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Forest Fires in Portugal: Post-Fire Management Lessons from the Pacific Northwest

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Outlines:

- **Portugal and Forestry:**
    - Location, Geography, Climate
    - Main species, forestry products and ownership
    - Wildfire issue
    - Post-fire management
- **Lessons in PNW Region:**
    - Short-term rehabilitation treatments:
        - BAER Program
    - Long-term restoration
        - Natural Regeneration
        - Salvage Logging
- **Conclusions**

Location, Area, Population

Portugal in EU map.

Portugal map.

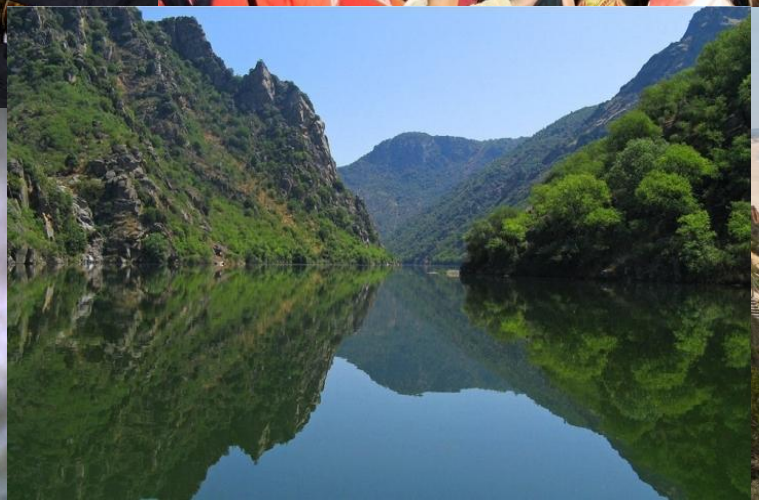
- Westernmost country of Europe bordered by the Atlantic ocean to the west and south and by Spain to the North and East
- The Atlantic archipelagos of the Azores and Madeira are also part of Portugal
- 92,090 Km2 (35,645 sq mi) of total area
- population: 11,317,192 (May 2010 estimate)










LISBON

Geography and climate

- Mainland Portugal is split by its main river, the Tagus. **Northern** Portugal, with its mountains and high plateaus and deep valleys, is very different from the lower, mainly flat areas of the **south**, with few outstanding features.

Northern Portugal landscape.

Southern Portugal landscape.

- Portugal has a **Mediterranean climate** (rainy winter and dry and hot summer)
- Annual average temperature in mainland Portugal 13 C (55.4 F) - 18 C (64.4 F).
- 2500 to 3200 hours of sunshine a year
- Rainfall is uneven, with marked differences between the north and south
- Both the Azores and the Madeira Islands have a **Subtropical climate**, but there are differences between the islands.

South Coast – Algarve.

Laurissilva Forest – Madeira.

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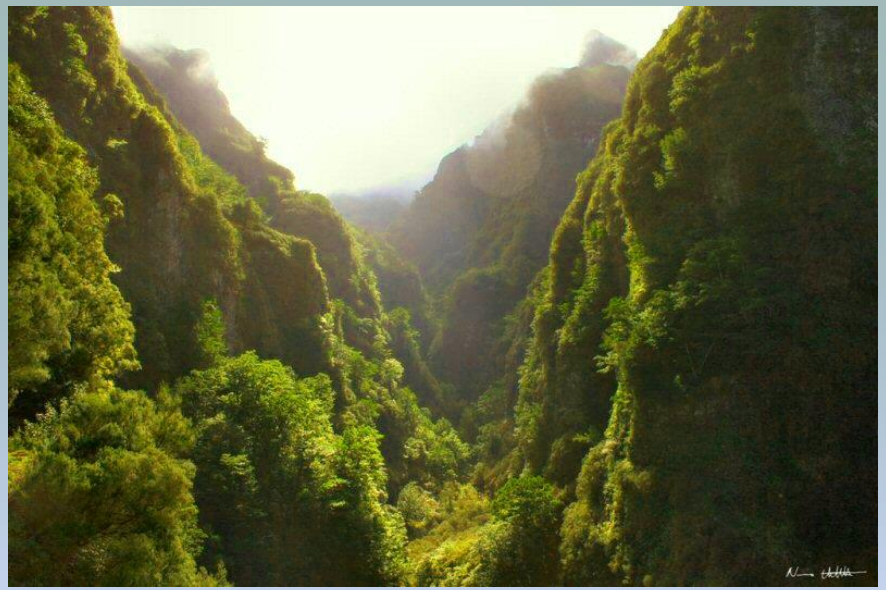
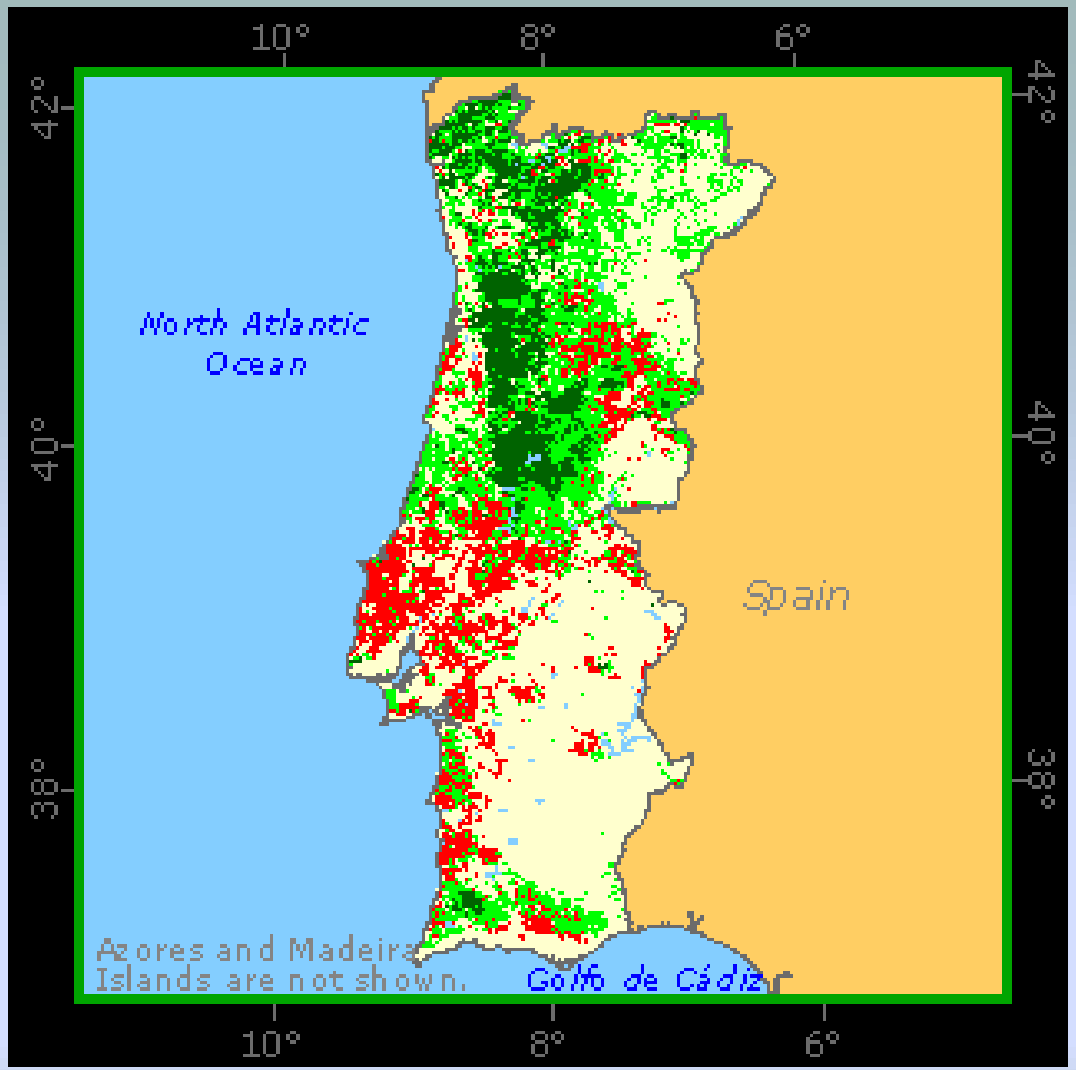


