



IMPACTS OF FOREST FIRES ON SOIL EROSION AND NATURAL ENVIRONMENTS UPSTREAM OF THE AL WHDA DAM, MOROCCO

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Azurém Campus, Guimarães.

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Plan of the presentation

1. Introduction
2. Study areas
3. Genesis, factors and evolution
4. Aspect of forest fire impacts
5. Mitigation and emergency management
6. Discussion and Conclusion

1- Introduction

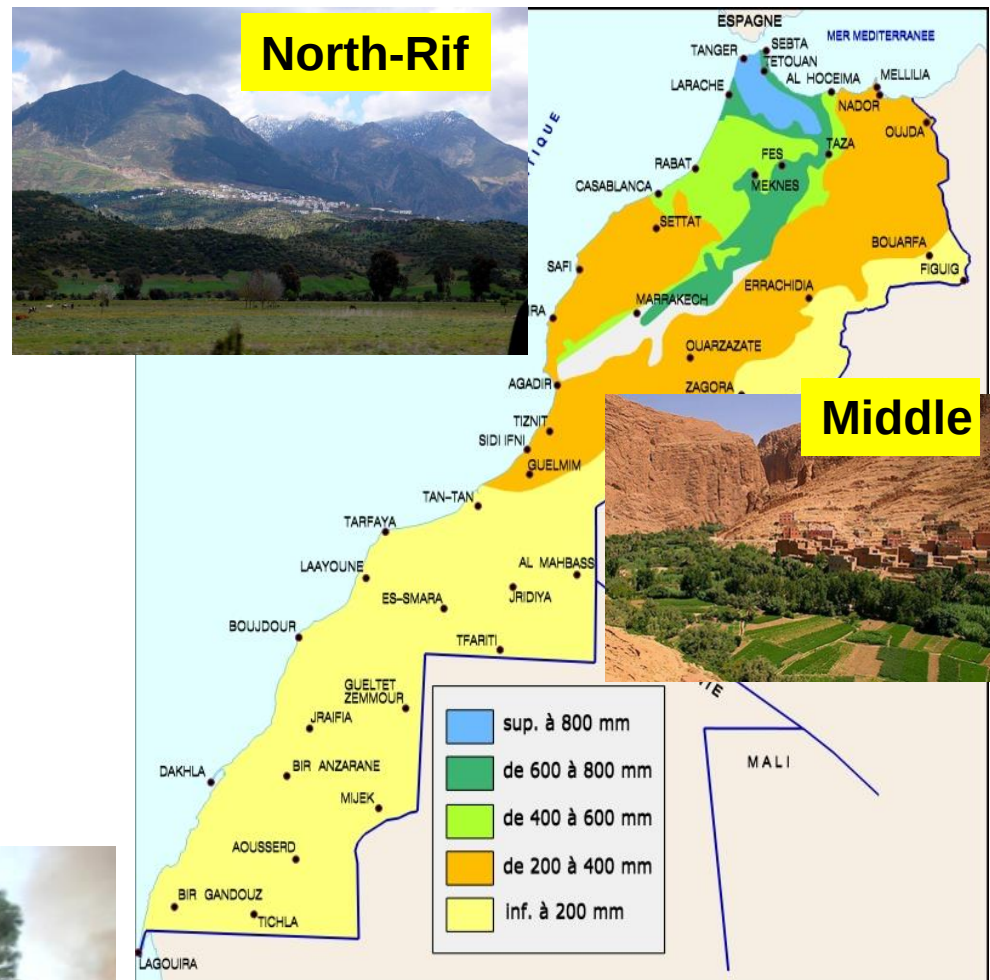
Forest fire in Northern Morocco is usually generated by the illegal anthropic actions, mainly land clearing, the massive extension of the cultivation of cannabis (*Cannabis sativa*).

This devastates all Rif forest mountain ecosystems without exception **with a great intensity and impact on the vegetation leading to a catastrophic ecological and biological imbalance at the Rif level.**

The deterioration of forest has been the subject of a certain projects and interventions to rehabilitate it without any results.

2- Study areas

- Morocco is characterized by four types of climate: humid, subhumid, semi-arid and arid.
- The Rif Mountains are very wet (up to 2,000 mm/year), with long periods of snow.
- The Rif Region has a population of 3,725,191 inhabitants, representing 10.6% of Morocco's population.



