FOREST AND WILD-FIRES MANAGEMENT

FW1

AFFORESTATION AND REFORESTATION

NATURE-DEMO

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ADRESSED HAZARDS

PROTECTED CRITICAL INFRASTRUCTURE

Primary functions and key services

- **Storm Protection:** afforestation reduces wind speed, limiting damage from storms, hail, and snow drift. This protects power infrastructure, transport networks, and buildings.
- **Erosion Control:** tree roots stabilise soil, preventing erosion that threatens roads, bridges, pipelines, and reservoirs. Reforestation also reduces sediment in water systems and dams.
- **Landslide & Rockfall Risk Reduction:** trees strengthen slopes and rocky terrain, lowering the risk of landslides, mudflows, and rockfalls affecting roads, railways, and settlements.
- **Flood Mitigation:** forests improve infiltration, reducing runoff, floods, and waterlogging. They protect drainage systems, ports, and coastal infrastructure by slowing water and stabilising shorelines.
- **Debris Flow Regulation:** vegetation traps sediment and stabilises slopes, reducing debris flows that threaten transport and water systems during heavy rain.
- **Desertification Prevention:** forests retain soil moisture and support groundwater recharge, protecting irrigation and water infrastructure in arid regions while reducing dust storms.
- **Wildfire Risk Management:** fire-resistant afforestation can act as natural firebreaks.
- **Microclimate Regulation:** forests buffer extreme temperatures, protecting roads, railways, and buildings from heat and frost damage.

Cost-benefit profile

The cost-effectiveness depends on location and method. It was shown that natural regeneration is often the most cost-efficient. Carbon sequestration costs range from $4–9 per ton for conservation and $16–25 per ton for afforestation, depending on timber co-benefits (Griscom et al. 2017).

Non-consumptive uses of forests, such as recreation and tourism, add further value. Protected forested areas attract an estimated 8 billion visits annually, contributing significantly to rural economies and promoting environmental awareness (FAO, n.d.).

Environmental impacts (EU taxonomy)

- ☑ **Climate change mitigation**
- ☑ **Climate change adaptation**
- ☑ **Sustainable use and protection of water and marine resources**
- ☑ **Transition to a circular economy**
- ☑ **Pollution prevention and control**
- ☑ **Protection and restoration of biodiversity and ecosystems.**

What is it?

Afforestation and reforestation involve the establishment of vegetation in areas that have been degraded or deforested. Afforestation refers to planting trees in land that was not previously forested, while reforestation focuses on re-establishing native plant cover in areas where forests have been lost.

Afforestation and reforestation are critical strategies for enhancing ecosystem resilience, combating climate change, and improving biodiversity. These practices help restore degraded landscapes, increase soil stability, improve water retention, and promote long-term carbon sequestration. By planting native vegetation and restoring forests, these methods contribute to ecosystem restoration, providing habitats for wildlife, stabilising local climates, and reducing the risk of erosion and desertification, all of which are vital for protecting infrastructure against climate-related risks

(Busch et al., 2024; Conant et al, 2017; Griscom et al. 2017)

Selecting species that are adapted to local climate and soil conditions ensure successful afforestation and reforestation.
Image Credit: [Freepik], [n.d.]. Free to use.

Challenges this NbS addresses

- **Flooding –** Tree roots improve water absorption, reducing runoff
- **Soil Erosion –** Prevention: Forest cover stabilises soil and prevents degradation
- **Wind Damage –** Reduction: Tree belts act as windbreaks, protecting land and infrastructure
- **Climate Variability –** Adaptation: Forests stabilise temperatures and water cycles
- **Climate Change –** Mitigation: Trees absorb CO_2, reducing global warming
- **Forest Degradation –** Prevention/Recovery: Reforestation restores degraded forest ecosystems
- **Desertification –** Prevention: Trees retain soil moisture and prevent desertification
- **Biodiversity Loss –** Recovery: Reforestation restores habitats and ecosystems

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Ecosystem services

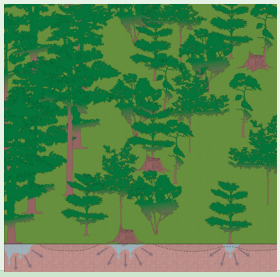
- **Carbon sequestration:** forests and large vegetation absorb high amounts of CO_2, storing it long-term in biomass and soil.
- **Soil conservation:** prevents soil degradation, maintains fertility, and reduces soil erosion through plant roots and vegetation cover.
- **Biodiversity support:** provides shelter, habitats, and ecological corridors for forest-dwelling species, enhancing biodiversity.
- **Hydrological regulation:** improves water infiltration, reduces evaporation, supports groundwater recharge, and mitigates drought risks.
- **Climate regulation:** stabilises local temperatures and wind patterns, creating a more consistent microclimate within forest ecosystems.
- **Soil fertility enhancement:** improves organic matter, nutrient cycling, and supports healthy soil ecosystems.
- **Water retention:** supports water storage in soil, reducing surface runoff and enhancing groundwater recharge.
- **Cultural and aesthetic value:** provides cultural significance, aesthetic benefits, and opportunities for leisure and recreation.
- **Air quality improvement:** enhances air quality by capturing pollutants, increasing oxygen production, and reducing airborne particulate matter.

Main components

Before implementation: site preparation by clearing invasive species, removing debris and choosing resilient species adapted to local climate and soil conditions.

During implementation: soil preparation with organic amendments, contour trenching, and erosion control techniques, combination of mixed vegetation layers and strategic placement for maximum protection (e.g. considering predominant wind directions).

Additional considerations: integration with forest management to enhance overall forest health, adequate monitoring and maintenance, incorporating water harvesting structures and improved water retention to support plant growth and resilience.



Conceptual illustration for afforestation and reforestation management NbS
Image Credit: [Alchemia-Nova Research and Innovation], [2025]

Site suitability, scale and coverage

Afforestation and reforestation are suitable for rural, peri-urban, and mountainous regions, where forest cover can enhance ecosystem resilience. They are most effective in areas prone to soil erosion, flooding, and wind damage, such as watershed contour lines, sediment flow catchments, riparian buffer zones, and wind-exposed landscapes.

- **Flexible implementation:** can be adapted to different terrains, from flatlands to steep slopes, to mitigate specific hazards.
- **Tailored to local conditions:** species selection and planting strategies are adapted to soil type, climate, and hydrology to optimise long-term stability.
- **Scalable approach:** can be applied at various scales, from localised protective tree belts to large-scale forest restoration, ensuring integration with existing land use and infrastructure networks.
- **Land-use compatibility:** can be integrated into existing landscapes with considerations for agriculture, urban expansion, and conservation, ensuring minimal conflicts with other land-uses.
- **Maintenance and monitoring needs:** requires longterm management to prevent issues like invasive species encroachment, tree mortality, and fire risks.

Izta-Popo - – Replenishing Groundwater through Reforestation in Mexico
Image Credit: [Alma Alejandra Tiscareño Vizcarra /Volkswagen de México], [2013]. Used with permission.

Example Installed Case

Izta-Popo – Replenishing Groundwater through Reforestation

Location: Popocatépetl and Iztaccíhuatl, Puebla-Tlaxcala Valley, Mexico

Implemented by: Volkswagen México in partnership with the Comisión Nacional de Áreas Naturales Protegidas

Description and results:

- Reforested 300 hectares with approximately 300,000 native Hartweg's Pines
- Improved groundwater infiltration, replenishing over 1,300,000 cubic meters of water annually
- Reduced runoff and increased water retention, mitigating drought risks
- Enhanced biodiversity and carbon sequestration
  Increased community awareness and stakeholder engagement in NbS

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