MADEIRA

Forest of Portugal

-The Portuguese forest is a very old ecosystem, beginning with deciduous trees in the North and evergreen trees in the South. Currently, the Portuguese forest area occupies about 3.3 million hectares (8.15 million acres).

- Portugal has the **highest proportion of forest area in Europe (38 %)** – larger than the area dedicated to agriculture (33%).



Legend

- Water
- Closed Forest
- Open/Fragmented Forest
- Other Wooded Lands
- Other land cover

Forest Species Area

Forest Tree Species	Forestry Area (%)	Area (ha)
Maritime Pine (Pinus pinaster)	29,1	976.069
Stone Pine (Umbrella Pine)	2,3	77.650
Other Conifers	0,8	27.258
Holm Oak (*Quercus rotundifolia*)	13,8	461.577
Other Oak Trees (*Quercus*)	3,9	130.899
Chestnut Tree	1,2	40.579
Eucalypt (*Eucaliptus globulus*)	20,1	672.149
Cork Oak (*Quercus suber*)	21,3	712.813
Other Broadleaves	3,0	102.037
Total	100,0	3.349.327

Distribution of Forest Area by species (DGRF, IFN 2001).

- **Maritime pine** (*Pinus pinaster*), **Cork oak** (*Quercus suber*) and **Eucalyptus** (*Eucalyptus spp.*) are the three most representative species, and are also of greatest economic interest.
Together, they occupy nearly **75%** of the forest area.

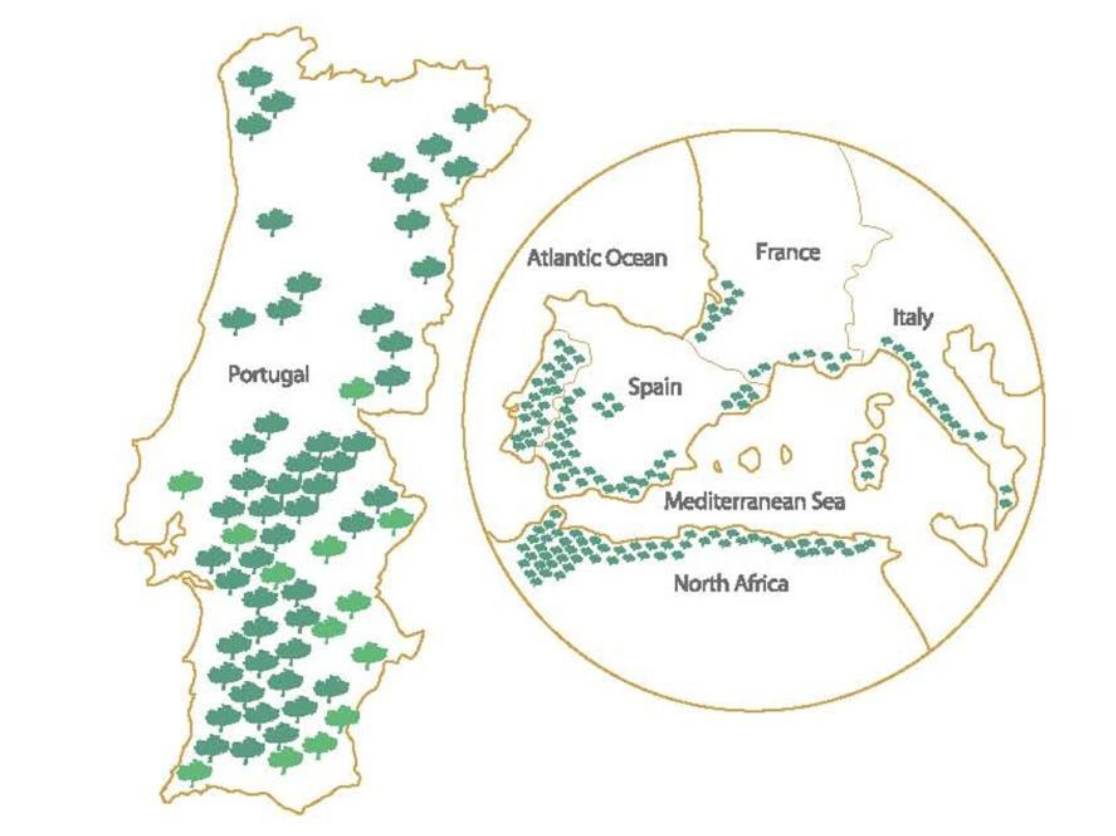
-The **Maritime pine** is the species that occupies the largest area, being the backbone of the sawmill and particleboard industry.

Maritime Pine stand after pruning.

Maritime Pine.

Maritime Pine timber.

- The **Cork oak** *(Quercus suber)* occupies an area that corresponds to about 25% of its natural distribution throughout the world.
- Cork products (it is the primary source of cork for wine bottle stoppers), amounting to about 900 million euros (**1.15 billion $US**), (APCOR, 2003).
- Portugal provides half the world 's production of cork.



Cork Oak in the world (APCOR).

Wine bottle stoppers

Cork Oak (*Quercus suber*) after harvesting of cork (right and top left) and the cork (bottom left).

