

DEKLIM Emissions Workshop
MPIC Mainz, 2-3 December 2002



Coupling Anthropogenic and Climate-driven Changes of Fire Regimes:

Challenges for Vegetation and Fire Modelling

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Case I: Abrupt Tropical Rain Forest Conversion

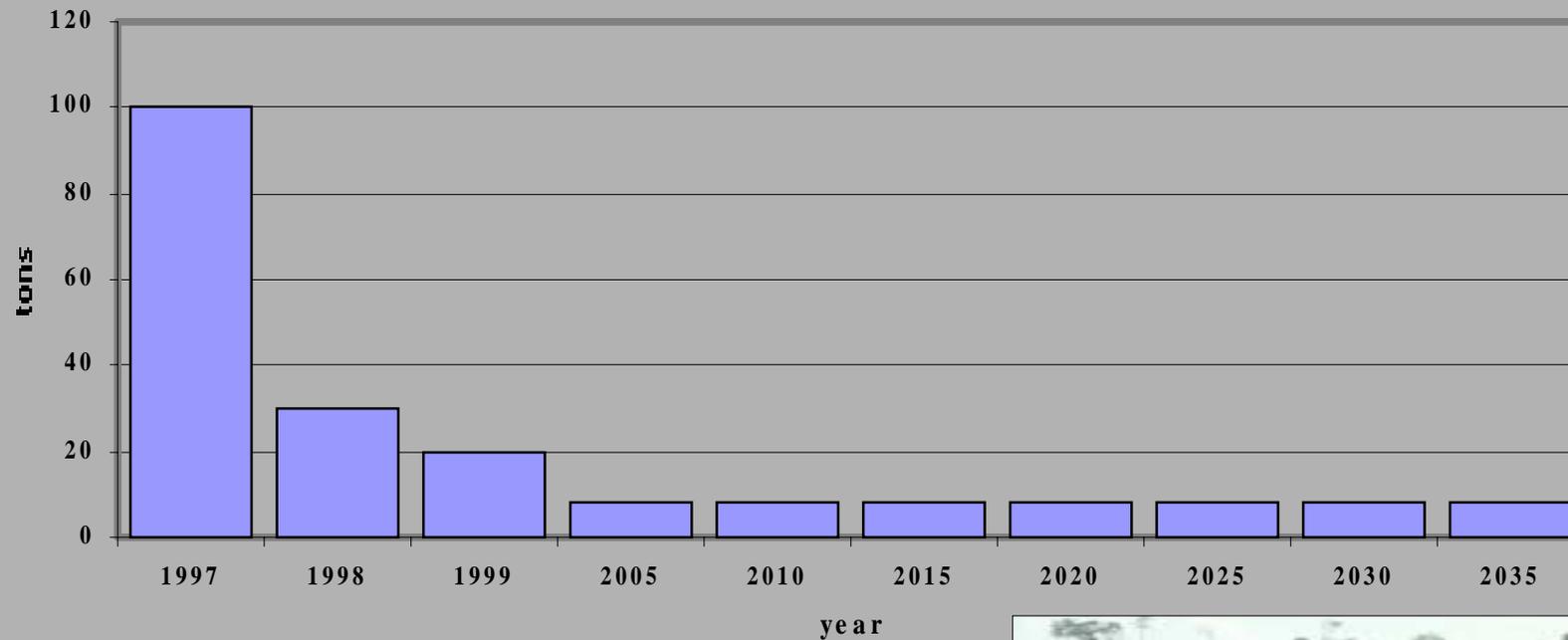


Abrupt conversion



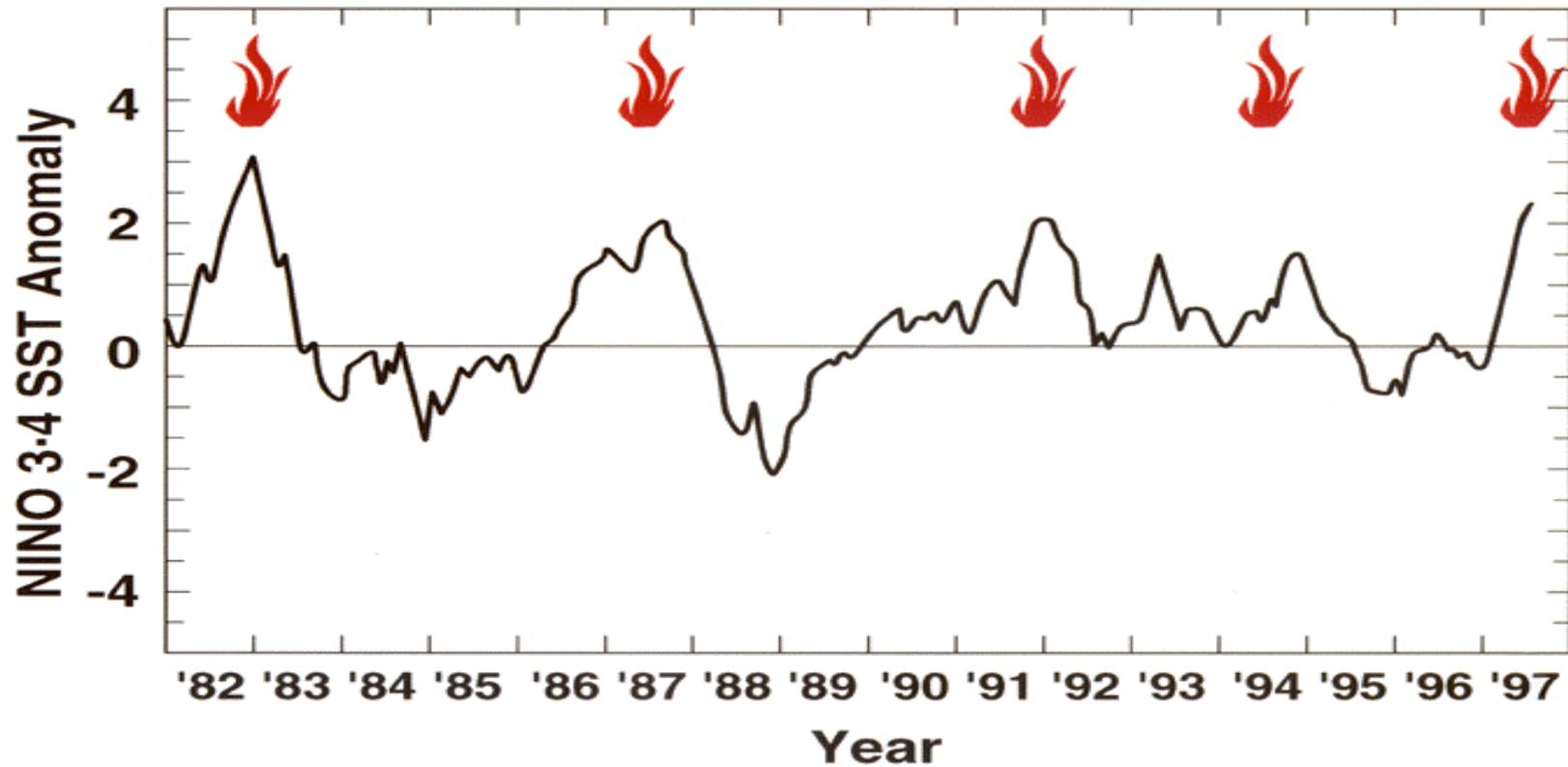
***Imperata* Savanna**

Case I: Abrupt Tropical Rain Forest Conversion Gross Carbon Release Pulses



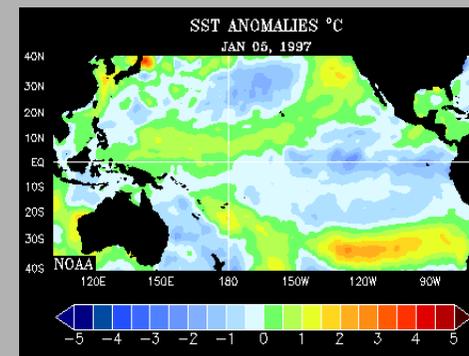
