FY14 at an estimated cost $60,000 (personnel time, vehicles, telemetry equipment). We anticipate requesting two additional years field support (FY15, FY16) and one year for analyses and report preparation (FY17) for this project.

Moonlight Fire Restoration Project Proposal (2014)

Moonlight Fire Black-backed Woodpecker Monitoring

Project Leader Name: Matthew Johnson (WFRP program manager, PNF)

Link to Restoration Strategy desired condition and goal:

- Provide a diversity of vegetation types and habitat to support viable populations of all wildlife species (LRMP 4-29).
- Maintain viability of snag-dependent wildlife (LRMP 4-30).
- Maintain viability of species dependent upon dead and down material (LRMP 4-31).
- Maintain burned forest habitat as an ecological component of the forest.
- Retain patches of burned forest adjacent to intact green forest.
- Manage a substantial portion of burned forest habitat as large patches (minimum of 50 acres, preferably larger) of high severity burned forest habitat. Consider that post-fire habitats are still being used by a diverse and abundant wildlife community.
- Delineate burned forest habitat patched in locations with relatively higher densities of larger diameter trees. Retain burned forest patches in areas where pre-fire snags are abundant as these are the trees most readily used by avian species during the first five years post fire. Retain snags in salvaged areas in the largest and densest clumps possible, exceeding green forest standards. Retain smaller snags in heavily salvaged areas as well, as a full size range of snags are necessary to accommodate the suite of species utilizing these resources.
- Snag retention immediately following a fire should aim to achieve a range of snag conditions from heavily decayed to recently dead in order to ensure a longer lasting source of snags for wildlife.
- When reducing snags in areas more than five years post fire, snag retention should favor large pine and Douglas-fir but decayed snags of all species with broken tops should be retained in burned areas when feasible.
- Retain snags (especially large pines) in areas being re-vegetated as these may be the only source of snags in those forest patches for decades to come.

Objective: Monitor Black-backed woodpeckers (collaborative study with Institute for Bird Populations) to evaluate restoration opportunities and activities. This project will identify areas to avoid modifying burned forest habitat (i.e., removing black-backed woodpecker habitat (i.e., species is using the area), as well as areas not utilized by woodpeckers prior to implementing ground disturbing activities. Further, this project will begin to identify habitat occupancy dynamics, where and when birds leave and remain in specific habitats. Estimate woodpecker use of burned forest habitats in and out of the Moonlight Fire footprint may be conducted to

better inform post fire restoration activities within the fire footprint and across the analysis area.

Project justification: This project meets all criteria set forth by 16 USC 579c because it:

- Improves and protects lands affected by the Moonlight Fire;
- Is on lands administered by the Forest Service; and
- will determine the distribution, abundance, and resource selection by black-backed woodpecker within the restoration analysis area. This project also will examine woodpecker resource selection within varying aged burned forest habitat (in and out of the moonlight fire footprint) to inform restoration activities on the occupancy dynamics of Black-backed woodpecker in the Moonlight Fire footprint (i.e., what habitats are used by woodpecker for the longest periods post fire).

Project description: Collaborative study with Institute for Bird Populations (IBP) to evaluate restoration activities. IBP is a USDA FS partner and conducts black-backed woodpecker MIS monitoring at the regional level. This project also will identify areas to avoid modifying burned forest habitat (i.e., removing black-backed woodpecker habitat (i.e., species is using the area), and areas not utilized by woodpeckers prior to implementing ground disturbing activities. Further, this project will begin to identify habitat occupancy dynamics, where and when birds leave and remain in specific habitats. Estimate woodpecker use of burned forest habitats in and out of the Moonlight Fire footprint may be conducted to better inform post fire restoration activities within the fire footprint and across the analysis area.

Monitoring and evaluation:

1. Burned Forests – Survey for black-backed woodpeckers in burned forest habitats and plan restoration activities to maximize woodpecker productivity.
2. Evaluate factors, temporal and spatial, are influencing black-backed woodpecker occupancy dynamics in post fire landscapes, how do we manage and restore burned forest habitats in the short- and long-term, for burned forest specialists (e.g., black-backed woodpeckers)?

