

UTILIZING NATURAL INFRASTRUCTURE APPROACHES TO IMPROVE CLIMATE AND DROUGHT RESILIENCE IN FORESTED WATERSHEDS

The Infrastructure and Investment in American Jobs Act (IIJA) includes significant investments in the health of our nation's forested watersheds across the country, with \$3.4 billion available for wildfire mitigation and \$2.1 billion available for ecosystem restoration. Our organizations are eager to partner with the U.S. Forest Service (USFS) and other partners to utilize this once-in-a-generation funding opportunity to strategically invest in a suite of climate resilience strategies and natural infrastructure/nature-based approaches[1] that can mitigate the impacts of drought and wildfire on forested watersheds while providing multiple benefits such as restoring degraded fish and wildlife habitat, sequestering carbon, and improving drinking water quality for millions of people.



Soap Creek, Colorado | Photo: Jackie Corday

CONNECTING THE DOTS: HEALTHY FORESTS AND WATERSHEDS IMPROVE CLIMATE RESILIENCY

Forest health is an important driver of overall watershed health and climate resilience in the Western United States.

Forests are home to our natural water infrastructure - the source watershed streams, wetlands, and meadows that capture the annual snowmelt and storm events and provide critical drinking water for communities across the West. In the Western United States, 65% of the drinking water supply comes from forests.[2] Forests and their natural water infrastructure also serve as natural reservoirs; enhancing drought resilience through soil moisture storage and groundwater recharge helps sustain river base flows in the summer when crops, boaters, and fish need water. Well-managed forests and their supporting natural water infrastructure provide numerous additional public benefits, including preventing soil erosion, improving water quality, lowering water treatment costs, capturing carbon, and benefiting wildlife habitat and fisheries.[3]

[1] Natural infrastructure (NI) is "the strategic use of networks of natural lands and waterways, working landscapes, and other open spaces to conserve ecosystem values and functions and provide associated benefits to human populations. World Resources Institute Nature-based solutions (NBS) are "actions to protect and sustainably manage and restore natural or modified ecosystems to provide human wellbeing and ecological benefits." NBS usually includes restoration, conservation, and innovative solutions that lead to the sustainable management of source watershed floodplains, wetlands and wet meadows. International Union of Conservation of Nature

[2] Water, Climate Change and Forests. Pacific Northwest Research Station, US Forest Service. June 2010.

[3] Ten Strategies for Climate Resilience in the Colorado River Basin. Martin and McCoy, et. al. 2021, page 22.



Mill Creek in need of restoration, Colorado | Photo: Jackie Corday

The current drought facing much of the West is exacerbated by climate change and points to a future of increasing challenges to forest and watershed resilience and uncertain water supplies. Rising temperatures contribute to significant declines in river flows and water availability, which contribute to drier soils and landscapes. The size, frequency, and severity of wildfires has also increased due to warmer temperatures and drought, placing our water supplies and infrastructure at risk. And in western states, thousands of high elevation forest streams, wetlands, and meadow complexes have been impaired due to historical land uses such as mining, elimination of beaver, historic logging and agricultural practices including intensive grazing of livestock.

Nature-based solutions which protect, restore, or mimic natural water infrastructure, including strategies like wet meadow and wetland restoration and floodplain reconnection, contribute to more resilient forests and rangelands.

Nature-based solutions can provide many natural hazard risk-reduction services, often referred to as natural defenses, to reduce risks to lives, property, and communities overall. Protected and restored wetlands and riverscapes in forested headwaters – when restored using process-based restoration[4], including low tech process-based restoration (LTPBR)[5] - can provide important natural defenses and other public benefits such as improved water quality, peak flow attenuation, aquifer recharge, and flood control[6], help sequester carbon,[7] mitigate the impacts of wildfire[7] and protect essential drinking water sources and essential water infrastructure such as reservoirs. Restoration projects that restore fundamental ecological processes are the most durable and provide the greatest value and diversity of benefits.[9]

Process-based restoration reestablishes the conditions for natural processes to occur and maintain them over the long term. Many of these strategies, particularly LTPBR treatments are simple, structural additions to riverscapes that mimic natural processes to recover the ecological functions of riparian and wetland ecosystems. Treatments such as beaver mimicry structures or beaver restoration are being found to provide important fire breaks and, in some instances, help ecosystems rebound more quickly post-wildfire.[10] Examples from the Cameron Peak Fire in Colorado and other locations in Idaho and California have shown that beaver-dammed areas may experience a less intense fire or create fire refugia for wildlife. Emerging science also indicates that intact or restored forested riverscapes also function as filters for ash and other fire-produced pollutants that enter waterways, maintaining water quality for wildlife and people, and reducing post-fire sedimentation impacts on built infrastructure.[11] Healthy stream corridors provide higher survivorship of post-fire mature trees, providing valuable seed sources for recovery.

