

# Forest Habitats

## 10. Forest Conservation and Restoration

### DEFINITION

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Forests are essential ecosystems that provide critical services to people and nature (WWF 2020). Temperate forests are the primary forest type within the United States, with boreal and tropical forests covering less area (National Geographic Society 2022). In the United States, forests cover 765 million acres, and woodlands cover 58 million acres (Perry et al. 2022). Forests provide food, fuel, oxygen, clean water, erosion control, and health benefits to people. Forests also enhance biodiversity, provide habitat, facilitate carbon sequestration, and can deliver protection from flooding and other impacts from climate change. For these reasons and others, forest conservation and restoration are crucial (WWF 2020). *Forest restoration* is the process of returning a forest to its healthy state; this can include a variety of actions such as prescribed burns, reforestation, controlling invasive species, and pruning competing underbrush (American Forests 2023). *Forest conservation* as a management practice is the maintenance of forested areas for both people and the environment. Both conservation and restoration are essential to forest management (Pawar and Rothkar, 2015).

### TECHNICAL APPROACH

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Forest conservation and restoration approaches vary based on the goals of the particular manager or management agency. Goals typically include both ecosystem and socioeconomic outcomes (Stanturf et al. 2017). When considering forest conservation and restoration, it is crucial to evaluate the trade-offs of timber production and ecosystem values (University of Cambridge 2022). Some primary forest conservation and restoration methods are as follows:

- **Fuels management:** Fuels management is a priority for many forests as a method to mitigate the harmful effects of wildfires, invasive species, and other disturbances. Within forests, fuels management often consists of **prescribed burning** and **mechanical thinning** (USFS 2021).
- **Reforestation:** Reforestation is one of the main practices for forest restoration. There are three main reforestation methods: natural regeneration, assisted natural regeneration, and planting (USFS 2022).
  - **Natural regeneration:** Natural regeneration allows regrowth to occur naturally. Depending on the project, natural regeneration can provide the most cost-effective reforestation method. It is essential to be aware of the species that will likely grow in these areas to ensure they will meet project goals (Chazdon 2017).
  - **Assisted natural regeneration (ANR):** ANR is a method requiring less labor and funding than planting, but aims to accelerate a forest's natural regeneration process. ANR can be achieved by improving soil, removing competing species, and mitigating disturbances (Ciccarese et al. 2012).

- **Planting:** Some forest restoration projects require systematic planting of native species, with the best results coming from species-diverse planting projects (Ciccarese et al. 2012).
- **Controlling invasive species:** Another crucial management approach to forest restoration is invasive species management, including prevention, early detection and rapid response, long-term control, and monitoring. In long-term, large-scale forest conservation and restoration projects, prioritization is critical to ensure cost-effective management. Native tree species resistant to invasive pests can be planted to aid in stand reestablishment (NPS 2022).

## OPERATIONS AND MAINTENANCE

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Forest management activities often need to be repeated over time to maintain their effectiveness. The restoration activities listed previously, such as fuels management and invasive species control, will likely need to be repeated at regular intervals. Maintenance intervals will differ based on the type of forest and extent of the issue being managed.

## FACTORS INFLUENCING SITE SUITABILITY

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- ✓ **Disturbed sites:** Disturbance events, like wildfires or invasive species outbreaks, often create a need for forest restoration projects, specifically reforestation projects (National Forest Foundation 2023).
- ✓ **Areas conducive to natural regeneration:** Forest restoration projects in the regions that can regenerate naturally can be more cost-effective (Stanturf et al. 2017).
- ✓ **Erosion-prone soils:** Forest restoration can protect these soils and increase soil infiltration (Stanturf et al. 2017).
- ✓ **Riparian areas:** Restoring and conserving forests in riparian areas can help reduce erosion and filter sediment entering waterways. Riparian areas are often corridors for wildlife species (Stanturf et al. 2017).
- ✓ **Areas prone to disturbance:** Restoring and conserving forests prone to disturbance can lessen the severity of these disturbances, such as floods, wildfires, and invasive species invasions (Silva et al. 2023).
- ✓ **Habitat of key species:** Forests are critical biodiversity hubs, and forest conservation and restoration are often centered around specific species of concern (Ciccarese et al. 2012). One of the most prominent examples is the forest conservation and restoration movement supporting the spotted owl (USFS 2021).
- ✗ **Severely degraded sites:** While restoring severely degraded sites is important, it is often not the most cost-effective, so it is essential to consider the level of degradation when reviewing funding sources and the total budget (Silva et al. 2023).