Abrupt conversion





El Niño and Burning / Smoke Episodes in Indonesia

**Return intervals of inter-annual extremes:
Response of ENSO to global warming?**



El Niño: Desiccation of the equatorial rain forest

Increase of mortality and available fuels; change of microclimate

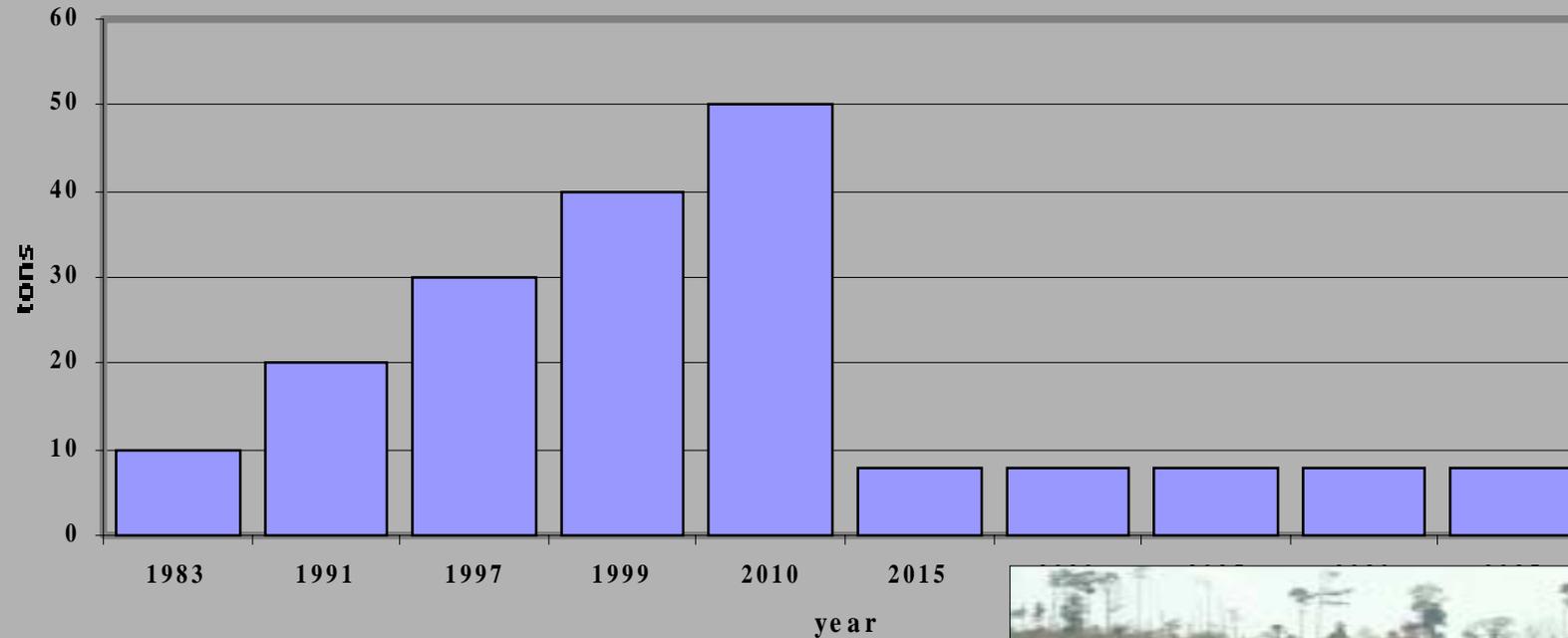




**Case II:
Forest degradation
by multiple fire events**



Case II: Tropical Rain Forest Degradation Gross Carbon Release Pulses



Successive degradation 



Imperata Savanna