Middle

South



3- Fire Factors

3-1. Natural causes

Temperature increase: The importance of fires increases in the dry period (June to October). More than 95% of the area is burned in this period, with a peak in August and is speeded **by the wind** waves providing the required oxygen to light fires.

Topography: Along the steep slopes in mountain areas, the fire moves quickly compared with the flat areas.

Block collapsed: Process by friction, based on sparks produced by the shock of a hard rock such as stone and iron.



3-2. Human Causes

- Pasture fire: for having more land for the livestock or to warm their body in mountains fire or cooking Tajine.
- The coalfields: is usually related to traditions and culture to heat meat on natural



Over-grazing in Rif mountain area



Au Maroc, le feu continue de dévaster les forêts. Le dernier en date s'est produit

- **Honey collectors:** Collecting honey from wild bee colonies is usually done by subjecting the bees to smoke and opening the tree where the colony is located.

- Careless smokers,
- Urban passengers to heat meals.
- Fires by children.

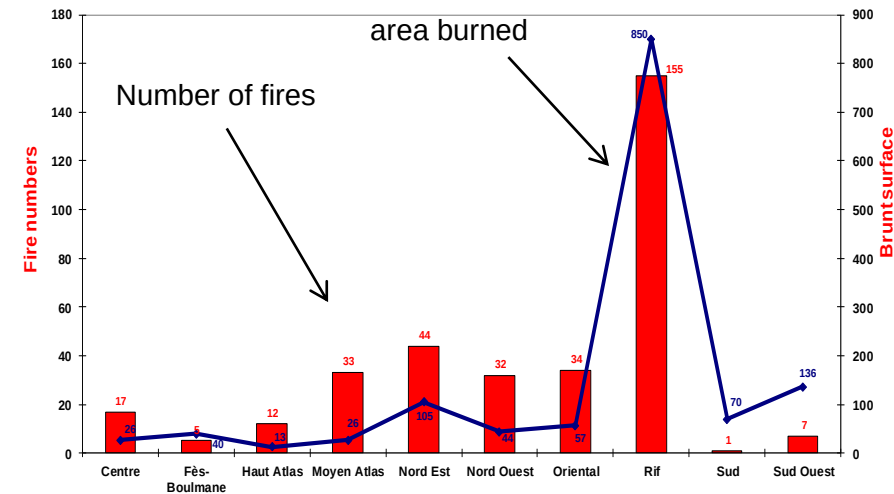
- **Cannabis agriculture**

A large part of these occupied lands in Rif area was foresting that farmers cut down to grow Cannabis (drugs) despite this being an illegal activity since 1974.

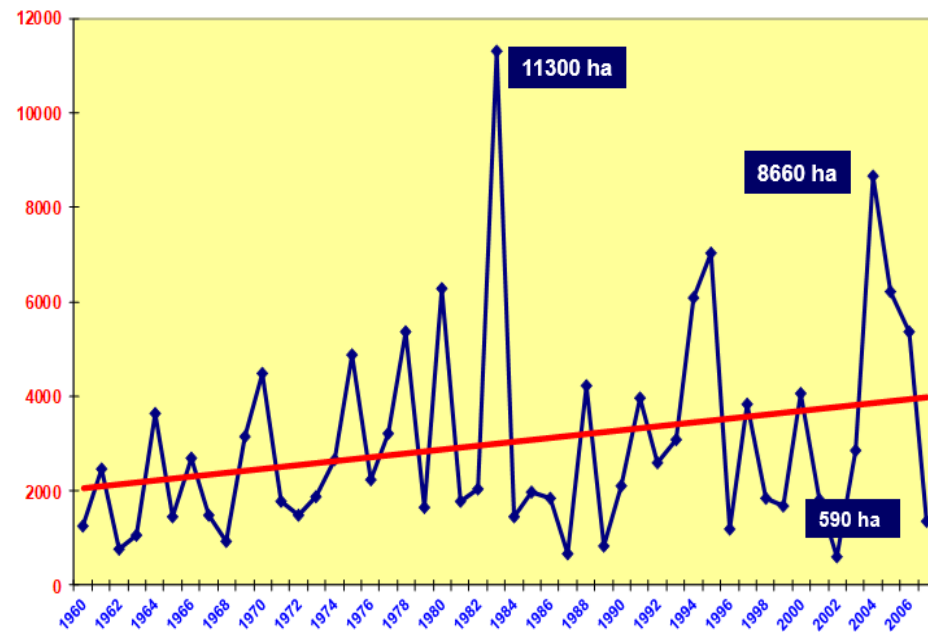


3-3. Evolution of fires

- In the last 50 years (1960- 2009), nearly 12,912 fires have damaged 149,292 ha of forests, an equivalent average of 2,986 ha per year.

