FOREST AND WILD-FIRES MANAGEMENT

FIRE-RESISTANT TREE SPECIES AND PLANTS

FW7

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ADDRESSED HAZARDS

PROTECTED CRITICAL INFRASTRUCTURE

Primary functions and key services

Fire-resistant tree species and plants contribute to mitigating various hazards affecting landscapes and critical infrastructure (Colorado and Henking, 2023)

- **Fire spread reduction:** significant reduction of wildfire ignition risk and fire progression by incorporating low-flammability vegetation that resists combustion and reduces fuel availability. Moderate reduction of fire embers' spread by trapping airborne burning debris within denser, fire-resistant vegetation.
- **Soil stabilisation:** moderate mitigation of post-fire erosion and runoff, improving soil stability.
- **Microclimate cooling:** create shaded zones, reducing heat extremes.
- **Water retention:** improve hydrological resilience in dry areas. Prevention of hydrophobic soil formation post-fire by maintaining soil structure and water infiltration capacity through root networks of fire-adaptive vegetation.

Forest fire.
Image Credit: [Adobe Stock, EU, 2023], [n.d.]. Free to use.

Ecosystem services

Beyond infrastructure protection, fire-resistant tree species and plants contribute significantly to ecosystem functions:

- **Carbon sequestration:** capture and store CO_2, mitigating climate change.
- **Biodiversity conservation:** support species adapted to fire-prone landscapes.
- **Water retention and filtration:** help maintain hydrological cycles.
- **Aesthetic and recreational value:** enhance landscapes for tourism and leisure.
- **Soil stabilisation and erosion control:** prevent post-fire land degradation.

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?

Fire-resistant tree species and plants are vegetation types with characteristics that reduce ignition and fire spread. These species have high moisture content, low volatile oil/resin levels, and protective structural traits such as thick bark or self-pruning mechanisms. They serve as natural fire barriers, helping to mitigate wildfire risks while providing additional environmental benefits, such as biodiversity support, carbon sequestration, and soil stabilisation.

Implementing fire-resistant vegetation in fire-prone areas enhances landscape resilience while reducing the reliance on mechanical or chemical firebreaks. They are often used in urban green spaces, agricultural zones, and forestry management to protect critical infrastructure and ecosystems from the adverse effects of wildfires. (Colorado and Henkin, 2023; Hood et al., 2021; Mahamed et al., 2023)

Site suitability, scale and coverage

Fire-resistant vegetation is most effective in fire-prone regions where wildfire containment and ecological resilience are priorities.

- Suitable for **urban, suburban, and rural** landscapes.
- Commonly implemented in **Mediterranean, temperate, and semi-arid** environments.
- Ideal for **buffer zones, roadside vegetation, and wildfire-prone forests**.

Challenges this NbS addresses

Fire-resistant tree species and plants help mitigate multiple hazards by preventing, reducing, or recovering from their impacts:

- **Wildfires risk –** prevention/reduction (low-flammability species limit fire spread and intensity).
- **Soil erosion –** reduction/recovery (deep-rooted plants stabilise soil post-fire).
- **Heat stress –** reduction (vegetation provides shade, reducing local temperatures).
- **Biodiversity loss –** prevention/recovery (supports ecosystem restoration post-fire).

Cost-benefit profile

Implementing fire-resistant vegetation involves initial investment and ongoing maintenance costs, but it provides significant long-term economic benefits. The upfront costs include plant selection, site preparation, and installation, which vary based on vegetation type, labour, and regional conditions. Maintenance expenses include irrigation, pruning, and removing dead vegetation to retain fire-resistant properties, ensuring long-term effectiveness. Despite these costs, fire-resistant landscapes reduce wildfire intensity and spread, lowering property damage risks and fire suppression expenses. Additionally, some insurance providers offer reduced premiums for properties with fire-resistant vegetation, recognising the decreased risk of fire-related losses. Over time, these landscapes provide cost savings while enhancing safety, making them a strategic and financially viable investment for wildfire-prone areas (IUCN, 2016).

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Main components

Vegetation species studied for wildfire prevention and/or conservation are reported in the review of Colorado and Henkin, (2024):

- **Quercus ilex (Holm Oak)** has a thick bark and has slow-burning leaves (Schirone et al., n.d).
- **Cunninghamia lanceolata** and **Schima superba** (leaves were studies, portable burner set at 300°C).
- **Savanna trees (Crossopteryx febrifuga and Piliostigma thonningii)**: all plant was studies, fire exposure up to 620°C.
- **Eucalyptus spp. and Callitris intratropica**: the bark was studied for fire-resistant
- **Pitch pine, balsam fir, eastern hemlock, beech, sugar maple and chestnut oak**: studied for their bark
- **Sabal palmetto** (Cabbage palms): all plant was studied, direct and controlled fire on site, over 300°C.
- **Ajuga reptans**, (USA), Myrica rubra, and Camellia oleifera (China).

Other technical parameters to take into account for its design:

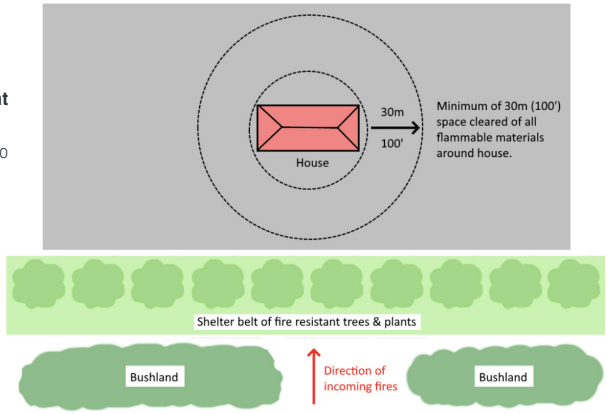
(Hengst & Dawson, 1994; Pinard and Huffman, 1997; VanderWeide et al., 2011; Colorado and Henkin, 2023; Park et al., 2024)

- **Thick bark:** insulates against heat and slows fire penetration.
- **High moisture content:** retains water in leaves and stems, reducing flammability.
- **Low resin and oil content:** minimises combustibility and ignition risk.
- **Fire-tolerant foliage:** leaves that resist drying out and burning quickly.
- **Deep root systems:** enhances moisture absorption and soil stabilisation.
- **Sparse or self-pruning branches:** reduces ladder fuels that can carry fire to the canopy.
- **Broad leaves:** burns slower compared to needle-like or highly resinous leaves.
- **Vegetation and materials for dry conditions:** selection of vegetation and materials that survive to drought while maintaining fire resilience.
- Selection of materials considering their ability to **regenerate quickly after fire.**

Example of installation

- **Post-Wildfire Land Restoration**
- **Location:** Fresno de Rodilla, Burgos, Spain (Eliades, 2020; Land Life Company 2018)
- **Implemented by:** Land Life Company in collaboration with the Fresno de Rodilla City Council.
- **Description and results:** This project focused on restoring over 102 hectares of land devastated by wildfires by planting native, mixed-species forests designed to be more resilient to future fires. The initiative aimed to sequester approximately 22,000 tons of carbon over the first 40 years, enhance biodiversity by creating habitats for local species such as the Iberian wolf and wildcat, and support the local economy through job creation and community engagement (Eliades, 2020; Land Life Company 2018).

Conceptual illustration for Fire resistant trees and plants NbS
Image Credit:
[Alchemia-nova Research and Innovation], [2025]



Firebreak area around house combined with shelter belt of fire-retardant plants and trees
Image Credit: [Angelo Eliades, Deep Green Permaculture], [2020]. Used with permission.

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