Case III: Tropical Peat Swamp Forest Degradation

**Penetration of wildfires
into drained & desiccated
peat-swamp biomes**

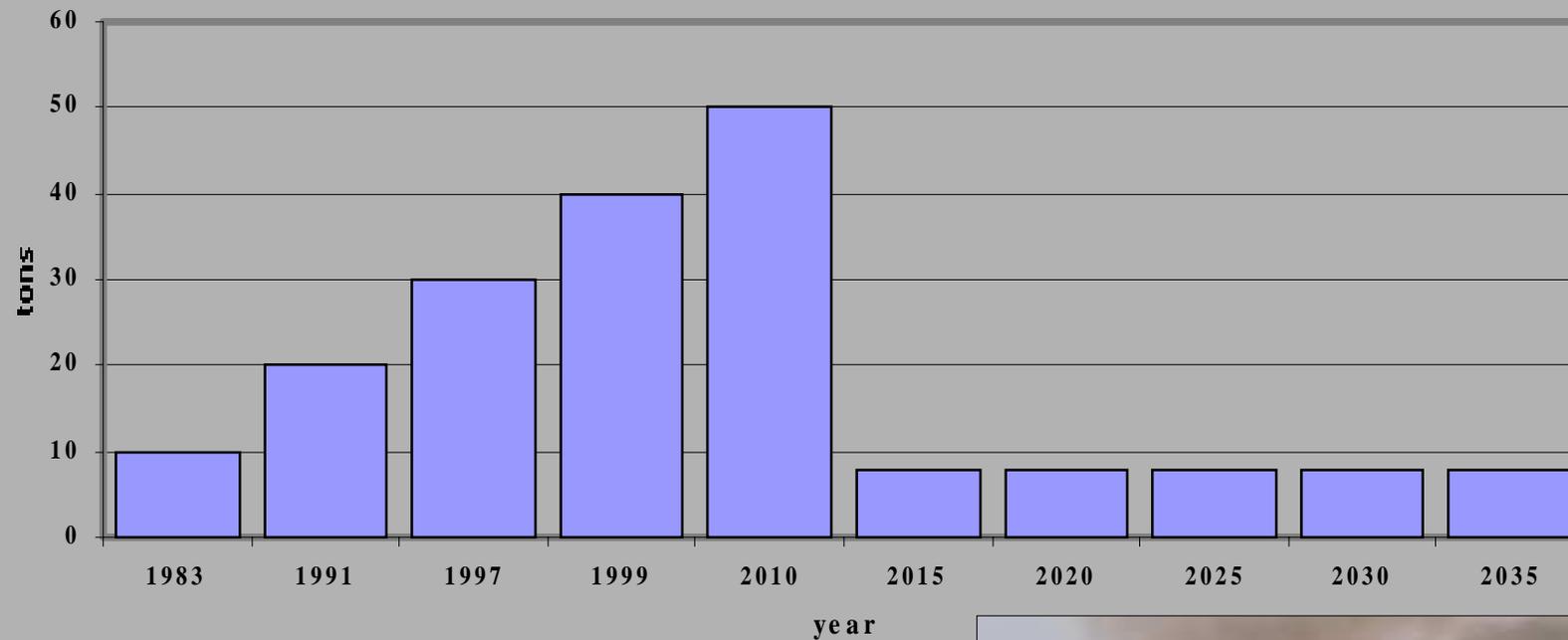




**Initial fire and
wood harvesting,
followed by degradation**



Case III: Tropical Peat Swamp Forest Degradation Gross Carbon Release Pulses



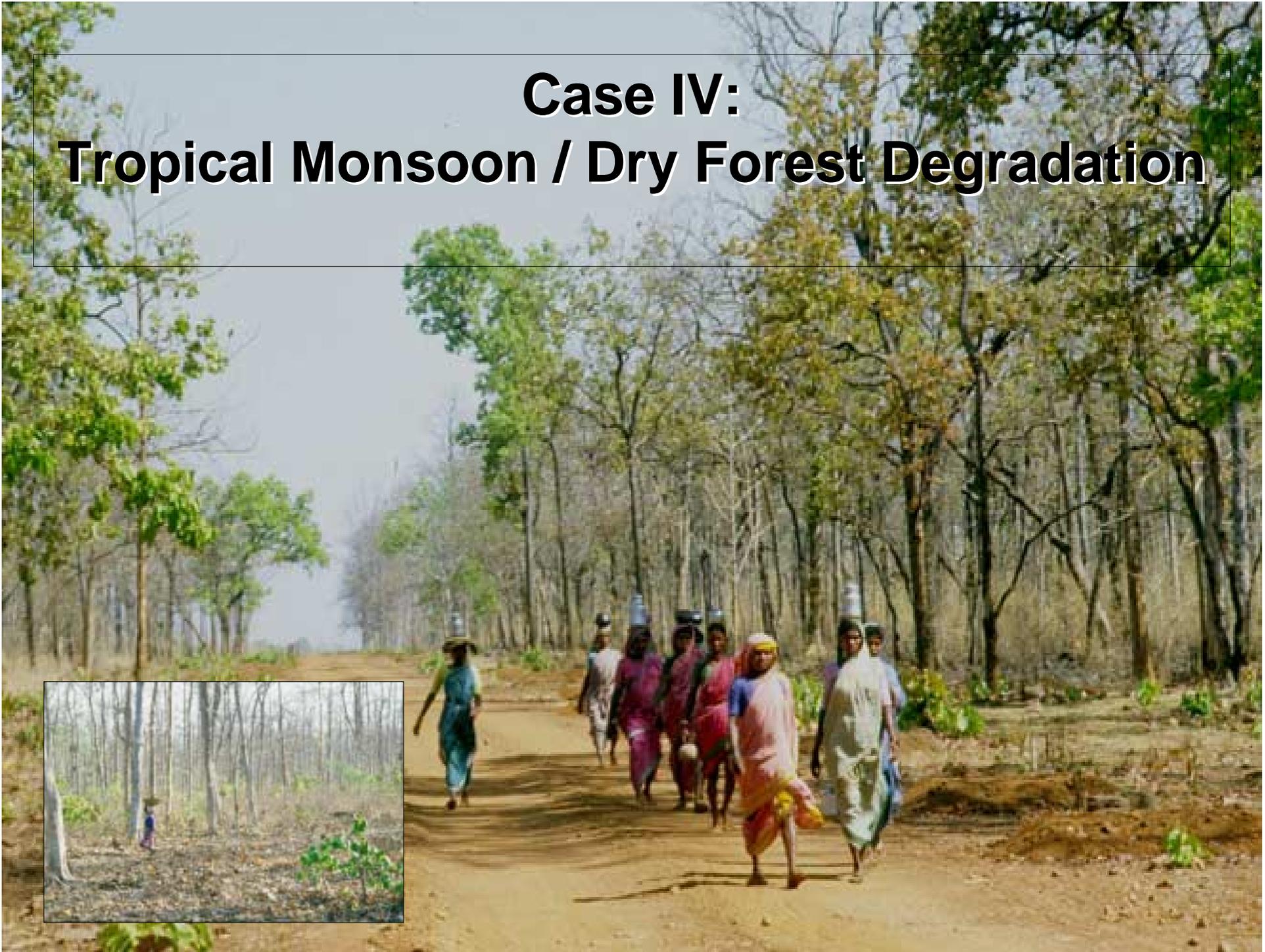
Drainage



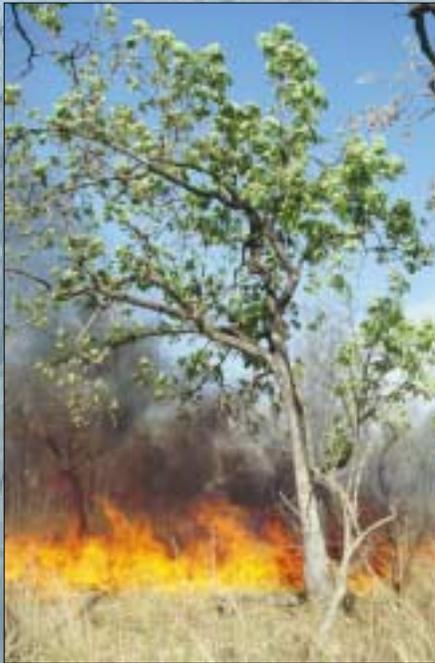
Flammable wetlands



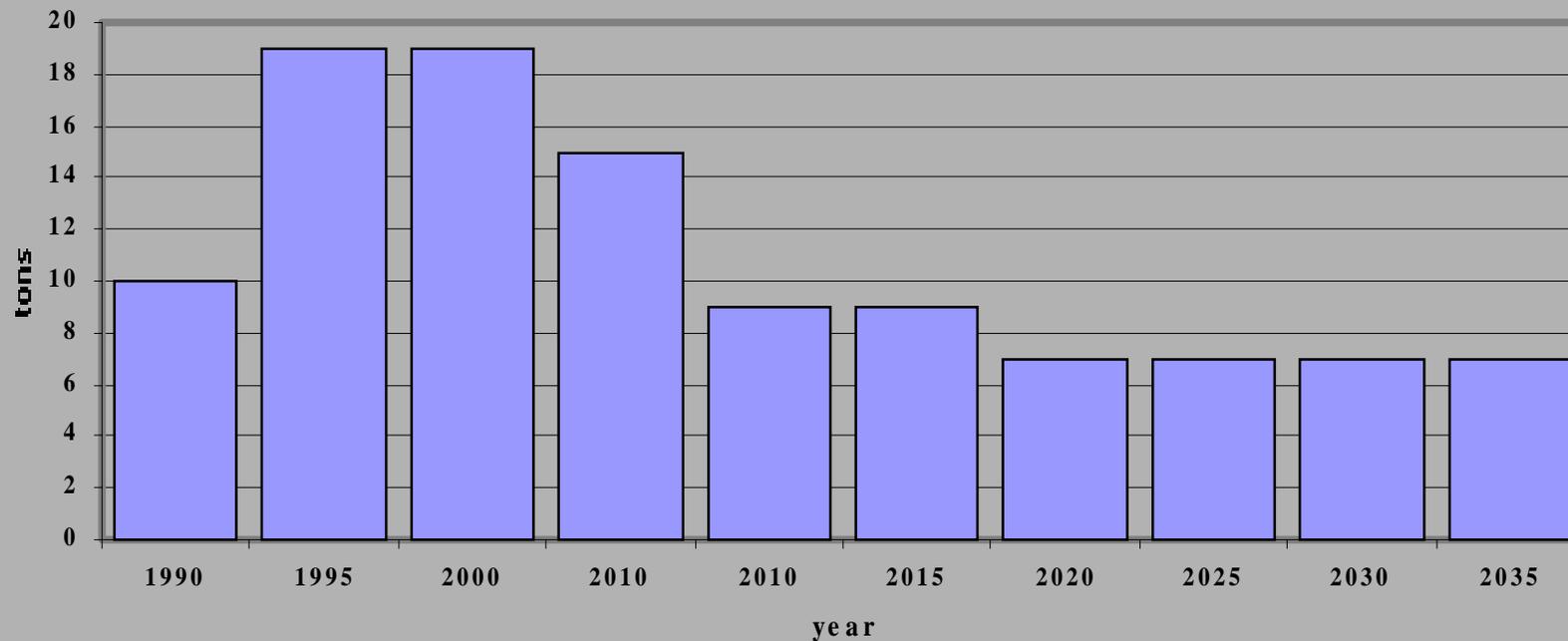
Case IV: Tropical Monsoon / Dry Forest Degradation