## TOOLS, TRAINING, AND RESOURCES FOR PLANNING AND IMPLEMENTATION

Name and Link	Resource Type	Year	Authors/ Authoring Organization	Geography	Description	Resource Includes			
						Design/Construction Guidance?	Site Selection?	Monitoring Guidance?	Example Projects?
Implementing Forest Landscape Restoration: A Practitioner's Guide	Guidebook	2017	International Union of Forest Research Organizations	Global	This guide provides information for forest practitioners on implementing large-scale forest landscape restoration projects.	✓	✓	✓	✓
Increasing the Pace of Restoration and Job Creation on Our National Forests	Report	2012	US Department of Agriculture Forest Service (USFS)	National	This document details methods the USFS implements to further forest restoration efforts.	✓	✓	—	—
National Forest System Reforestation Strategy: Growing and Nurturing Resilient Forests	Strategy document	2022	USFS	National	This document outlines the national forest strategy for reforestation across the country. Reforestation is one of the most essential approaches for forest restoration, and this guide provides a framework for government agencies managing reforestation projects.	✓	✓	✓	—
Forest Service Open Space Conservation Strategy	Strategy document	2007	USFS	National	This strategy document outlines methods that government agencies can employ to promote open space conservation, including forests.	✓	✓	—	—
Sustaining Oak Forests in Eastern North America: Regeneration and Recruitment, the Pillars of Sustainability	Journal article	2014	USFS	Eastern/Midwestern United States	This article outlines the importance of oak conservation and restoration. Oak species are some of the key targets of conservation and restoration initiatives throughout the eastern United States.	✓	✓	—	—

Name and Link	Resource Type	Year	Authors/ Authoring Organization	Geography	Description	Resource Includes			
						Design/Construction Guidance?	Site Selection?	Monitoring Guidance?	Example Projects?
How Traditional Tribal Perspectives Influence Ecosystem Restoration	Journal article	2022	North Fork Mono Tribe, White Mountain Apache Tribe, USFS	National	This article emphasizes the importance of Indigenous collaboration when approaching conservation and restoration projects.	✓	—	—	✓
Forest Vegetation Simulator (FVS)	Software	Originally released in 1973; latest update in 2023	USFS	National	FVS is a tool commonly used in forestry by land managers. FVS can provide useful insight into how to conduct different forest management projects.	✓	✓	✓	✓

## LIKELY BENEFITS AND OUTCOMES

Primary objectives for each strategy are **highlighted**.

### Climate Threat Reduction

- **Carbon storage and sequestration:** Forests sequester the most carbon of any land use type. As a result of land conversion, forest carbon stocks have been lost over the past centuries, but forest conservation and restoration can protect the carbon stocks and restore some of those that have been lost (Perry et al. 2022).
- **Reduced flooding:** Forests can play a role in flood risk reduction through various processes, including soil infiltration, evaporation, canopy interception, and creating drag on runoff, which delays flood flows (Asseily 2023).
- **Reduced wildfire risk:** Forest restoration can reduce severe fires and mitigate the risk associated with wildfires through fuel treatments and returning to historic forest conditions (Jones et al. 2021).
- **Heat mitigation:** Forests can reduce heat by releasing water vapor into the air and providing shade (Pawar and Rothkar 2015).
- **Improved air quality:** Forest conservation and restoration can lead to improved air quality as a result of the reduction of severe wildfires and by trees absorbing pollution (Perry et al. 2022).

## Social and Economic

- **Jobs:** Globally, more than 1.6 billion people's income depends on forests (Aerts and Honnay, 2011). Forests within the United States are crucial for creating jobs in rural communities (USFS 2012).
- **Mental health and well-being:** Studies show that forests can have therapeutic benefits for people, including reduced stress and positive benefits for mental health disorders (Stier-Jarmer et al. 2021).
- **Cultural values:** People all over the world have a deep connection with forests. Because of extensive intergenerational and traditional knowledge of the land, Indigenous ecological knowledge about forest conservation and restoration is crucial to managing forests (Bullock 2023).
- **Recreational opportunities:** Forests across the country provide ample recreational value. Forest conservation and restoration can create and preserve these lands for human use. The USFS has estimated that the recreational value of the national forests is \$14 billion annually (Avitt 2021).
- **Reduced erosion:** Forest conservation and restoration can protect erosion-prone soils by increasing water infiltration and filtering sediments (Stanturf et al. 2017).
- **Crop and timber yields:** Trees can be a renewable resource when forests are managed sustainably. Timber products are used across the world, and forest conservation and restoration can ensure longevity for timber managers. Forests can also be used for agroforestry, which integrates forest management with crop and livestock production systems (Perry et al. 2022).