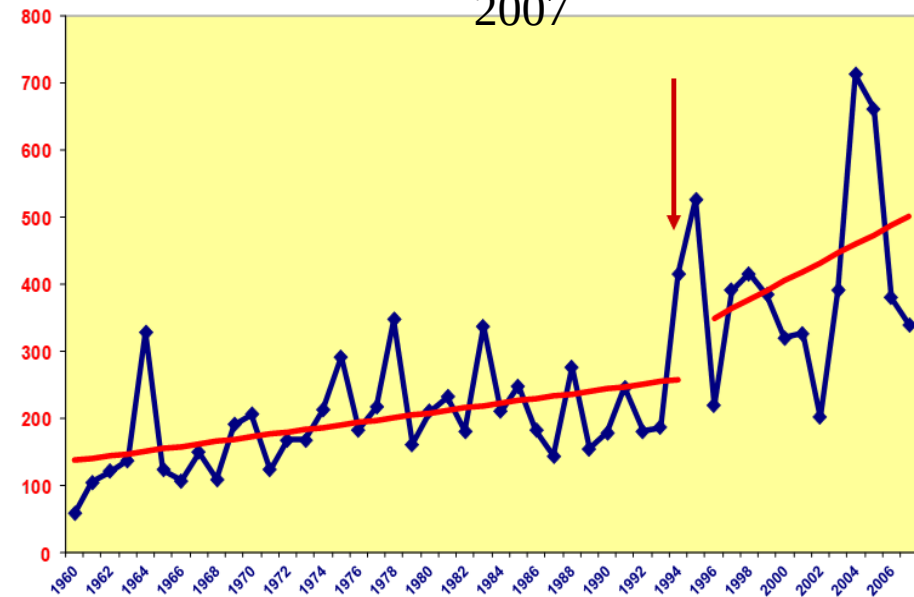


Distribution of forest fires by region in 2007



High interannual variability of the burnt areas (Morocco)