Case IV: Tropical Monsoon / Dry Forest Degradation



Case IV: Tropical Monsoon Forest Degradation Gross Carbon Release Pulses



Degradation

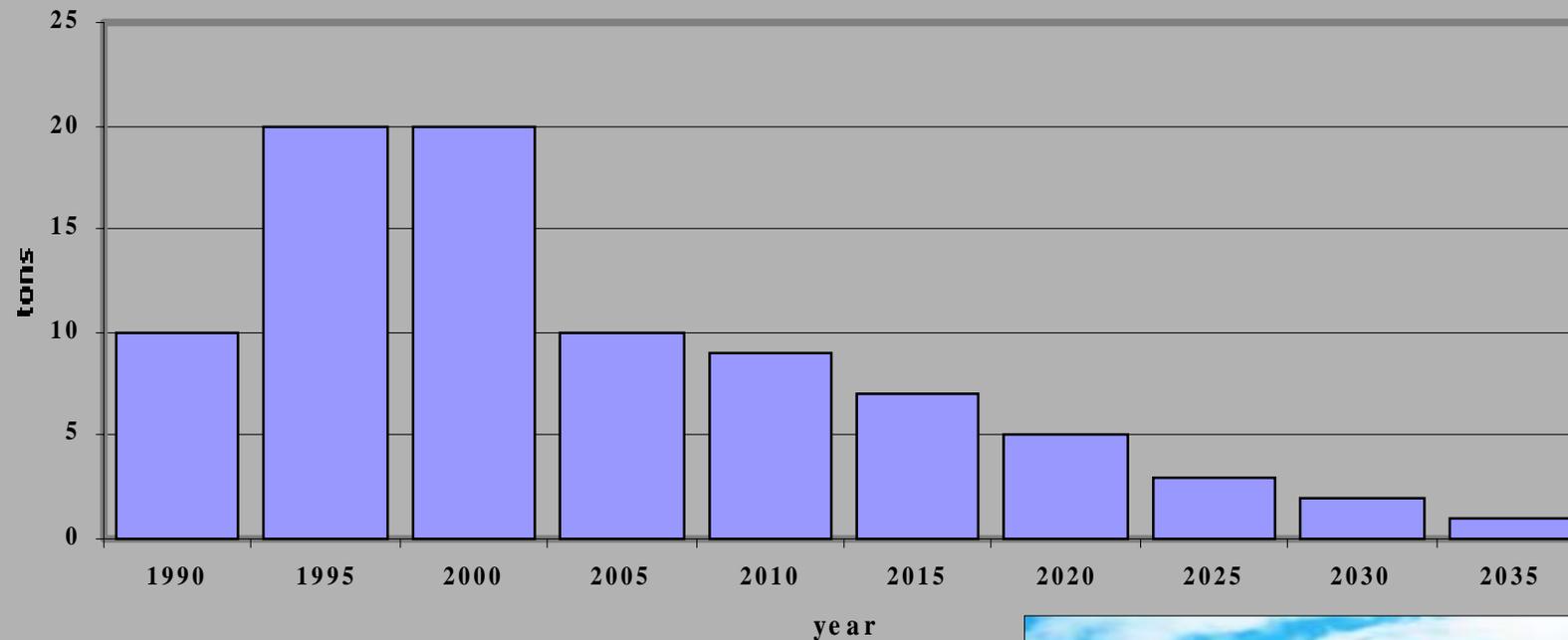


Open Woodland

Case V: Tropical Subtropical Mountain Forest Degradation



Case V: Tropical Subtropical Mountain Forest Gross Carbon Release Pulses

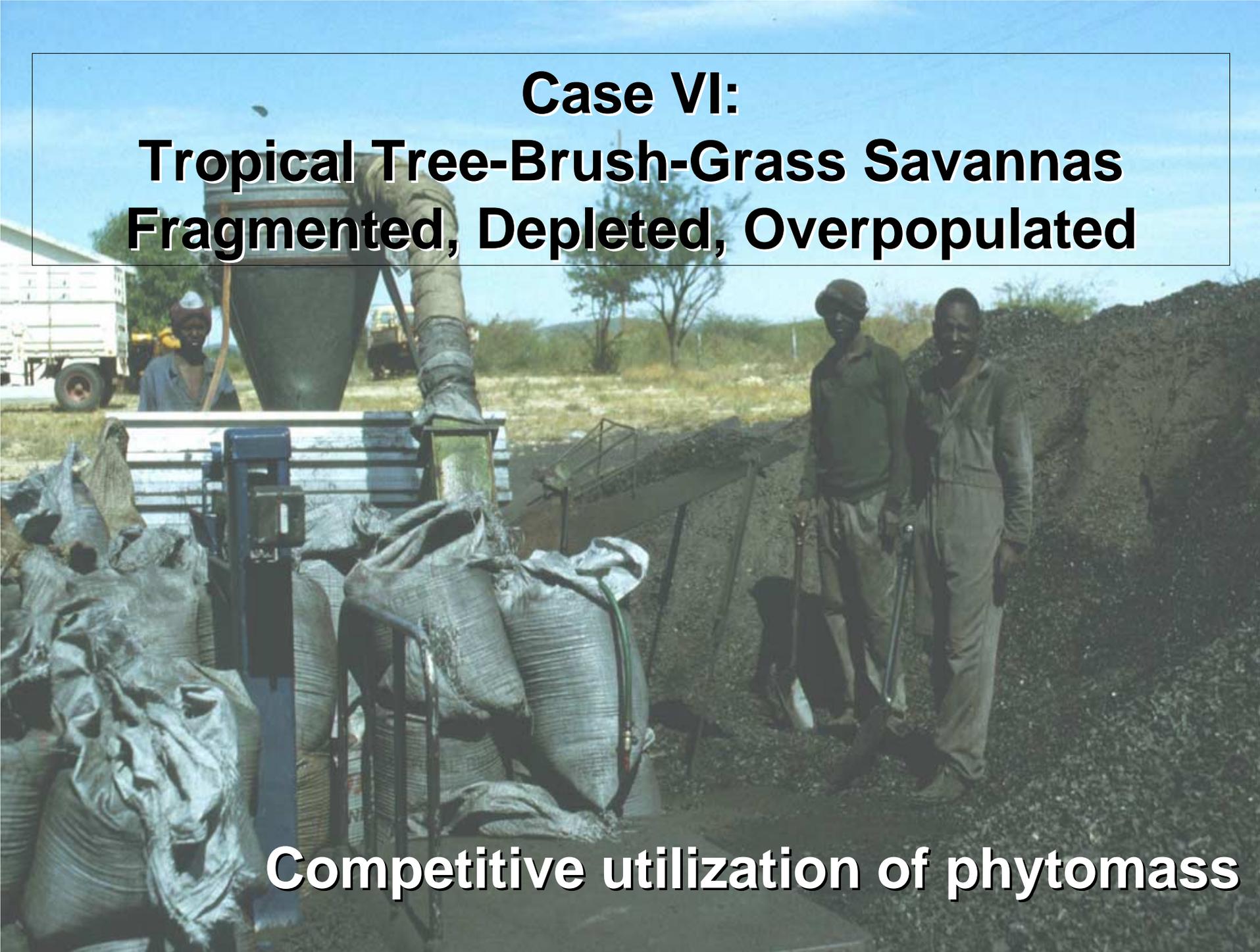


**Overcutting, grazing,
trampling, fire**



Case VI: Tropical Tree-Brush-Grass Savannas Fragmented, Depleted, Overpopulated

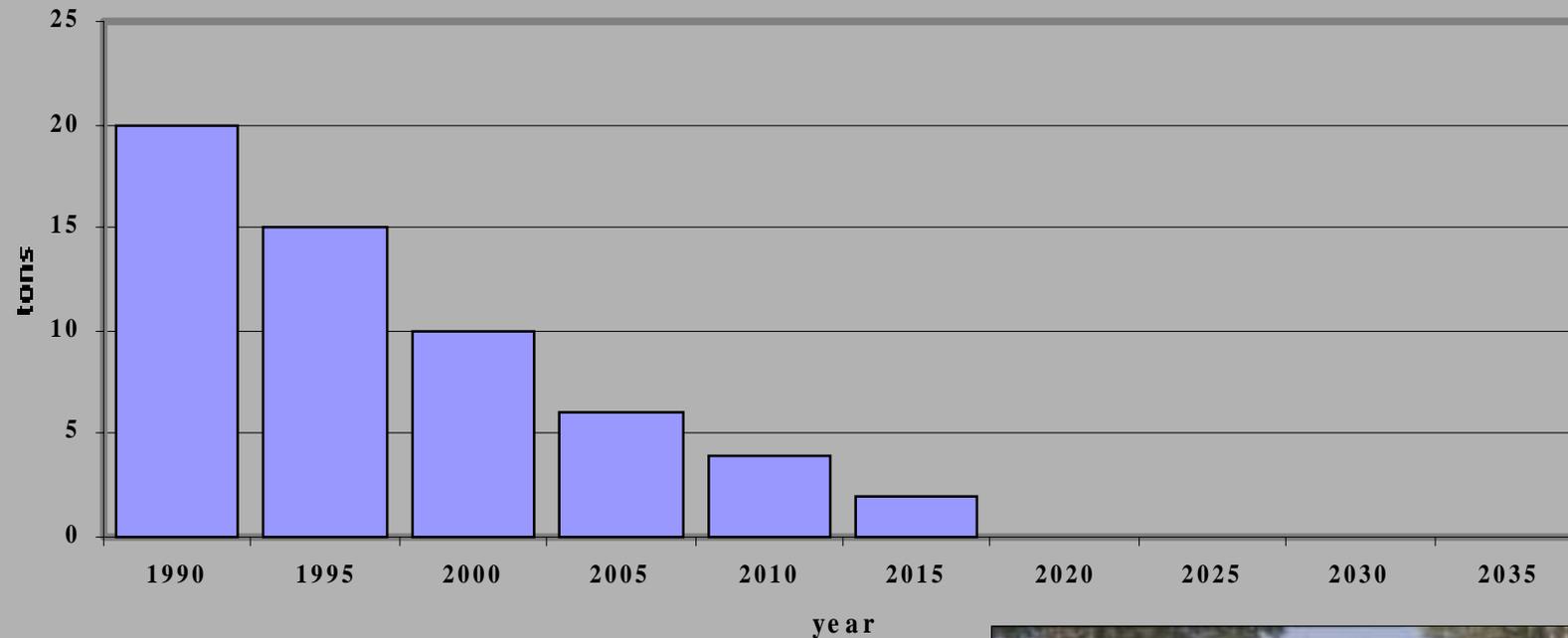




**Case VI:
Tropical Tree-Brush-Grass Savannas
Fragmented, Depleted, Overpopulated**

Competitive utilization of phytomass

Case VI: Tree-Brush-Grass Savannas Overpopulated Gross Carbon Release Pulses



**Export
of Phytomass**

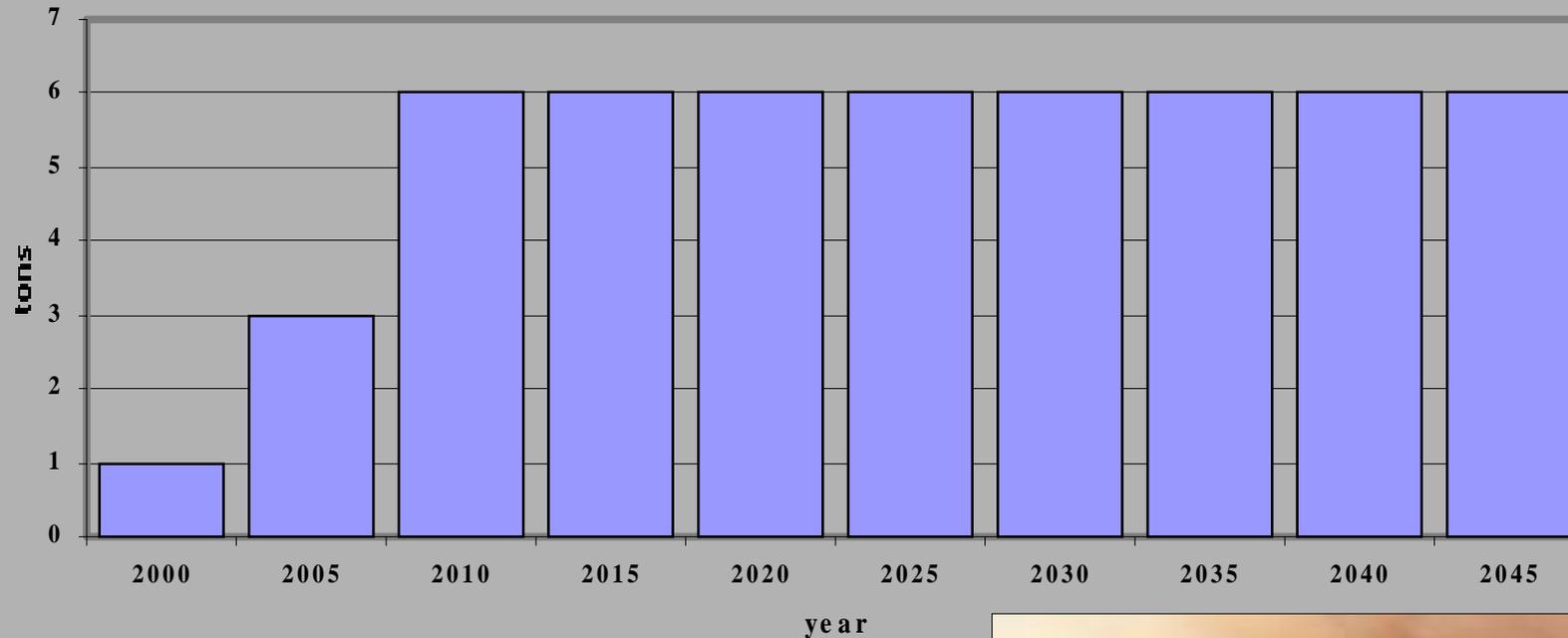


**Case VII:
Tree-Brush-Grass Savannas Depopulated
(AIDS Scenario), partially fragmented,**



**Increase of total and available
fuel loads resulting in re-
establishment of fire regimes
and vegetation mosaics**

Case VII: Depopulated Savannas (AIDS Scenario) Gross Carbon Release Pulses



**Recovery of
fire regimes**