-The expansion of **Eucalyptus** (mainly the *Eucalyptus globulus*, the Tasmanian Blue Gum tree) is relatively recent in Portugal (19th century) and coincides with the installation and growth of paper industry.

- The pulp industry, relies almost exclusively on Eucalyptus globulus (4.1 million m3) and is targeted for printing and writing paper for export.

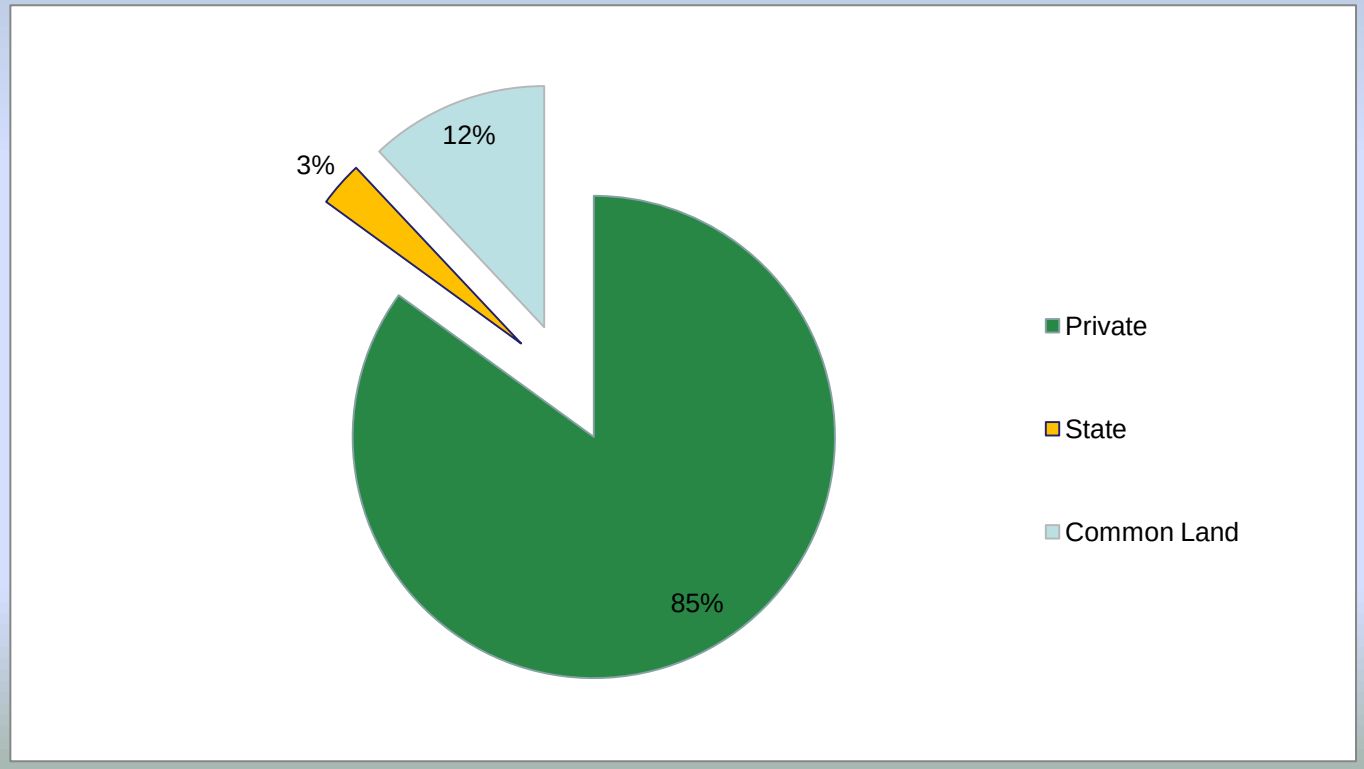
Paper and pulp mills – Portucel Soporcel group.

Forest ownership

-About **85%** of Portuguese forest is on private property, only 3% belong to the state and the remaining 12% are common land.

-Approximately 220,000 hectares (54,632 acres, 7%) of Portuguese forest are under pulp industries administration.

-Other private areas of forest have an average of 5 hectares (12.36 acres) per owner.



Forest ownership in Portugal.

Current issues affecting forests in Portugal

- Excessive **fragmentation of property**
- Portugal is the EU country with **more forest in the hands of private owners**, and most of them face **low profitability**
- This is related to abandonment of forests and traditional agricultural practices
- Result is a **lack of forestry management and increased biomass and combustible material**

- This situation is to a major extent responsible for the scourge of **fires**, which has taken in recent years the proportions of public calamity.

Firefighters in Portugal.

Wildfires in Portugal.

Wildfires in Portugal – a Big issue!

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- Portugal in Europe is the most affected country by the wildfires
- Most serious wildfires within last decade
- Perceived severity and frequency increasing