[4] An approach to restore a dynamic state as characterized by spatial and temporal variations in biotic abundance and composition that reflects those in [undisturbed] reference systems, and channel geometry that changes in response to natural flow variability. The Science and Practice of River Restoration, Wohl et. al, 2015.

[5] An approach to restoring natural stream functions with “an explicit focus on promoting geomorphic and fluvial processes, a conscious effort to use cost-effective, low-tech treatments (e.g., hand-built, natural materials, non-engineered, short-term design life spans) because of the need to efficiently scale-up application. Low-Tech Process-Based Restoration of Riverscapes Design Manual, Wheaton et al. Utah State University 2019.

[6] https://www.nature.org/content/dam/tnc/nature/en/documents/Beyond_The_Source_Full_Report_FinalV4.pdf

[7] Montane Meadows: A Soil Carbon Sink or Source? Ecosystems Nov. 2020

[8] Smokey the Beaver: Beaver dammed riparian corridors stay green during wildfire throughout the western United States. Fairfax and Whittle, 2020.

[9] Standards for Ecologically Successful River Restoration. Palmer et. al, 2005.

[10] Smokey the Beaver: Beaver dammed riparian corridors stay green during wildfire throughout the western United States. Fairfax and Whittle, 2020.

[11] Beaver Dams Help Wildfire-Ravaged Ecosystems Recover Long after Flames Subside. Isobel Whitcomb. February 2022.

Process-based restoration projects have yet to be implemented on a large scale. With IJA funding, scaling up these multi-benefit projects across watersheds on USFS land becomes much more feasible. It can improve wildfire resilience and long-term water security in the face of increasing hydrologic variability. These findings have led some practitioners to encourage the U.S. Forest Service and other land management agencies to consider nature-based solutions to achieve some fire mitigation goals at a lower cost than human-engineered solutions. Overall, process-based restoration approaches, combined with ecological forest management strategies such as targeted thinning and prescribed fire, can be an effective, holistic strategy to reduce the severity of future wildfires and help minimize associated post-fire risks to wildlife and communities.



Beaver Creek, Colorado | Photo: Jackie Corday

EXAMPLES OF NATURE-BASED SOLUTION PROJECTS ON FOREST LANDS

Across western forest lands, there are already examples of places where nature-based solutions like beaver mimicry structures have been introduced to improve watershed-and landscape-scale resilience to drought, flood, and wildfire in the face of climate change, development pressure, and increasing demands on natural resources in western watersheds.

*Trail Creek Restoration Project, Gunnison Ranger District
Grand Mesa, Uncompahgre and Gunnison (GMUG) National Forest, Colorado*

The Trail Creek Restoration Project, underway in the Gunnison Ranger District of the Grand Mesa, Uncompahgre and Gunnison (GMUG) National Forest is perhaps one of the country's largest scaled LTPBR efforts taking place on National Forest Lands. Trail Creek is one of many streams in the Colorado River headwaters that were a broad valley-wide wetland complex, naturally maintained by beavers prior to human disturbance. After near-extirpation of the species, two centuries of land use impacts and suppression of beaver populations, most of the natural stream-wetland corridors in these areas have become incised, simplified, and dried up. The project aims to address these concerns through the installation of LTPBR treatments such as beaver mimicry structures and other woody material structures that help restore natural riverscape processes. This is a collaborative project, consisting of staff from the USFS, National Forest Foundation, High Country Conservation Advocates, EcoMetrics, Western Colorado University, Trout Unlimited, Arable Earth LLC, and Range Works LLC, among other state and local partners. By restoring these natural ecosystems, the project team aims to improve watershed- and landscape-scale resilience to drought, flood, and wildfire in the face of climate change, development pressure, and increasing demands on natural resources in the Gunnison River headwaters.

*Wet Meadow Restoration, Gunnison Climate Working Group
Grand Mesa, Uncompahgre and Gunnison (GMUG) National Forest, Colorado*

Since 2012, the Gunnison Climate Working Group has led wet meadow restoration[12], another form of process-based restoration, in Colorado's Gunnison Basin. This collaborative group, including USFS staff, has been working to enhance ecosystem resilience of riparian areas and wet meadows by restoring their hydrologic and ecological function. They use a variety of restoration techniques – mostly hand constructed with rocks – and include grade control structures like one rock dams, flow dispersal structures and headcut control structure. These techniques help slow down water during flow events, raise water tables, reduce erosion, stabilize head cuts, reduce impacts of wildlife and cattle trailing, reconnect channels to floodplains, and increase cover of wetland plants. Between 2012-2016, the team restored approximately 140 acres with over 1,000 structures along 21 stream miles in eight watersheds, enhancing over 1,000 acres of Gunnison sage-grouse brood-rearing habitat.