A photograph of a red and white fire truck driving on a dirt road through a dense forest. The truck is equipped with a water cannon that is spraying a powerful stream of water across the road. The truck has 'STAB' on the front grille and a license plate that reads 'DPA 813E'. The forest consists of tall, thin trees, and the scene is lit with natural daylight.

**Case VIII:
Baltic Region
Densely Populated Industrial Countries**

**Successful fire protection,
increase of forested land area**

**Case VIII:
Baltic Region
Densely Populated Industrial Countries**

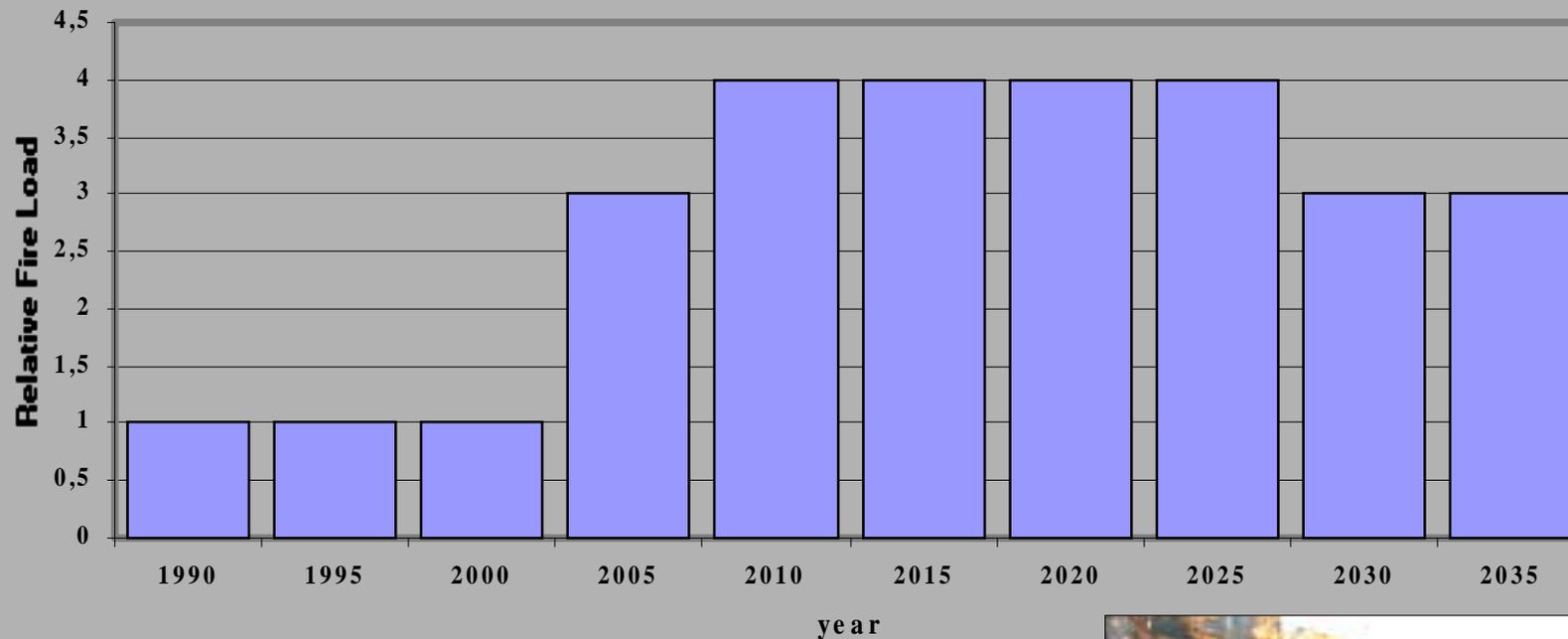


Restoration of cultural fire regimes



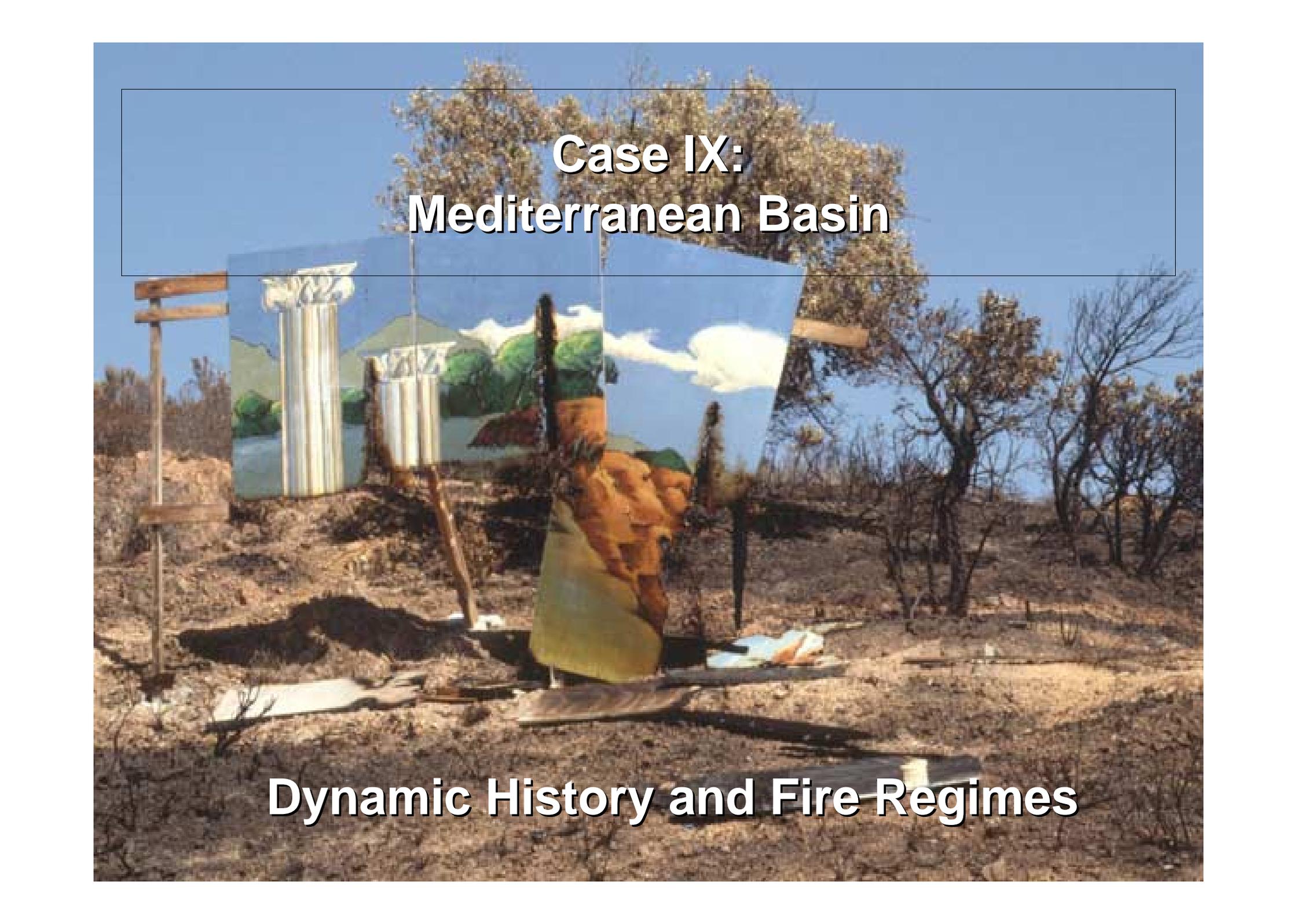
Eero Järnefelt 1873
Raatajat rahanalaiset
Ateneum, Helsinki

Case VIII: Baltic Region Gross Carbon Release Pulses



**Successful wildfire
protection, prescribed fire**



A photograph showing a landscape with a fire scar. In the foreground, there is a large, brown, charred tree trunk. Behind it, a reconstruction of a classical building facade is visible, featuring two columns and a pediment. The background shows a dry, hilly landscape with sparse vegetation and a clear blue sky. The text "Case IX: Mediterranean Basin" is overlaid on the top part of the image.