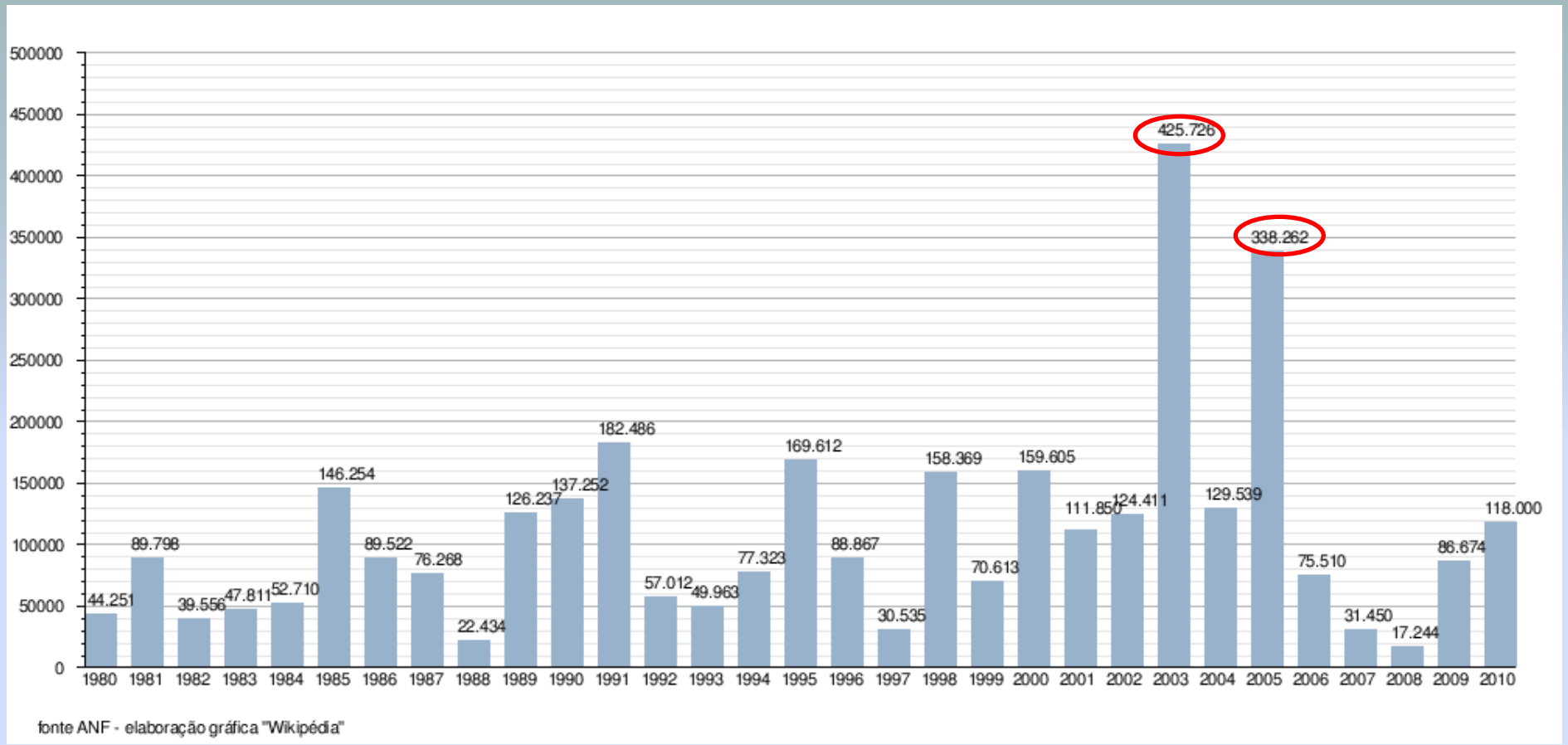
"Portugal burning with thermometers above 40° C (104 F)"

Combating the fire with helicopter.

A Portuguese man trying to stop the fire.

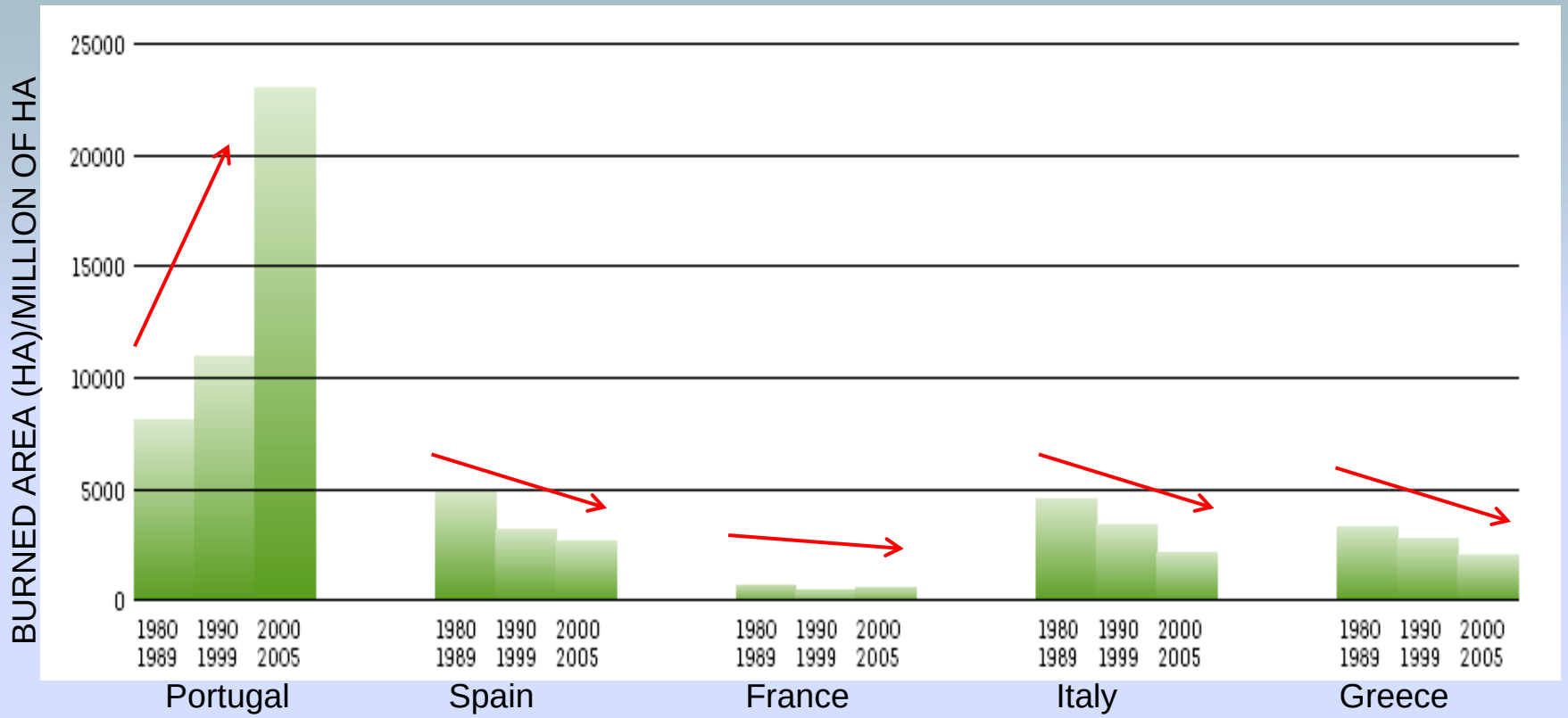
Evolution of annual burned forest area in Portugal (since 1980)

(ha)



Evolution of annual burned forest area in Portugal (since 1980) (AFN).

The burnt area in Portugal has increased considerably in recent decades.
Between 1990 and 2005 burned about 2.3 million hectares (5.68 million acres), representing about 25% of the continental area of Portugal.



Average burned area (hectares per area unit) in last decades in Southern Mediterranean Europe countries.

