

Forest fire in Rif mountains in Northern Morocco

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Plan of the presentation

1. Problematic
2. Study areas
3. Forest fire risk impacts assessment on soil using MEDALUS approach
4. Quantitative assessment of soil erosion using EPM
5. Conclusion

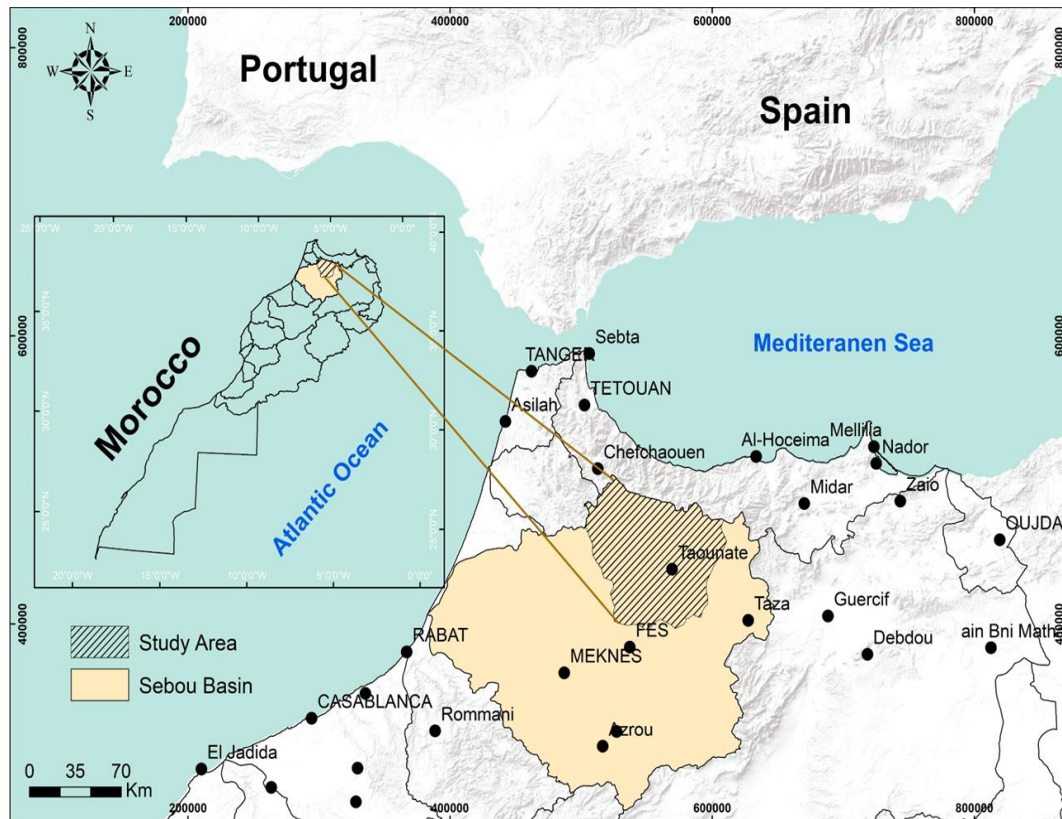
1- Problematic

Forest fires are one of the main factors leading to the degradation of environmental areas in mountainous fragile areas, in Rif mountains in general and the study area in particular are among the most frequent areas that suffer from frequent fires, especially in the area of Oudka, mainly in recent decades, as a result of human intervention in order to obtain more areas at the expense of the forest to cultivate Canabis agriculture.

Forest fire disturbs the integrity of forest ecological structures , and their balances. Consequently, these phenomena accelerate the loss of green resources, and soil degradation, as well as negatively influencing human lives and incomes.

2- Study areas

Physical characteristics



- Is distinguished by the fragile environment, due to its complex geological structure, and its lithological characteristics by the predominance of fragile rocks.
- The topographic situation is characterized by steep and moderate slopes that are highly fragmented.

-The study area is characterized by a bioclimatic gradient ranging from arid in the south to sub-humid and humid in the high peaks in the north.

-The Mediterranean rainfall is abundant with an average of between 800 mm/year and 1500 mm/year