**Case IX:
Mediterranean Basin**

Dynamic History and Fire Regimes

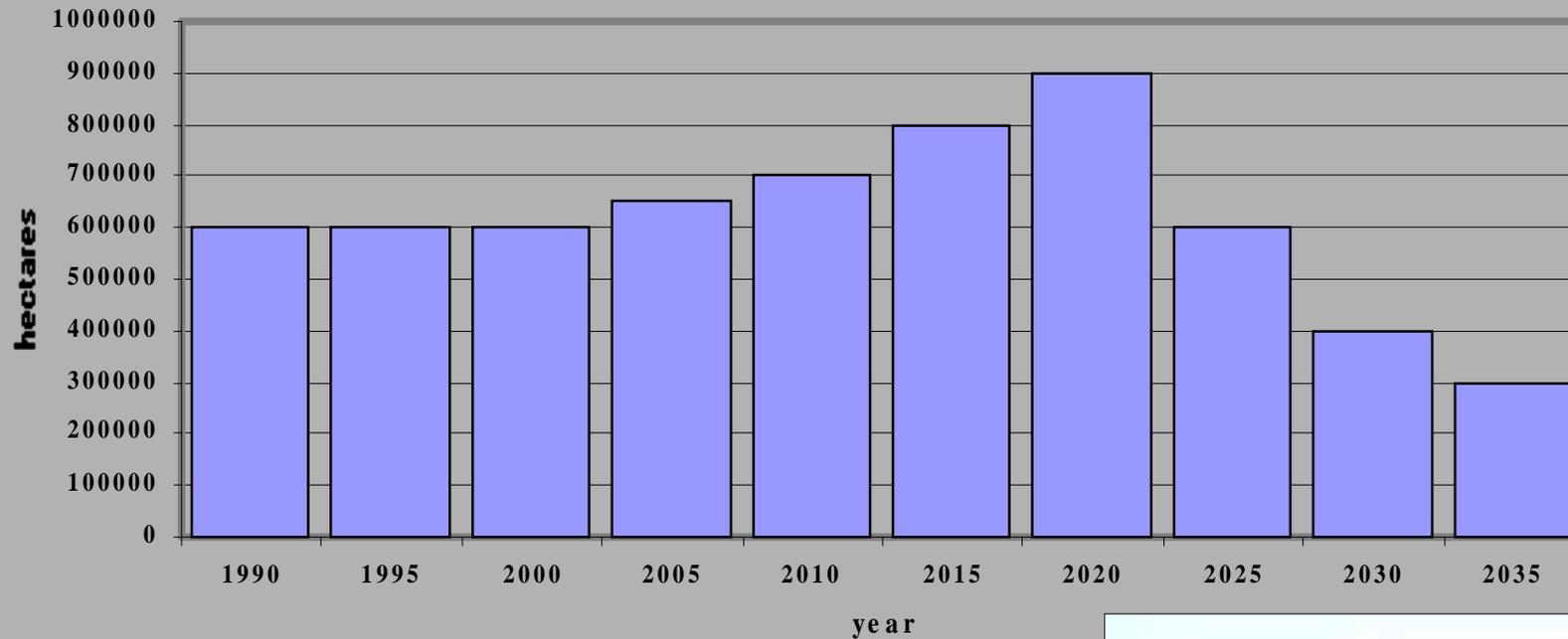
Case IX: Mediterranean Basin



**Intensive utilization and
depletion of vegetation
resources**

... followed by rural exodus

Case IX: Mediterranean Basin Gross Carbon Release Pulses



**Increase of wildfire
occurrence and severity**



Treated

Untreated

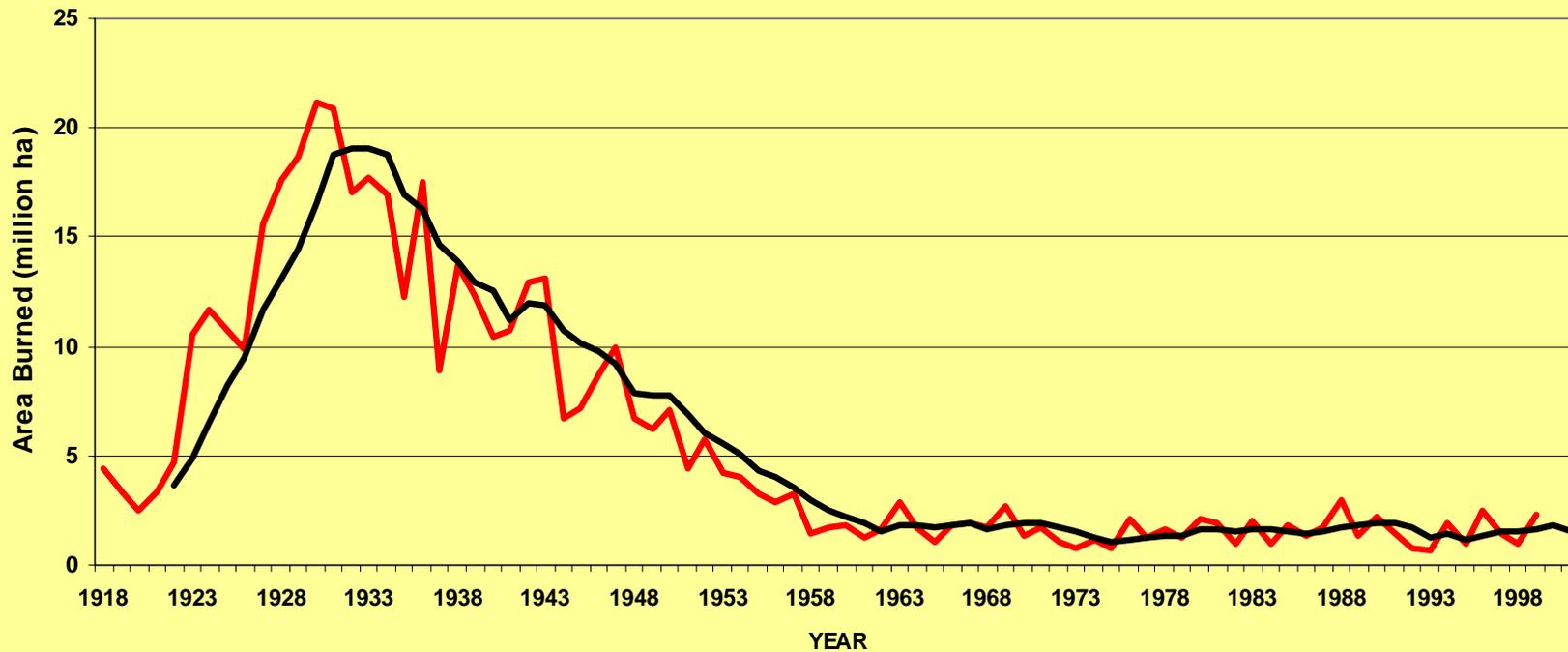
**Case X:
Temperate North America**



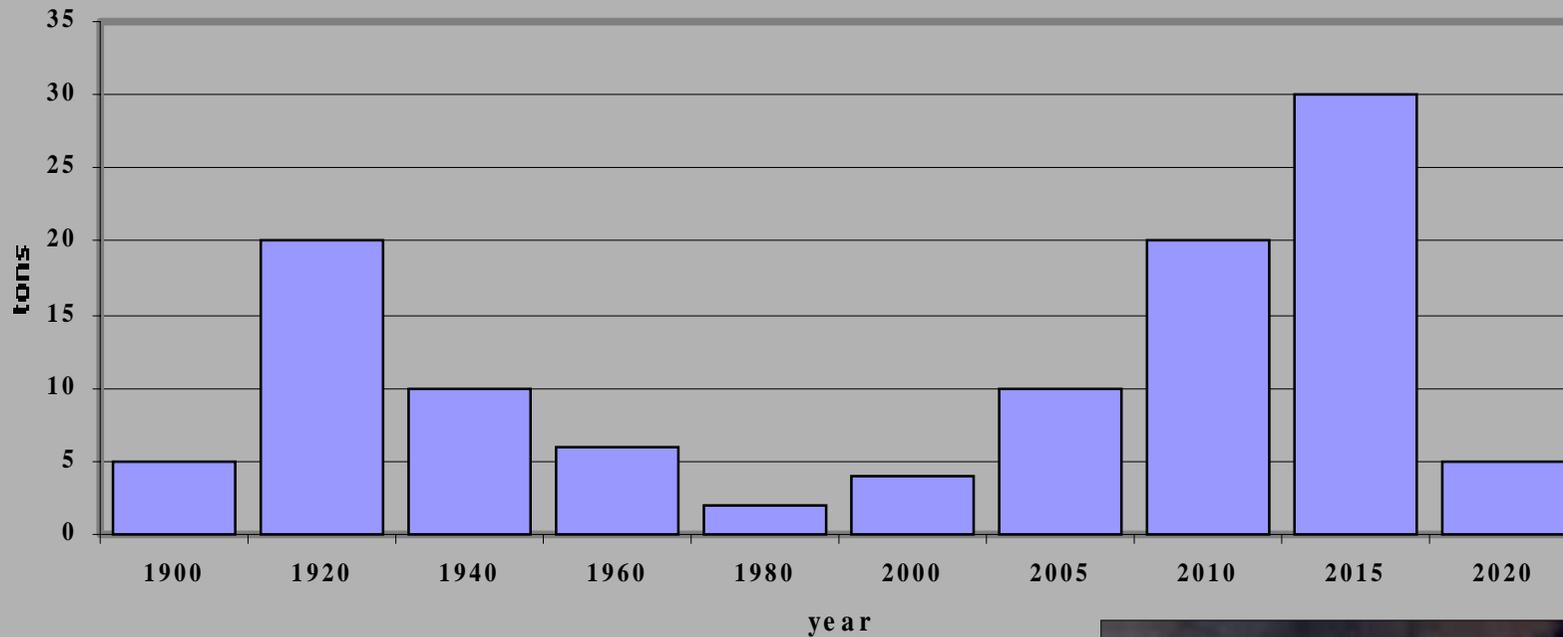
**Changed fire regimes and
fuel complexes**