Wildfires are the most serious natural catastrophe that occur in Portugal

- high frequency and large
- destructive effects

- Economic and environmental damage
- Source of damage for people and property

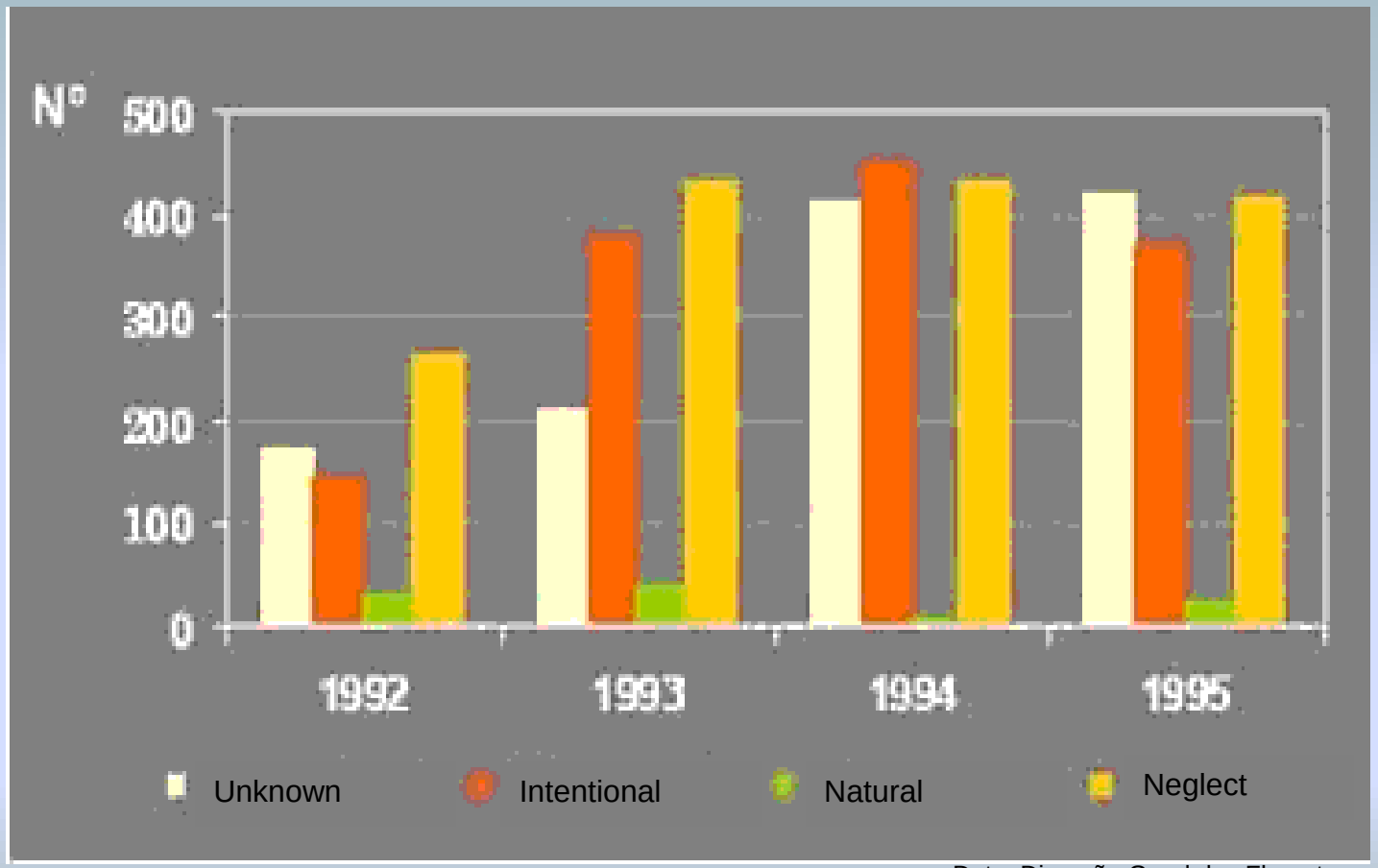
Wildfires are considered Natural catastrophe

NOT because they are caused by natural phenomena

Portuguese firefighters.

Causes

Human origin, either by **neglect and accident** (fire, burning of waste, rockets, cigarettes badly off, power lines), or **intentionally**.
The fires from **natural causes** account for a small percentage of the total number of occurrences.



Data: Direcção Geral das Florestas

Causes of investigated fires.

Damage

- Significant damage in terms of **burnt area** or **destruction of natural species**.
- Emissions of gases and particles released during a fire, may be responsible for some environmental impacts.
- Burnt area more likely to create other hazards, such as landslides and floods – with the destruction of the vegetative surface layer, soils are more vulnerable to erosion and transport phenomena caused by rainwater, thus reducing its **permeability**.

Burnt forest.

In addition to the destruction of forest **wildfires** may be <u>responsible for</u>:

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- Death and injury to people and animal
- Destruction of property
- Cut lines of communication;
- Amendments, sometimes irreversibly, of the natural environment balance;
- Spread of pests and diseases, when the burnt material is not handled properly.

A forest fire in Portugal close to a house.

The face of tragedy – Portuguese woman.

Post-Fire Management in Portugal

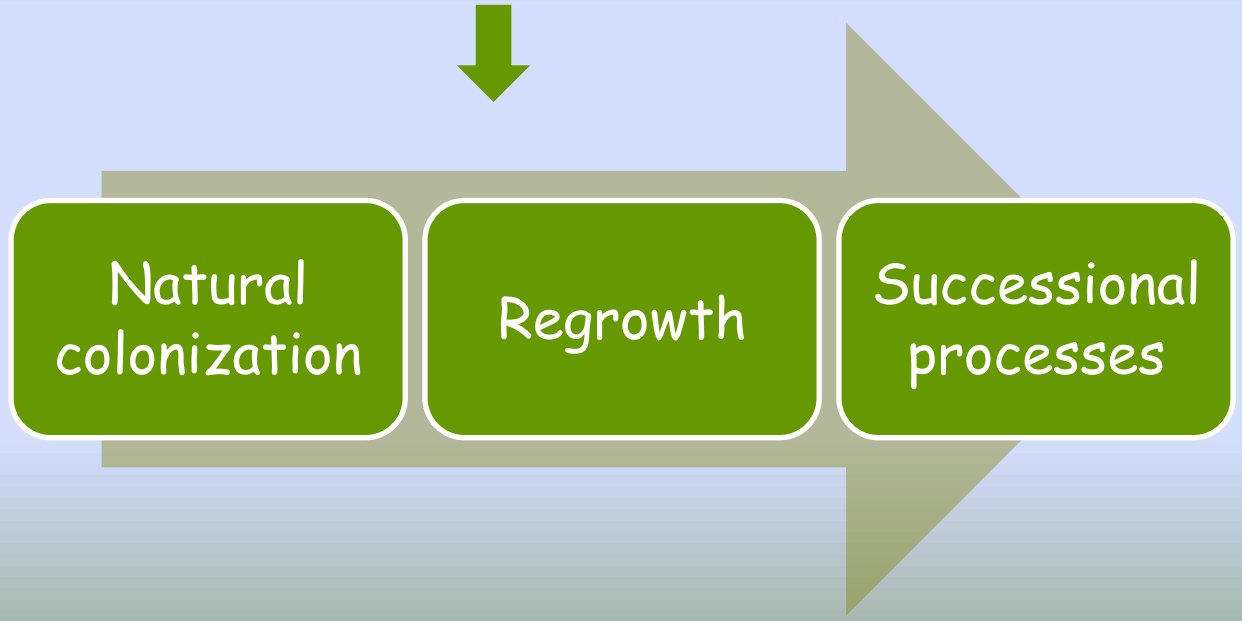
- Policies for the reforestation of burned forests have been common

<u>Active restoration techniques</u>:

Plantation or direct seeding

In contrast,

It's not frequent to take advantage of <u>passive restoration techniques</u>: Protecting areas from further disturbances



- Recent studies in Portugal also support the idea that passive forest restoration techniques, (i.e., natural regeneration) are a valid approach

Pine reforestation in a burned area in Portugal.