## Ecological

- **Enhanced biodiversity:** Forests contain more than 80% of the world's terrestrial biodiversity. It is crucial to restore forests with multiple species native to the region to achieve the best biodiversity benefits (Aerts and Honnay 2011; Ciccarese et al. 2012).
- **Supports wildlife:** Forests provide habitat for birds, mammals, reptiles, amphibians, and fish. Conversion of forest to other land types is typically the most detrimental disturbance for most species living within forests. Forest conservation and restoration provide and protect habitats for these species (Perry et al. 2022).
- **Improved water quality:** Forests are critical for watershed protection. They improve water quality because of their little soil disturbance, resulting in minimal erosion. More than half of the contiguous United States' water supply originates on forested land, occupying only 29% of the total land area (Perry et al. 2022).
- **Invasive and nuisance species management:** One of the primary operations involved with forest conservation and restoration includes invasive species management. One of the main restoration activities for invasive and nuisance species management is planting tolerant trees after removing competing species (NPS 2022).
- **Supports native plants:** Forest conservation and restoration is typically done to restore and protect native plant species (Ciccarese et al. 2012).

## BARRIERS AND SOLUTIONS FOR PRACTITIONERS

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### Common Barriers

Several barriers are common across many of the nature-based solutions strategies; these are described in more detail in [Section 1 of the Roadmap](#). Additional notes about the barriers specific to forest conservation and restoration are included here.

- **Expense:** Lack of funding is the primary obstacle forest restoration practitioners report (Cook-Patton et al. 2020). Forest restoration costs on a landscape-scale level can be in the billions of dollars. While the economic investment is high, forest conservation and restoration should be considered socioeconomic and environmental investments for the future (Wu et al. 2011).
- **Capacity:** Certain methods of forest restoration have high labor requirements, which can be a constraint in implementing these projects (Ciccarese et al. 2012).
- **Public opinion:** Public support is crucial for forest conservation and restoration on public lands. It is important to educate about the importance of the conservation and restoration work (USFS 2012).
- **Conflict with other land uses:** Forest land conversion is one of the primary causes of forest loss. This land is typically converted into development or agriculture. With the growing population, deforestation is estimated to exceed 50 million ac by 2050. Forest land conversion has lasting socioeconomic and ecological effects, and it is important to find integrated ways to sustain the growing population while still prioritizing forest conservation and restoration (Alig et al.)
- **Regulation:** Forest restoration projects can be delayed by regulatory requirements such as fulfilling National Environmental Policy Act (NEPA) and endangered species consultation requirements. However, in some cases, categorical exclusions can exempt a particular project from NEPA requirements (Fretwell and Wood 2021).

### Community

- **Legal and administrative constraints:** Forest restoration is not currently occurring at the desired rate, often because of funding, legal, and organizational constraints and barriers (Jones et al. 2021).

### Ecological

- **Species-poor plantations:** Forest conservation and restoration may create single-species tree plantations, which do not provide the same ecological benefits as species-diverse forests (Aerts and Honnay 2011).

## EXAMPLE PROJECTS

Name and Link	Location	Leading Organizations	Techniques Used	Size, acres	Cost	Duration	Project Description	Climate Threats Targeted	Lessons Learned or Adaptive Management
Post-Fire Watershed Restoration and Monitoring in the Chiricahua Mountains of Arizona	Arizona	<b>US Fish and Wildlife Service, USFS</b>	Use of FVS to model forest management scenarios to aid in writing forest prescriptions.	Not provided	Not provided	Ongoing (began 2014)	This project aims to enhance land managers' ability to use conceptual tools and models for forest planning and identify actionable steps to increase climate resilience.	Severe wildfires, reduce invasive and nuisance species, reduce drought stress	Implementation for longer projects like this often tends to be delayed compared to short-term projects. They also learned that getting out into the field is crucial when planning these types of projects.
Blackfoot-Clark Fork Restoration Project	Montana	<b>Bureau of Land Management (BLM)</b>	Tribal collaboration and partnership, repairing damaged riparian areas	2.64 million (164,000 of BLM land)	\$1.89 million from the Bipartisan Infrastructure Law (BIL) and \$9.54 million from the Inflation Reduction Act (IRA)	Ongoing (began 2023)	This project aims to use BIL and IRA funding to create climate resilience, enhance recreation, restore riparian zones and wetlands, and conduct fuel treatment.	Access to clean water, reduce severe wildfires, increase carbon sequestration	Not provided

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Apache-Sitgreaves National Forest and White Mountain Apache Tribe	Arizona	USFS, White Mountain Apache Tribe	Forest restoration, rehabilitation, fuels reduction	~2 million (total forest area)	\$25,427,000	1 year	This multipart project aimed at restoring forests affected by wildfires and bringing socioeconomic benefits to the area. The funding for this project came from the Forest Service Recovery Act.	Severe wildfires, protect watersheds, enhance biodiversity	One of the main lessons learned from this case study was that outcomes were enhanced when intertwining forest stewardship with community development.

**Bolding** indicates DOI affiliates.



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