Case X: Temperate North America Gross Carbon Release Pulses

ANNUAL BURNED AREA (USA)
All Ownerships



Case X: Temperate North America Gross Carbon Release Pulses



**Successful wildfire
protection, prescribed fire**

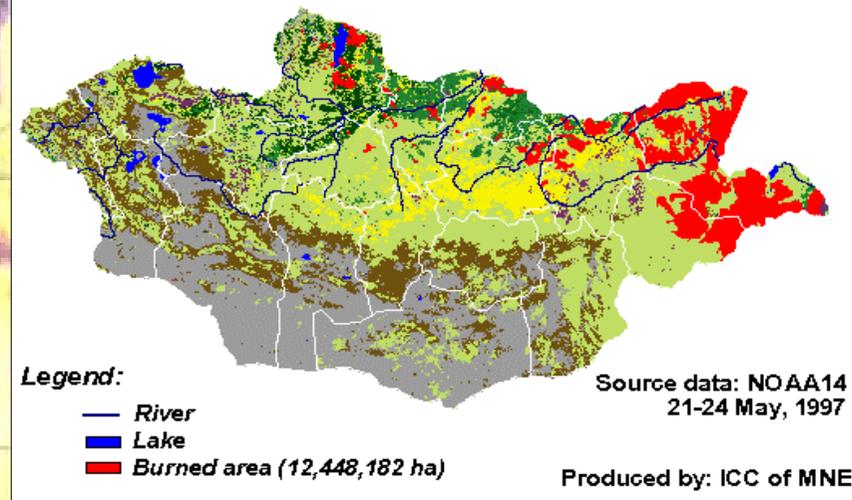


Case XI: Temperate-Boreal Transition - Asia

Burned scars
in Mongolia,
April, 2000

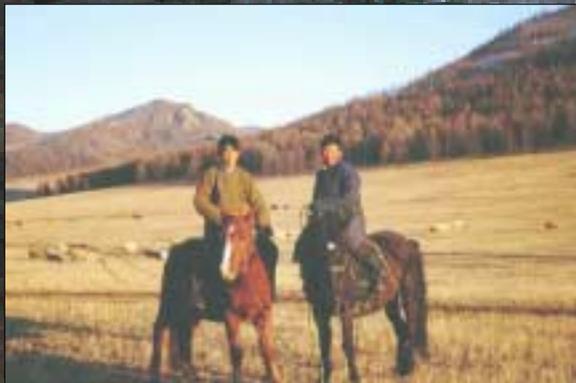
Imaged with NOAA-14
21 Jul 2000

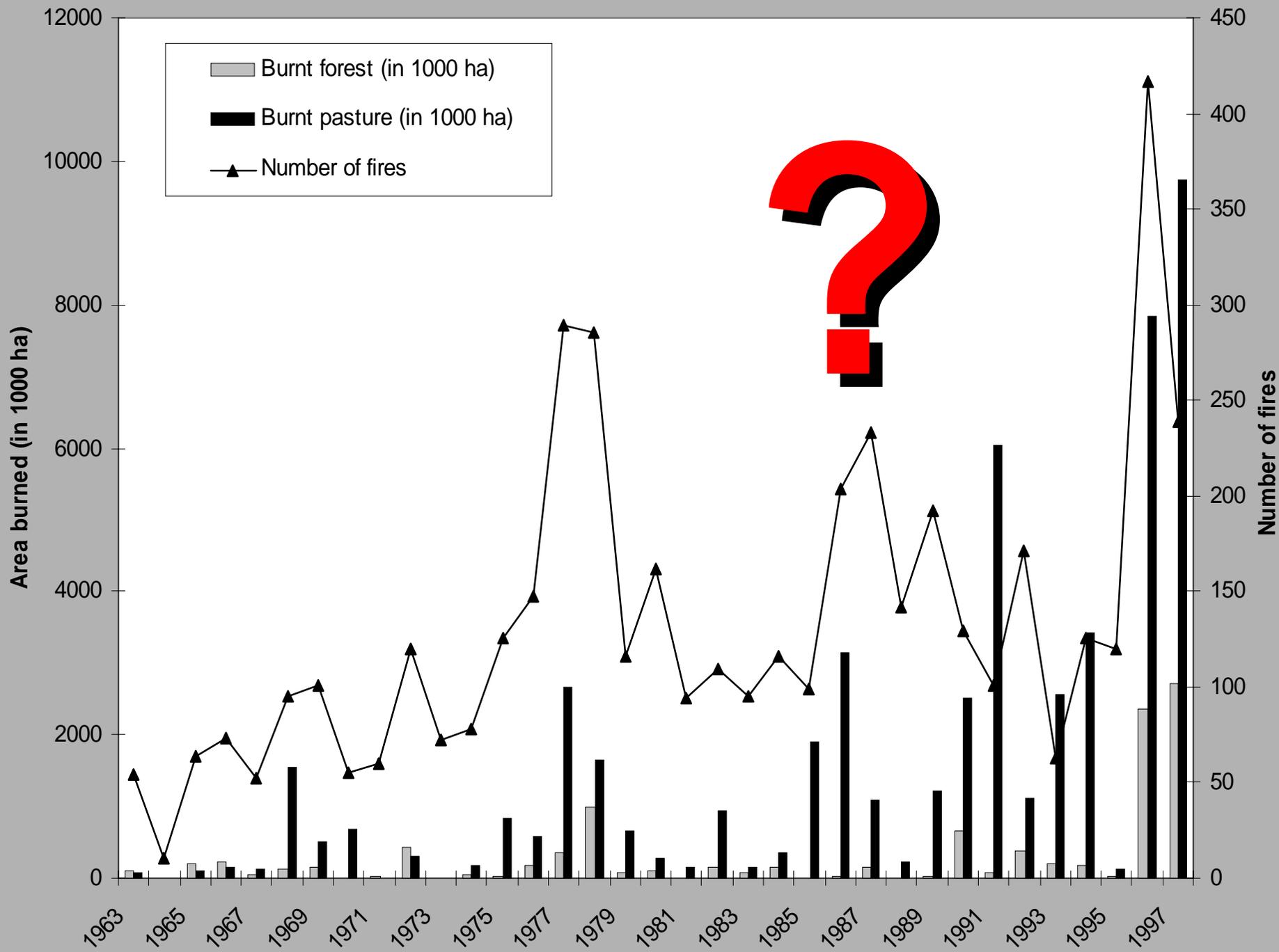
Forest and steppe fire map of Mongolia
Spring 1997