Burned forest in Portugal.

- Conflicts between active and passive restoration: If governments subsidize active restoration in areas where natural regeneration is occurring

Current global thinking on management concerns after a fire include:

- Minimizing erosion and its effects on aquatic systems;
- Retaining adequate forest structure for fire-associated wildlife;
- Capturing the economic value of the wood through post-fire timber harvests;
- Minimizing the likelihood of an insect outbreak among fire-stressed trees;
- Reducing the potential for a severe reburn, and
- Ensuring tree regeneration.

Salvage logging Process - McClure, British Columbia (north of Kamloops) (www.ubcbotanicalgarden.org)

Difficulty of making post-fire management choices !

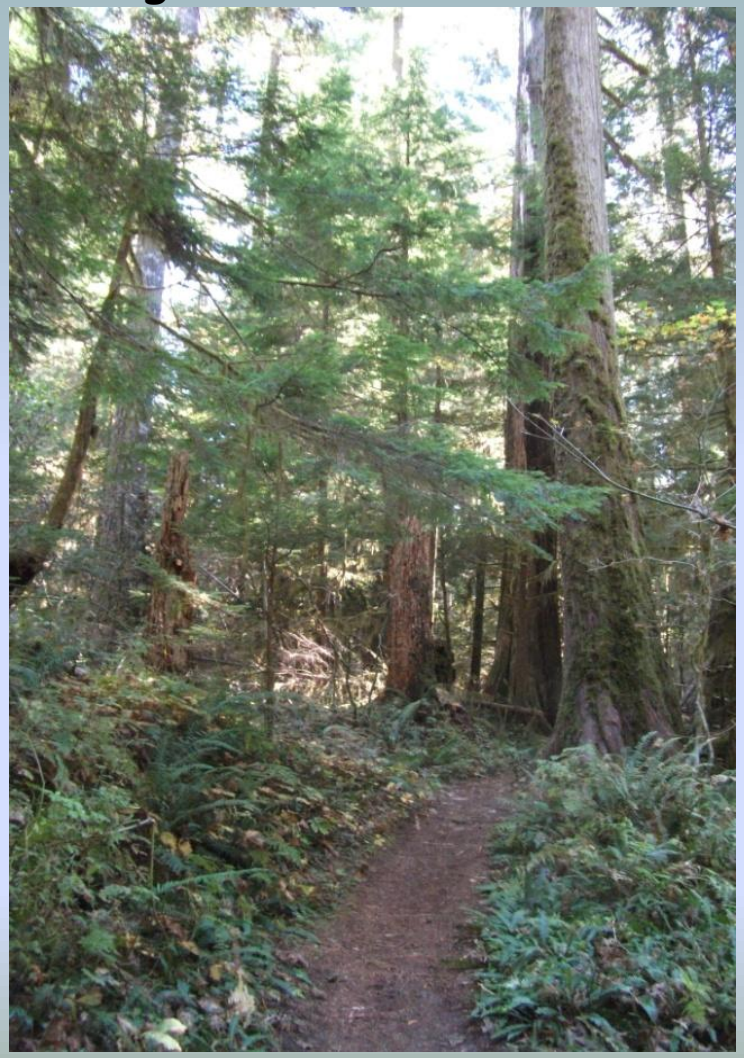
Forest and Rangeland ecosystems at any point in time or place are a **constantly changing product of 4 interacting forces**:

1 – Natural Climate, vegetation succession cycles and natural selection

2 – Large, recurring events, including the arrival and disappearance of species, that create new starting points for ecosystem growth and development

3 – Small to medium-size events that alter trajectories of growth and development

4 – Human actions that transform land cover, land use, local biota, or natural ecological Process



Post-Fire Management Choices in US:

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After a Wildfire

Step back and **let nature proceed** (e.g. Wilderness Preservation Areas)

Do not have a choice!

Invest to shape a future **different from what nature is likely to deliver** (areas under Management Plans and policies)

"null" choice (Nature)

"action" choice (Influence Nature)

Post-Fire Ecosystem Restoration

- Where not to act?

- Where to act?

- What the actions should be?

- The time frame in which acting will be beneficial,

- Finding resources to pay for management actions.

Lodgepole regrowth after 1988 fires, Yellowstone NP.

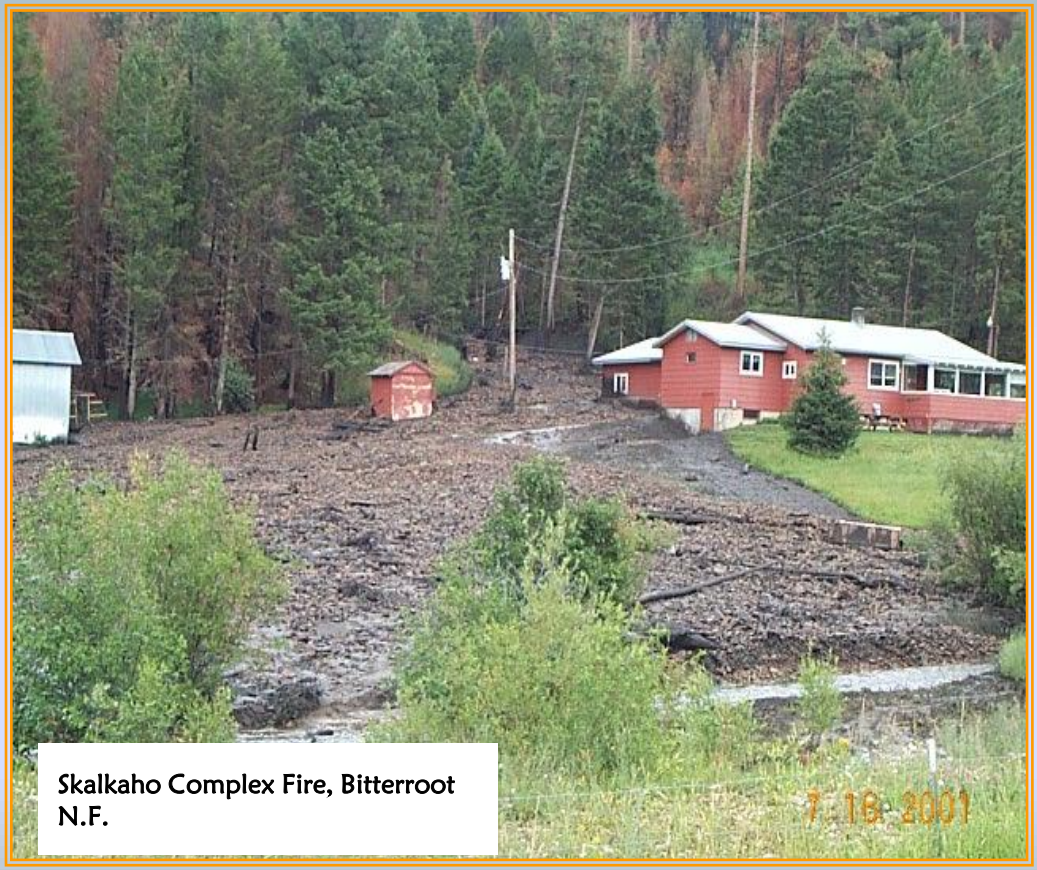
Reforestation of McNally Fire one acre at a time.