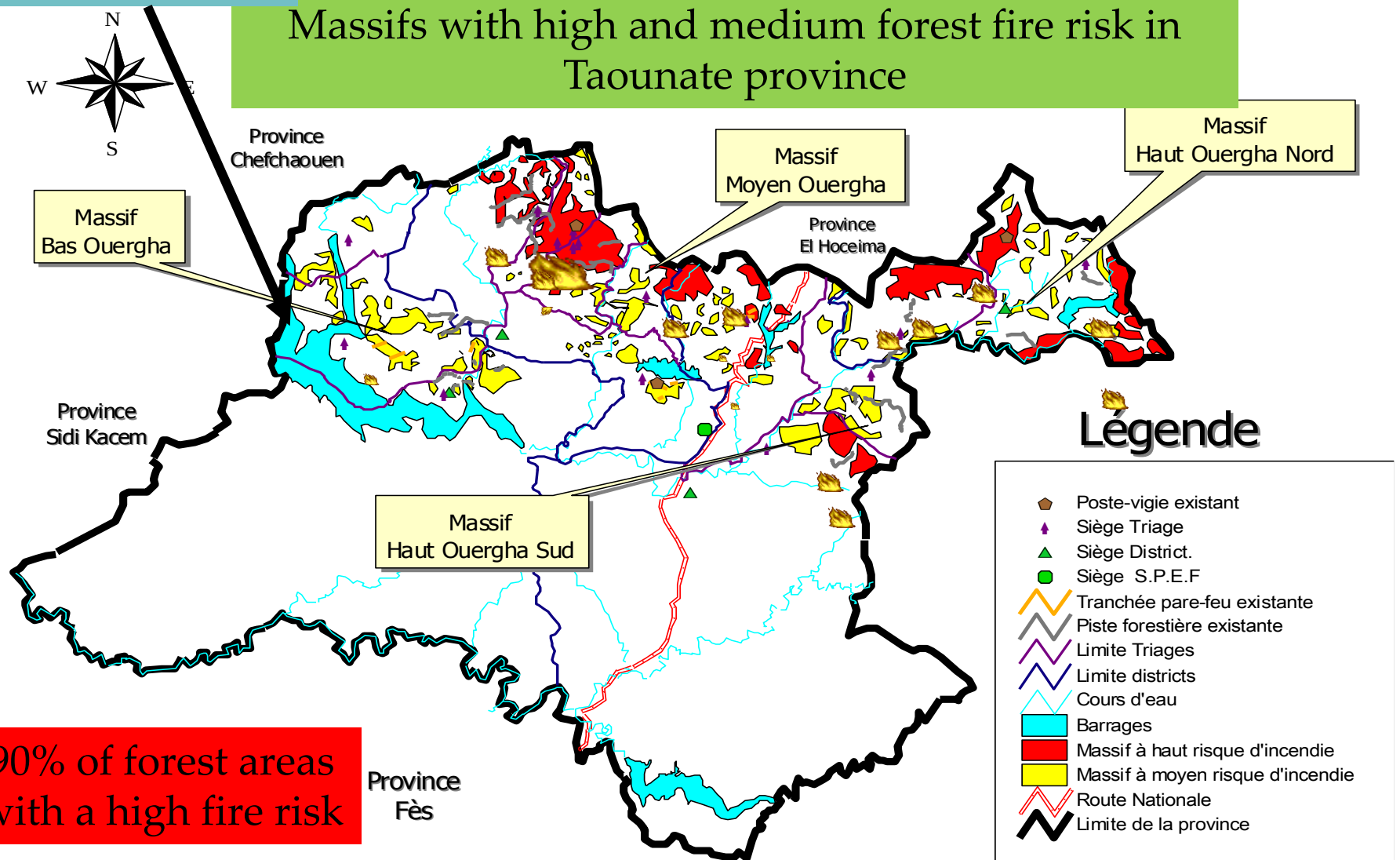
Source of Data: Forest service, Taounate province



The number of fires varies, but has been increasing, especially since 1994 (Morocco)

Al Wahda dam

Massifs with high and medium forest fire risk in Taounate province



90% of forest areas
with a high fire risk

10 % of forest areas
with medium fire risk

Source: Forest service,
Taounate province

4. Aspect of Forest fire impacts

a. Degradation in vegetation cover causes:

- Change in density and fertility.
- Losses related to own needs (soil organic matter) ;
- Losses linked to the intensity of the vegetation
- Losses in total elements (drainage outside the ecosystem and deep transfers at the root zone).



Water erosion:
leads to the loss of
porosity and fertility

Soil stripping
and loss of
fertility and
soil leaching



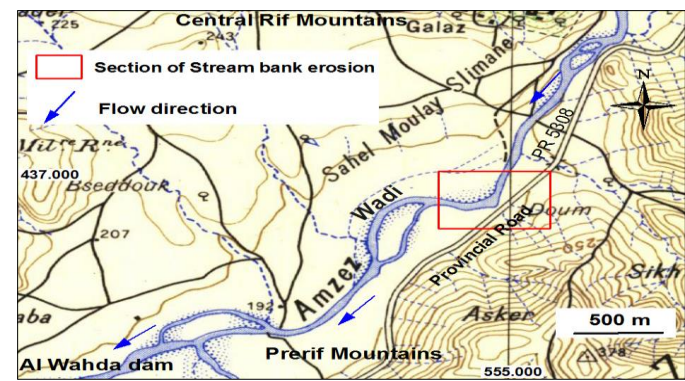
The transformation of land into Badlands

Source: El motali H., et al, 2019.