Deer Creek, Indian Valley Meadow, California | Photo: Luke Hunt

*Wet Meadow Restoration, Sierra Meadows Partnership
USFS Region 5 - Sierra Nevada Mountains*

In California, a diverse collaborative including USFS Region 5 representation, known as the Sierra Meadows Partnership[13], is working to increase the pace, scale, and efficacy of meadow restoration in the Sierra Nevada to achieve landscape level watershed benefits and climate resilience. The Partnership was formed in 2016 with the goal of restoring 30,000 acres of mountain meadow by 2030. In 2020, the Partnership completed 7 projects totaling approximately 300 acres and reported another approximately 5,000 acres in progress of being restored. Meadow restoration can include LTPBR techniques like beaver mimicry or other means to re-establish the natural processes that maintain the meadow, like using fill to address incision and reconnect the channel with the floodplain. Wet meadows provide a suite of benefits that enhance climate resiliency including groundwater recharge, attenuated peak flows and enhanced baseflows, improved water quality, improved critical habitat and climate refugia for special status species. In addition, restoring saturated conditions increases a meadows ability to function as a fire break.

[12] Gunnison Basin Wet Meadow and Riparian Restoration and Resilience-Building Project. Available: https://cnhp.colostate.edu/wp-content/uploads/download/documents/misc/2017.06.08_ExecSummary_GunnisonWetMeadows-sm%20Final.pdf

[13] Sierra Meadows Partnership. Available: <https://www.sierrameadows.org/>

UTILIZING NEW FUNDING TO IMPROVE RESILIENCY OF FORESTS AND WATERSHEDS

As the USFS prepares to allocate funding provided through the IIJA, we encourage the USFS to prioritize the distribution of these funds in ways that support a holistic approach to enhancing the overall climate resilience of forested watersheds to natural hazards such as drought and wildfire. Several programs, agreements, and contracts were authorized and received funding under IIJA that can be utilized to support both forest and watershed health and support the implementation of nature-based solutions projects such as process-based restoration. Sections 40803 and 40804 of the IIJA offer several opportunities to further natural infrastructure approaches in forested watersheds.

- \$400 million to the Department of the Interior (DOI) to award grants to States and Tribes for implementing voluntary ecosystem restoration projects on private and public lands, in consultation with USFS;
- \$100 million to USFS for projects under the Collaborative Forest Landscape Restoration Program, which has previously supported funding for LTPBR practices in the John Day watershed of the Malheur National Forest; [14]
- \$200 million for post-fire restoration activities that are implemented not later than three years after the date that wildland fire is contained (\$100M USFS; \$100M DOI);
- \$300 million for entering into contracts, including stewardship contracts or agreements, the purpose of which shall be to restore ecological health on not fewer than 10,000 acres of forest lands (\$150M for USFS; \$50M DOI for contracting);
- \$200 million to support forest restoration through good neighbor authorities (\$160M USFS; \$40M DOI);
- \$80 million to the USFS to establish a collaborative-based, landscape-scale restoration program to restore water quality or fish habitat on Federal lands, including Tribal forest land and rangelands; and
- \$180 million for the Joint Chiefs Landscape Restoration Partnership Program, which has also been utilized to implement large-scale wetland and riparian restoration efforts.[15]

Additionally, the IIJA includes funding to support wildfire research through the Southwest Ecological Restoration Institute and Joint Fire Science Program, thus presenting an opportunity to further conduct research and monitor the wildfire benefits of nature-based solutions such as process-based restoration.



Beaver Creek, Colorado | Photo: Jackie Corday

[14] Using Beaver Dam Analogues for Fish and Wildlife Recovery on Public and Private Rangelands in Eastern Oregon

[15] Lambert Ecological Restoration

INFRASTRUCTURE INVESTMENT AND JOBS ACT FUNDING OPPORTUNITIES

Overall, the IIJA, combined with other available federal and state funding opportunities through the American Rescue Plan Act (ARPA), presents an immediate opportunity for the USFS to invest in natural infrastructure approaches such as process-based restoration and LTPBR on a larger scale in priority watersheds. Our organizations, with these opportunities in mind, encourage the USFS to consider the following in allocating IIJA funding:

Prioritize Natural Water Infrastructure in IIJA Programming

Our organizations recognize that wildfires will continue to pose a significant risk to communities, property, and water supplies in the western United States. As the USFS moves forward with implementing its 10-year strategy to confront the wildfire crisis, we encourage the USFS to consider deploying stream and wetland restoration techniques as a possible fire mitigation strategy along with ecological forest management tools such as prescribed fire. Our organizations believe that collectively, this suite of strategies could effectively improve the resilience of forested watersheds while providing other important co-benefits. To accomplish this, we encourage the USFS to set aside a portion of IIJA funds available for wildfire risk reduction and ecosystem restoration to further demonstrate the opportunities of utilizing process-based restoration to reduce natural hazard risks to forested landscapes and watersheds. Opportunities such as the \$80 million available for the USFS to support collaborative-based, landscape-scale watershed restoration and \$400 million to DOI (with input from the USFS) for cross-boundary ecosystem restoration should prioritize nature-based solutions and process-based restoration treatments where appropriate. Finally, we encourage the USFS to set aside a portion of the Joint Fire Science Program funding to collect data from process-based restoration projects on their effectiveness in preventing and mitigating wildfire impacts.

Utilize the Watershed Condition Framework

The USFS released the first national Watershed Condition Framework (WCF) in 2011. The WCF establishes a comprehensive approach for proactively implementing integrated restoration on priority national forests and grasslands. The USFS has developed Watershed Restoration Action Plans (WRAPS) for each priority watershed, which can serve as building blocks to streamline permitting and secure funding. Our organizations encourage the USFS to utilize the WCF and existing WRAPS as a starting point for prioritizing IIJA investments in watersheds with either impaired function or functioning at risk. We also support prioritizing the use of the process-based restoration to invest in firesheds identified in the 10-year wildfire planning effort.

Utilize Strategic Partnerships

While the USFS and other federal land management agencies are taking steps to increase on-the-ground capacity through IIJA, our organizations recognize that the agency's capacity to plan and implement large-scale action is severely limited. These capacity limitations and planning and funding hurdles associated with implementing process across National Forests can often impede the potential to achieve expansive, watershed-scale restoration. To address these capacity concerns, our organizations encourage the USFS to work collaboratively with both existing partners such as the National Forest Foundation and new partners to strategically identify, plan, and develop larger-scale watershed restoration opportunities. Further, our organizations can assist by offering LTPBR training and demonstration opportunities for agency staff, assisting with identifying and developing project opportunities, and ensuring adequate matching resources are available to leverage federal funds.

Planning for On-the-ground Projects

Many of the USFS Programs emphasize on-the-ground results, making it easier to fund implementation, but more challenging to fund planning. It is critical to prioritize internal funds to also include planning for future projects on USFS land. These funds would help to identify additional projects and leverage implementation-focused funds from other sources like state funding as well as foundations and corporate sources.

Consider Community-Ready Opportunities

Several community-supported projects incorporating nature-based solutions are actively seeking funding for implementation. Collectively, these projects have broad community support active partnerships and have largely obtained all relevant approvals and permits (e.g., NEPA, 404, etc.). Some of these projects include:

- Gunnison National Forest, Colorado: The Trail Creek Restoration Project, mentioned above, recently completed its initial phase of LTPBR treatments, which improved conditions over an estimated 10-12 riverscape acres. Funding for the initial phase was primarily obtained through the National Forest Foundation and state funds. Project partners are actively seeking funding for phase two, which will treat an additional 2.7 miles of riverscape corridor. An additional eleven phases are pending. Overall, the partners estimate that the long-term funding needs are about \$5.1 million.
- Rio Grande National Forest, Colorado: Phase two of the Upper Saguache Creek Restoration will build on the success of phase one projects in the Upper Saguache Creek watershed, partners are working to restore floodplain connectivity and enhance wet meadow and riparian habitats in the Rio Grande National Forest by implementing process-based restoration, including post-assisted log structures. This project is a partnership between the US Forest Service and the Colorado Rio Grande Restoration Foundation and phase one will result in the restoration of 10 stream miles and 400 acres of riparian and wetland habitat through low-tech stream restoration methods and riparian revegetation. Planning for phase two of this project is underway with a hopeful timeframe for 2023-2025 and has an estimated cost of \$100,000. Restoration efforts will benefit watershed health, riparian corridors, and native aquatic species such as the Rio Grande cutthroat trout.
- Sierra Meadows Partnership Regional Meadow Restoration: In California, the Sierra Meadows Partnership has identified a suite of 16 meadow restoration projects across nine Sierra national forests encompassing over 1,650 acres that are ready for implementation in the next two years and need funding. The estimated cost of implementation for these projects is \$14.9 million.

Questions? Contact us:

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