Estimated cost and timeline: This project will be initiated in FY14 at an estimated cost $40,000 (2-person field crew, analyses and management recommendations). We anticipate requesting additional support (FY15, FY16) for this project (additional field work) and one year for analyses and report preparation (FY17).

Moonlight Fire Restoration Project Proposal (2014)

Non-motorized Trail Restoration and Hazard Tree Removal

Project Leader Name: Erika Brenzovich (Public Service Staff Officer)

Link to Restoration Strategy desired condition and goal: Desired conditions for non-motorized and motorized trails would be that trails are open and maintained to design and maintenance standards identified in Forest Service Handbook 2309.18 Section 23.12. Hazard trees along trails would not pose a safety risk to trail users and trail workers, and other vegetation would be maintained to safely accommodate hikers, bicycles, and equestrians. Trail tread would exhibit proper width, drainage, stabilization, and slope.

Objectives:

- Begin restoring burned trail segments within the fire area through removing hazard trees, brushing, and removing and trimming vegetation along the trails to safely accommodate hikers, equestrians, and bicyclists.
- Begin manual removal of brush from roots to keep trails open and maintained. Monitor whether manual removal of root wads is an effective means to maintain brush and keep trail open. Target accomplishment would be ¼ mile of root wad removal within the Moonlight Fire perimeter.
- Survey and reconnaissance for future repair and replacement of fire damaged structures to support the trail system such as bridges, turnpikes and culverts.
- Survey and reconnaissance for future trail maintenance on burned trails within the Moonlight Fire perimeter.

Project justification: The Moonlight Fire burned approximately eight miles of non-motorized trails, making them currently inaccessible to mountain bikers and equestrians due to down trees. These trails could be restored with Moonlight Restoration funds to allow access for mountain bikers and equestrians. Additionally, the safety of visitors and trail workers is at risk due to hazard trees along trails.

Project description: Hazard tree removal would be implemented on 8 miles of burned trails within the fire area through either force account crews or a tree contractor. Restoration implementation is proposed on approximately 1-3 miles of trails within the fire area for trail restoration and tread stabilization. A combination of survey and assessment is also being proposed to assess future maintenance and restoration needs on trails within the fire area. Work would include restoring burned trail segments within the fire area through hazard tree removal, brushing and removing and trimming vegetation along the trails. Trails include Cold Stream, Middle Creek, and Antelope Target accomplishments for FY 14 would be approximately 1-3 miles of burned trails within the fire area.

FY 14 work would also include beginning manual removal of brush from roots to keep trails open and maintained. Target accomplishment would be ¼ mile of root wad removal within the Moonlight Fire perimeter.

Engineering surveys and district staff reconnaissance would be needed to assess needs for future repair and replacement of fire damaged structures to support the trail system such as bridges, turnpikes and culverts. The Hungry Creek Bridge was damaged in the Moonlight Fire and is in need of replacement. Engineering surveys and reconnaissance would also occur to assess needs for future trail maintenance on burned trails within the Moonlight Fire perimeter.

Monitoring and evaluation: Monitor whether manual removal of root wads is an effective means to maintain brush and keep trails open. Monitor effectiveness of trail restoration and tread stabilization.

Estimated cost and timeline: Hazard tree removal would occur in FY 14, trail maintenance and restoration would occur over a five year period from FY 14-FY 18. Mon

Estimated cost for FY 14: $95,487

- Hazard Tree Removal Contract: $75000
- Engineering salaries for trail survey: $4119
- Brush/root wad removal, trail restoration, and trail monitoring: $12,368
- Vehicles: $3000
- Trail maintenance supplies: $1000

Appendix C – Moonlight Fire Potential Research Questions

The Moonlight Fire landscape has already proven to be an important resource for scientific research (see the list of recent studies below). In turn, forest managers continue to rely on science to inform ecological restoration and management activities. For studies to be most effective to the Moonlight Fire restoration effort, researchers must work closely with Forest Service managers to foster communication and collaboration, ensure relevance and applicability, and incorporate findings into project design and implementation. Proposed research must be directly linked to the desired conditions, goals, and objectives described in this strategy. Studies should focus on identifying or improving management actions; they should also lead directly to the design and implementation of on-the-ground restoration projects.