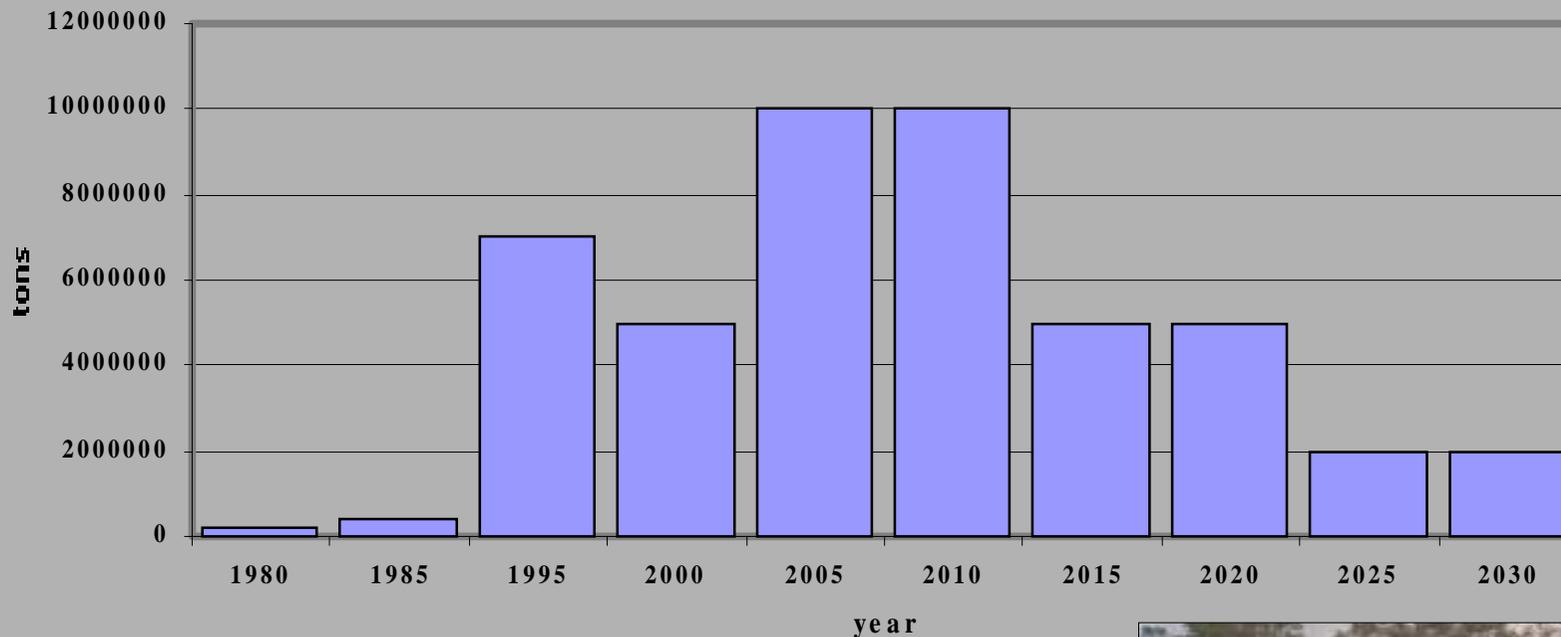
Consequence of non-sustainable forest
management and economic collapse:
resulting in restructuring of the rural society
and fire regimes

Case XI: Temperate-Boreal Transition - Asia





Case XI: Temperate-Boreal Transition - Asia Gross Carbon Release Pulses

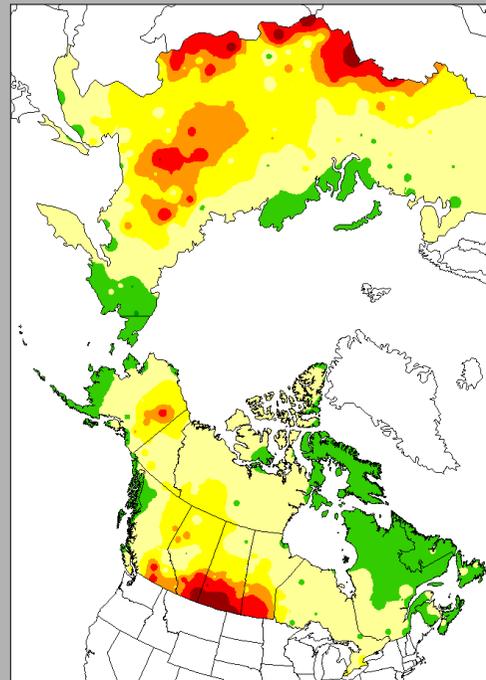


**Escalating destruction of
montane-boreal forests**

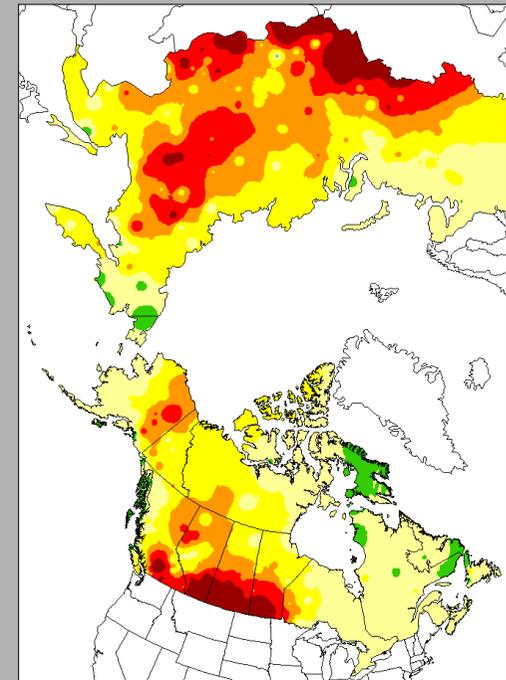


Case XII: Boreal Forests

**Potential Effect of
Climate Change on
Fire Hazard in the
Boreal Zone – the
Canadian Climate
Center GCM**



Historic Fire Weather



CCC 2 x CO₂

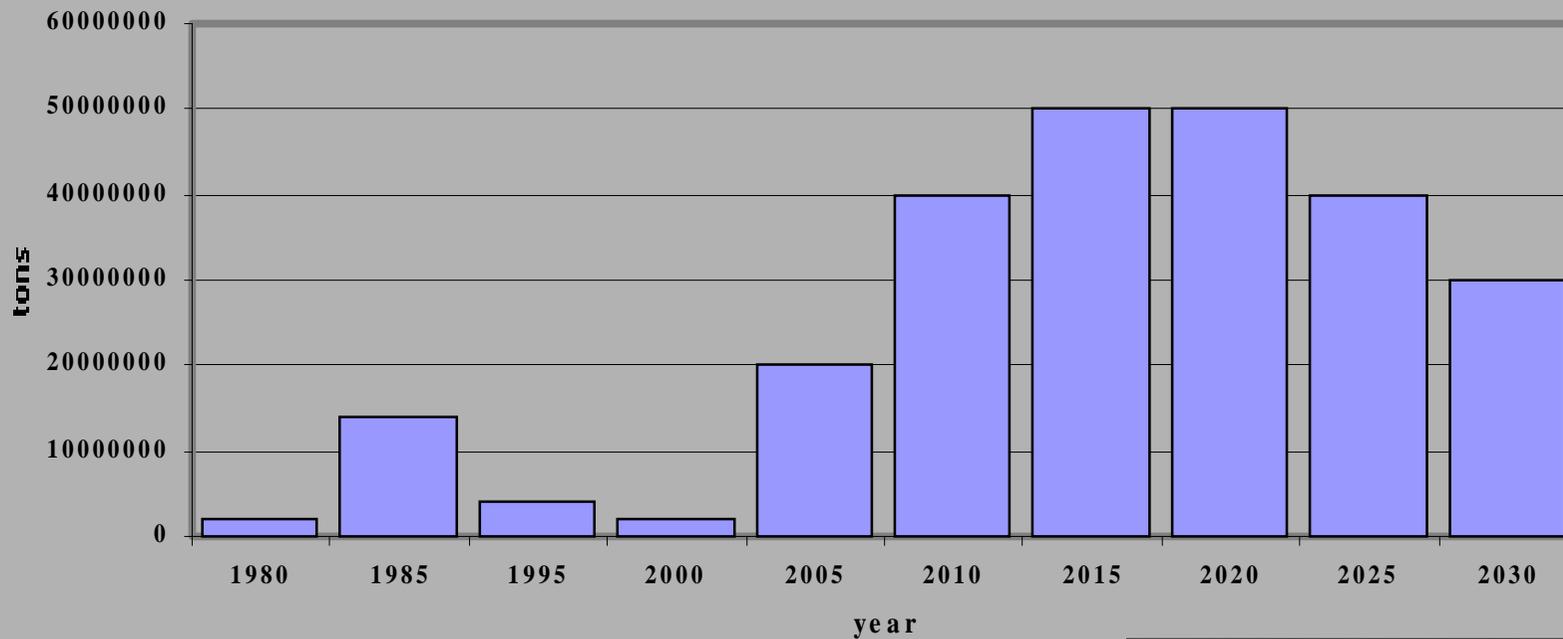


**Moderate dryness:
Low-intensity surface fires
(beneficial)**



**Extreme dryness:
High-intensity crown fires
(destructive)**

Case XII: Boreal Forests Gross Carbon Release Pulses



**Escalating replacement
of boreal forests**



A photograph of a large fire, likely a forest fire, with thick black smoke rising into the sky. The foreground shows a dense forest of tall, thin trees. The text "Global Fire Modelling" is overlaid in the center of the image.

Global Fire Modelling

Quo vadis ?