National System in US:
Burned Area Emergency Response (BAER) Program

➢EMERGENCY Program to reduce the immediate risk to life, property and natural resources following wildfire.

➢<u>Why is it BAER necessary?</u>

- Minimize threats to human life
- Minimize threats to property
- Stabilize & Prevent unacceptable degradation to natural & Cultural resources



Skalkaho Complex Fire, Bitterroot N.F.

The **BAER** process has 3 phases:

1 - Assessment/Prescription - a rapid evaluation of burned area conditions.

2 - Implementation - installation of treatments to minimize risk to values such as life, property and natural and cultural resources.

3 - Monitoring - follow-up activity to ensure BAER treatments are implemented and effective.

BAER Assessment Team:

- ✓ Hydrologists
- ✓ Soil scientists
- ✓ Foresters
- ✓ Engineers
- ✓ Geologists
- ✓ Biologists (wildlife/aquatic)
- ✓ Botanists
- ✓ Archeologists
- ✓ Geographic Information Specialists (GIS)

Time is of the essence BAER is an EMERGENCY! - The BAER assessment usually begins before the wildfire has been fully contained, and must be completed within seven days after containment.

•Identify "Values at Risk"

•Determine if there is an emergency to life, property, and cultural and natural resources

Prescribe Treatments

<u>Treatment Categories</u>
land, channels, roads & trails, major structures, hazard warnings

<u>Treatment Locations</u>
Treat only the portion of the burned area where emergency hazards exist.

<u>Treatment Priorities</u>
Natural recovery
Administrative closures
Treatment

Present assessment findings to the Forest Supervisor

2 - Implementation

"The BAER **EMERGENCY** is not over until all treatments have been implemented and are functioning effectively!"

✓ An Implementation Team Leader and Team are selected to install treatments prescribed by the assessment team.

✓ Treatments must be installed before the first damaging storms or other events that threaten life, property, or resource values needing protection – Timing is critical!

Ground application of hydromulch.

LEB.

Land Treatments:

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➢Mulch Application

•Mulch is used to provide immediate soil cover to reduce rain impact and soil erosion.
•Mulch may be applied manually or mechanically.

Aerial Hydromulching Cedar Fire, Cleveland N.F.

Helimulching Darby Fire, Stanislaus N.F.

➢ Seed Application

• Increase vegetative cover to reduce soil erosion and runoff, replace native seed bank where it is severely reduced by fire, out-compete invasive species (e.g., cheatgrass)
• Manual (hand seeding) or Mechanical: Aerial (helicopter or fixed wing) Ground (e.g., range drill)
• Seed may be applied with or without mulch
• Priority is to use native seed

➢ Runoff Barrier Installation

- Log erosion barriers (LEBs)
- Fiber rolls
- Contour tilling

LEB.

Fiber rolls.

Contour tilling.

Channel Treatments:

- In-stream Structures
  Small straw or log dams

- Debris Removal
  Clearing vegetative obstructions

Road and Trail Treatments:

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- Repair drainage features along roads and trails
- Patrol roads in winter

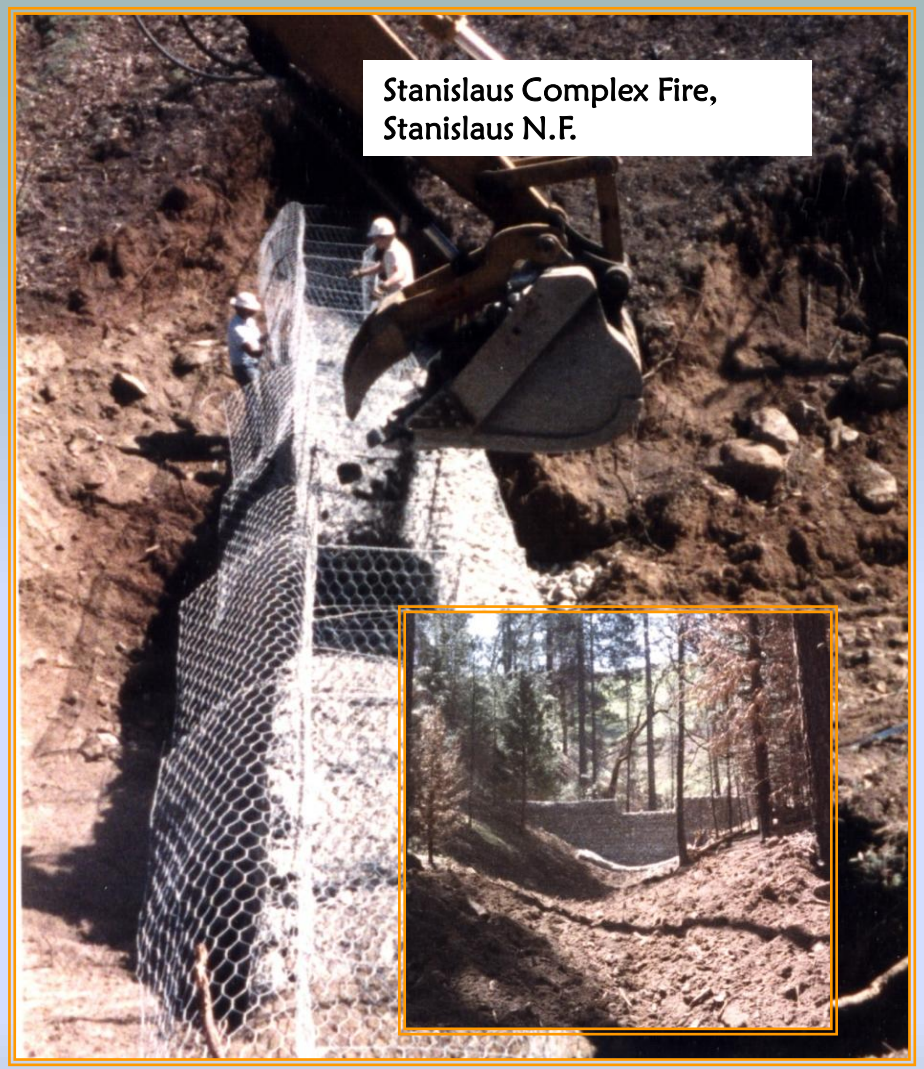
- Public notices – Brief explanations can gain public support of the rationale for road closures. It may reduce the risk of a closure control structure being torn out, which may allow access to an unsafe area.