The most applicable research studies will be those that are driven by the needs of forest managers. In recognition of this, the Moonlight Fire restoration team has developed the following preliminary list of potential research questions to help guide potential research and monitoring activities.

Vegetation

- Are the treatments described by North et al. (2009) in PSW-GTR-220, such as clustering thinning treatments, effective at increasing plant diversity and shrub cover in forest understories?
- What are the differences in effectiveness between cluster planting and natural revegetation in a post-fire environment? Treatments considered should include:
    - Site prep and planting
    - Site prep for natural regeneration
    - Planting without site prep
    - Natural regeneration without site prep
- How is the spread rate of annosus (*Heterobasidion* root disease) affected by post-fire salvage where no fungicide (i.e. Sporax®) is applied?
- What is the post-fire vegetation response in low to moderately low fire severity areas in terms of:
    - Growth rates
    - Understory regeneration
    - Species composition
    - Fuels
- How can historical reference conditions better quantify landscape heterogeneity and resilience as described by North et al. (2009) in terms of vegetation patch size, canopy

conditions, slope position, aspect? Does the conceptual framework in North et al. (2009) hold true?

  - What were the canopy conditions and seral stage distributions under more active fire regimes?
  - How has the landscape changed in terms of heterogeneity and patch size, and how can management be designed to emphasize heterogeneity over time?
  - What was the historic range of patch sizes for chaparral and other vegetation types across the landscape encompassing the Moonlight Fire?
  - In low to moderately low fire severity areas, does the stand more closely resemble the desired condition, including structural heterogeneity, and at what scale(s)?
  - How might historical reference conditions and concepts of heterogeneity be implemented in post-fire restoration strategies to build resilience particualry under a changing climate and future fire regimes?

- As described in the SNFPA ROD (USDA 2004, page 53): "...spatially determine distributions of existing and potential natural hardwood ecosystems (Forest Service Handbook (FSH) 2090.11). Map and/or model hardwood ecosystems at a landscape scale (approximately 30,000 to 50,000 acres). Include the following steps in the analysis: (1) compare distributions of potential natural hardwood ecosystems with existing hardwood ecosystems; (2) identify locations where existing hardwood ecosystems are outside the natural range of variability for potential natural hardwood ecosystem distribution; and (3) identify hardwood restoration and enhancement projects."
- Were the resource mitigation and protection measures integrated into the design features of the fire salvage effective and truly necessary?

Fire and Fuels

- What is the post-fire fuel pulse (broken into various size/hour class ranges) with potential fire modeling results in:
  - Natural recovery areas
  - Salvaged areas
- Is lop and scatter an effective fuels treatment method? Lop and scatter of small diameter ladder fuels is a common fuels and timber stand improvement technique in many western forests and evidence of past treatments can also be found here on the Plumas NF. Currently these treatments appear largely unfamiliar to this Forest and potentially unfamiliar to Region 5. However, lop and scatter offers several advantages including significantly lower project costs and quicker implementation timeframes. Ideally followed up with shoulder season broadcast or jackpot burning these treatments can get at the heart of crown fire susceptibility by removing ladder fuels and razing the height to live crown.

Unique Botanical Resources

- What is the genetic structure of the remaining Baker cypress populations? How closely related are the Mud Lake and Wheeler Peak populations?