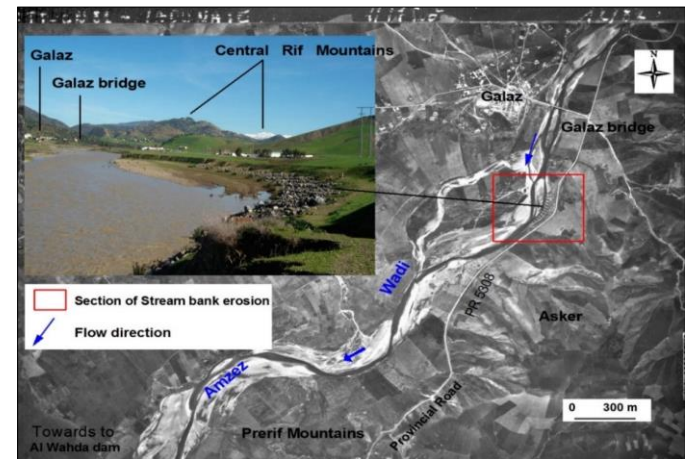
b. Siltation of dams and reduction of their lifetime

Deforestation contributes to the aggravation of the silting of the Al Wahda dam in Morocco, because:

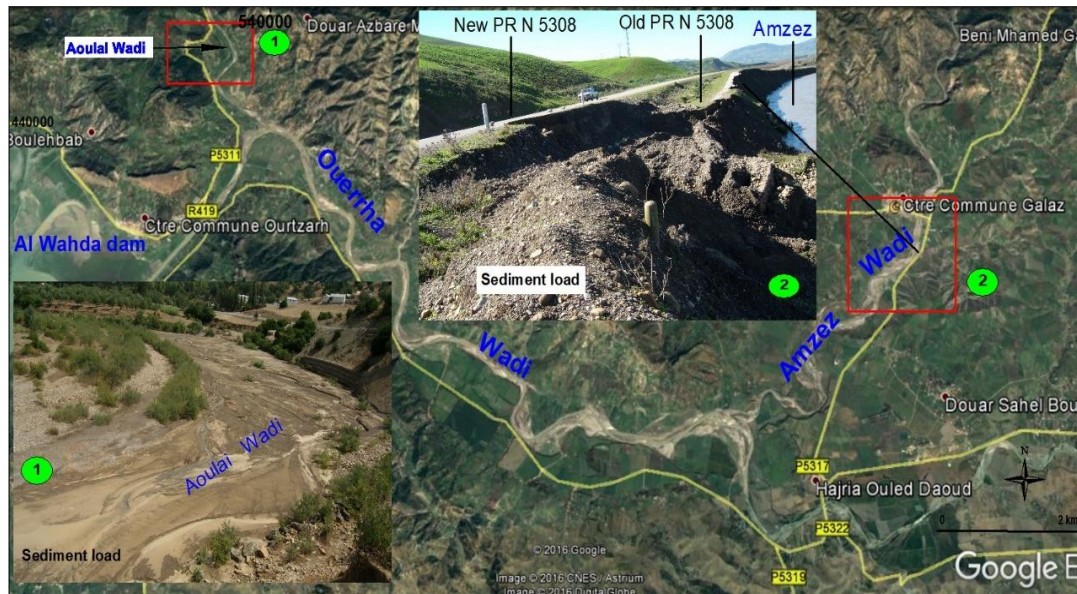
- The vegetation cover acts as a shock absorber for the splash effect,
- The root system improves soil permeability and therefore limits erosion process.



bank erosion in Amzez wadi at Galaz section in 1953



bank erosion on Amzez wadi at Galaz in 2016



Solid sediment produced and leads directly into the Al Wahda dam in Rif mountains



5. Mitigation and emergency management

A- Prevention

- Development of water points
- Opening and maintenance of firewall channels
- Raising Public Awareness
- Opening new rural roads
- Rural runway maintenance
- Construction of a lookout post



B- Detection and alert

- Preparation of adequate means of communication
- Recruitment of Fire Lookouts



C- Long term management based on static and dynamic maps

- Optimising investment resources for infrastructure and equipment
- Pre-position the resources for intervention



organization of campaigns to fight against drugs agriculture



6. Discussion and Conclusion

- Absence of reforestation program on burnt zones and the regeneration of burnt forests.
- lack of a fire early warning network through effective coordination between the different partners.

This study recommend:

- **Maintaining** and improving the economic conditions of the local population and to provide human and material resources for effective forest fire fighting.
- Maintenance and strengthening of the on-site communication system to ensure rapid responses.
- Thinking for an alternative of Cannabis agriculture in the northern region to stop the forest fires.

Muito obrigado