Major Structures

Debris Basins
Flood Flow Deflectors (deflector walls)

Hazard Warnings

Media announcements
Evacuations



3 - Monitoring

✓ Monitor the implementation and effectiveness of prescribed emergency stabilization treatments.

- Up to three years of monitoring treatment effectiveness may be covered by BAER funds.

- Funds must be requested annually.

Seed germination the first winter

BAER Program is short-term immediate response.

'first aid'

It's important to understand the treatments and techniques of this program. (Implementation and effectiveness)

Positive contribution to use this treatments correctly in Portugal

What about the long-term restoration?

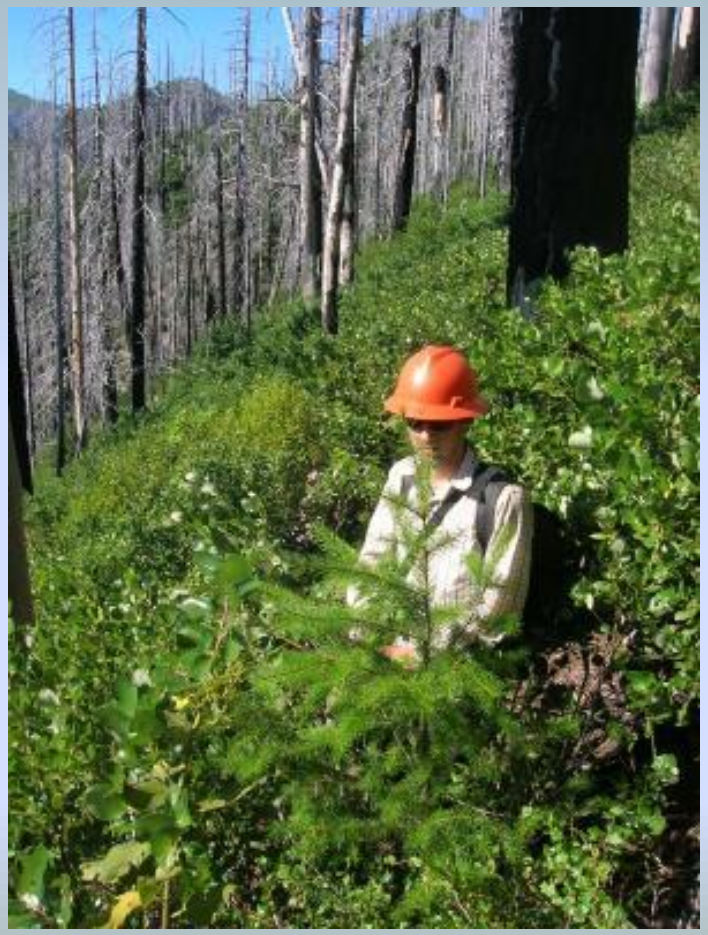
Long-Term Restoration: Lessons from US

- Restore the vegetation that existed until the passage of the fire or alternatively,
- Opt for species more adapted to the soil and climate, resulting in quality reforestation.

HOW?

- Natural regeneration
- Planting and/or seeding

- **What grows back after a fire often depends on what was there before, and the coping mechanisms of trees and understory vegetation depend on the historical fire regimes**



A naturally regenerated Douglas-fir seedlings emerges above a sea of snowbrush 10 years after a high-severity wildfire. In Klamath National Forest. (Photo: J. Shatford)

➢ Natural Regeneration

Fire-adapted trees:

- serotinous cones – cones that require heat to melt the resin and release the seeds (e.g. lodgepole pine, maritime pine)
- thick bark – can help the tree survive the fire and become a seed source for the regenerating forest (e.g. Douglas-fir, Cork oak, Maritime Pine)
- resprouting of burned trees and stumps(e.g. oaks)

Lodgepole pine and sprouts after a fire. Photo: Ann Deutch/National Park Service

225-year-old Douglas-fir tree showing that the burn did not penetrate into the live part of the tree.

Resprouting willows (*Salix sp.*) three months after the Libby South Fire in Okanogan National Forest.

Conifer Regeneration study after Forest Fire in the Klamath-Siskiyous (J.P.A. Shatford, D.E. Hibbs, and K.J. Puettmann)

- Random sampling of natural regeneration at locations that burned at high severity within 8 fires that burned 9-19 years ago in southern Oregon and northern California
- Mediterranean climate (hot dry summers and cool moist winters)

Results shows that conifer regeneration was abundant on study sites

natural regeneration of conifers is a normal response to fires in most locations.

18 years after a high severity wildfire in Klamath highlands of northern CA we can see the high density of white fir seedlings. (Photo: J. Shatford)

Salvage Logging controversy

Different viewpoints:

<u>Supporters</u>

It is part of a suite of restoration techniques, and that removal of timber means reduction of fuels for future fires

<u>Opponents</u>

it causes damage to burned sites, particularly to soils, that it increases sediment transport, and that it removes large dead trees that
have important ecological functions.

- Donato (2006) findings: *Conifer seedlings re-grew abundantly on their own after a forest fire, but comparatively few survived the harvesting and hauling of salvaged logs.*

The results suggest that post-fire logging may conflict with ecosystem recovery goals.

Conclusions

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- US has effective response to short-term rehabilitation:
  - The **BAER Program** is an effective mechanism for making timely decisions to protect valued resources from long-term damage by secondary fire effects

- **Natural regeneration** of conifers is an intrinsic response to fires in most locations

- Limitations of short-term studies (ecosystem recovery is a variable and dynamic process) and lack of scientific data related to Natural Regeneration

➢ **Adaptive Management** – the process of learning by doing and incorporating new information into management as it is learned, is one approach for moving forward.

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Thank you for listening!

Vera Serrão
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