Wildlife

- Post fire restoration activities require more detailed knowledge of the spatial and temporal variation in California Spotted Owl use of burned forests. Although California Spotted Owls require late-seral forest habitat, owls do exploit resources on post-fire landscapes. Recent studies have reported California Spotted Owls may select forest patches that burned at high severity for foraging over adjacent green forest habitat (Bond et al. 2009), and that high severity fire may burn over 30% of suitable habitat in a spotted owl breeding site without reducing the probability of site occupancy (Lee et al. 2012). Future research directed at improving our understanding of owl use of burned forest habitat would benefit from sampling owl behavior in recently burned patches on the forest (i.e., Chips Fire landscape) as well as within the Moonlight and Antelope Complex fire footprints to better inform post fire restoration activities.
- Can we manage post fire landscapes to promote biotic and abiotic seed dispersal, and thereby facilitate natural re-vegetation of burned habitats? Restoration activities within the Moonlight and Antelope Complex fires would benefit from a greater understanding of factors limiting seed dispersal into burned forest patches. For example: What is the relative contribution of small mammal and avian communities to natural regeneration within post fire landscapes (i.e., seed dispersal and predation)? Does relative abundance of specific seed dispersing species significantly impact natural post fire re-vegetation? If we effectively manage post fire landscapes to promote seed disperser populations, will natural regeneration increase in response? Can we manage green forest patches within or adjacent to burned forest to increase wind dispersal distance from source trees?
- What effect are aquatic invasive species having on native communities?
- What is the size of and factors limiting populations of Sierra Nevada yellow-legged frogs in the analysis area?
- What species of bats occur within the analysis area, what habitats are they utilizing throughout the annual cycle, and how may restoration activities be directed to best promote native bat populations.
- Can we vary grazing regimes on allotments to improve terrestrial and aquatic wildlife habitat and promote viable wildlife populations.
- What effect does increasing aquatic connectivity have on populations of native and introduced species?

Hydrology and Soils

- Roads and motorized trails have long been shown to be a factor in degraded forested watersheds throughout the western United States.

- What is the current state of the road system in the Moonlight Analysis Area? Which roads are quantifiably degrading water quality and aquatic conditions?
- How does the current observed impacts from roads relate to the fire?
- How do the relative impacts of roads to water quality and aquatic conditions differ when comparing different geologic areas in the Moonlight Analysis Area?
- How effective are our treatments of known problem roads?

- What is the risk of re-burn of wildfires to soil conditions? How does time since last fire and severity factor in?

Recent published studies of the Moonlight Fire area:

Bond, M. L., D. E. Lee, R. B. Siegel, J. P Ward, Jr. 2009. Habitat use and selection by California Spotted Owls in a post-fire landscape. Journal of Wildlife Management 73:1116-1124. http://onlinelibrary.wiley.com/doi/10.2193/2008-248/abstract

Bonnicksen, T.M. 2008. Greenhouse gas emissions from four California wildfires: opportunities to prevent and reverse environmental and climate impacts. FCEM Report 2. The Forest Foundation, Auburn, California. 19 p. https://www.biomassthermal.org/resource/documents/60_GreenhouseGasFourFires.pdf

Cochrane, M.A., C.J. Moran, M.C. Wimberly, A.D. Baer, M.A. Finney, K. L. Beckendorf, J. Eidenshink, and Z. Zhu. 2012. Estimation of wildfire size and risk changes due to fuels treatments. International Journal of Wildland Fire 21: 357-367. http://www.fs.fed.us/rm/pubs_other/rmrs_2012_cochrane_m001.pdf

Lee, D. E., M. L. Bond, R. B. Siegel. 2012. Dynamics of breeding-season site occupancy of the California Spotted Owl in burned forests. Condor 114:792-802. http://www.bioone.org/doi/pdf/10.1525/cond.2012.110147

North, M., B. Collins, S. Stephens. 2012. Using fire to increase the scale, benefits, and future maintenance of fuels treatments. Journal of Forestry 110 (7): 392-401. http://www.cnr.berkeley.edu/stephens-lab/Publications/Using%20fire%20to%20increase%20pace%20and%20scale%20North%20Collins%20Stephens%20JF.pdf

North, M., P. Stine, W. Zielinski, K. O'Hara, S. Stephens. 2010. Harnessing Fire for Wildlife. The Wildlife Professional. Spring 2010. The Wildlife Society. http://www.plantsciences.ucdavis.edu/affiliates/north/Outreach/Harnessing%20Fire%20for%20Wildlife%20by%20North%20et%20al.pdf

North, M.P. and M.D. Hurteau. 2011. High-severity wildfire effects on carbon stocks and emissions in fuels treated and untreated forest. Forest Ecology and Management 261: 1115-1120. http://www.fs.fed.us/psw/publications/north/psw_2011_north002.pdf

Seavy, N.E., R.D. Burnett, and P.J. Taille. 2012. Black-Backed Woodpecker Nest-Tree Preference in Burned Forests of the Sierra Nevada, California. Wildlife Society Bulletin 9999:1 -7. http://onlinelibrary.wiley.com/doi/10.1002/wsb.210/full