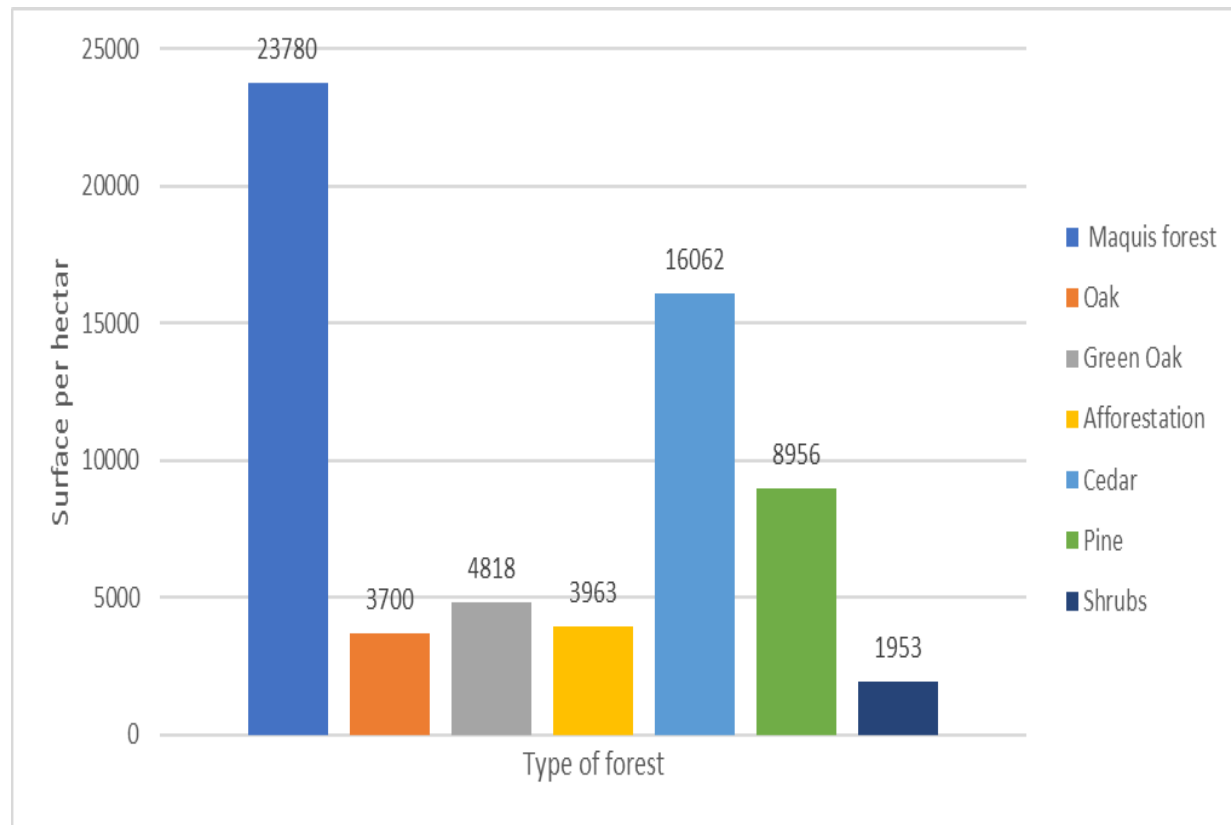
The Rif region in general, and the central Rif in particular, has one of **the highest population densities** in Morocco, exceeding 346 inhabitants/ Km^2 .

Agricultural activity is the most important and dominant economic activity in the studied area, relying mainly on seasonal farming, afforestation and livestock breeding



Some cases of the demographic load in Central Rural Rif Mountain zone.

The forest area in the study area extends over an estimated area of **63,232 hectares**, covering a limited area, **concentrated in the central rural area**, in the north of the studied area, with a proportion of about **10%** of the total area studied.

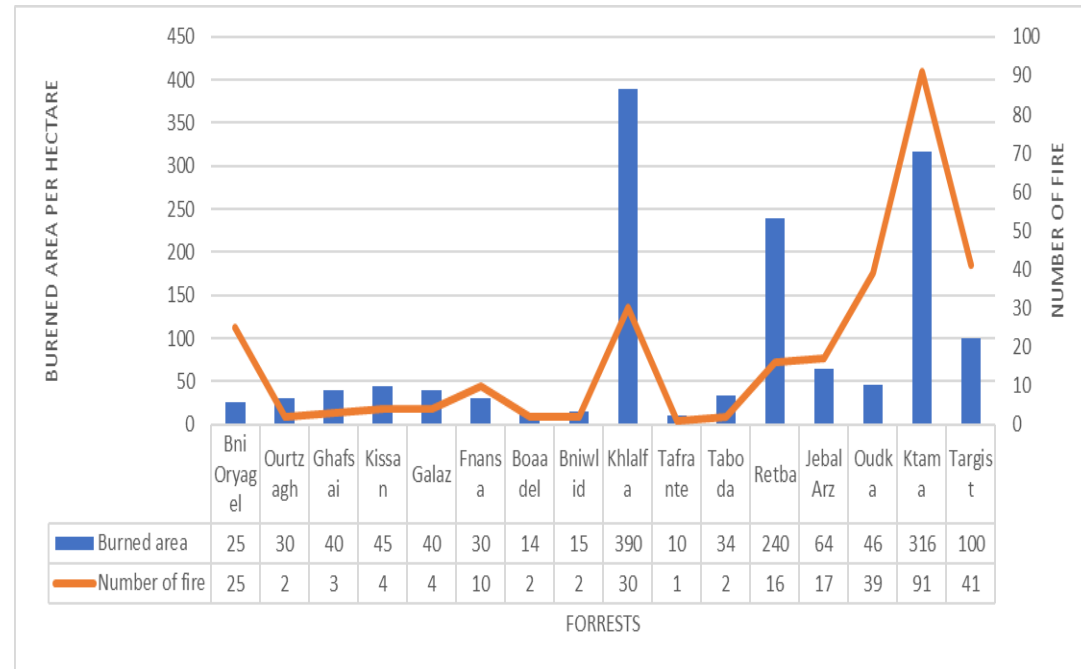


Distribution of forested and semi-forested areas in the central Rif mountains

Fire frequency

Rif areas not only experienced a higher frequency of fires, but also is well known by the largest burnt surface area.

This correlation highlights the significant role of human activity which plays in exacerbating fire risks and intensifying the scale of environmental damage."

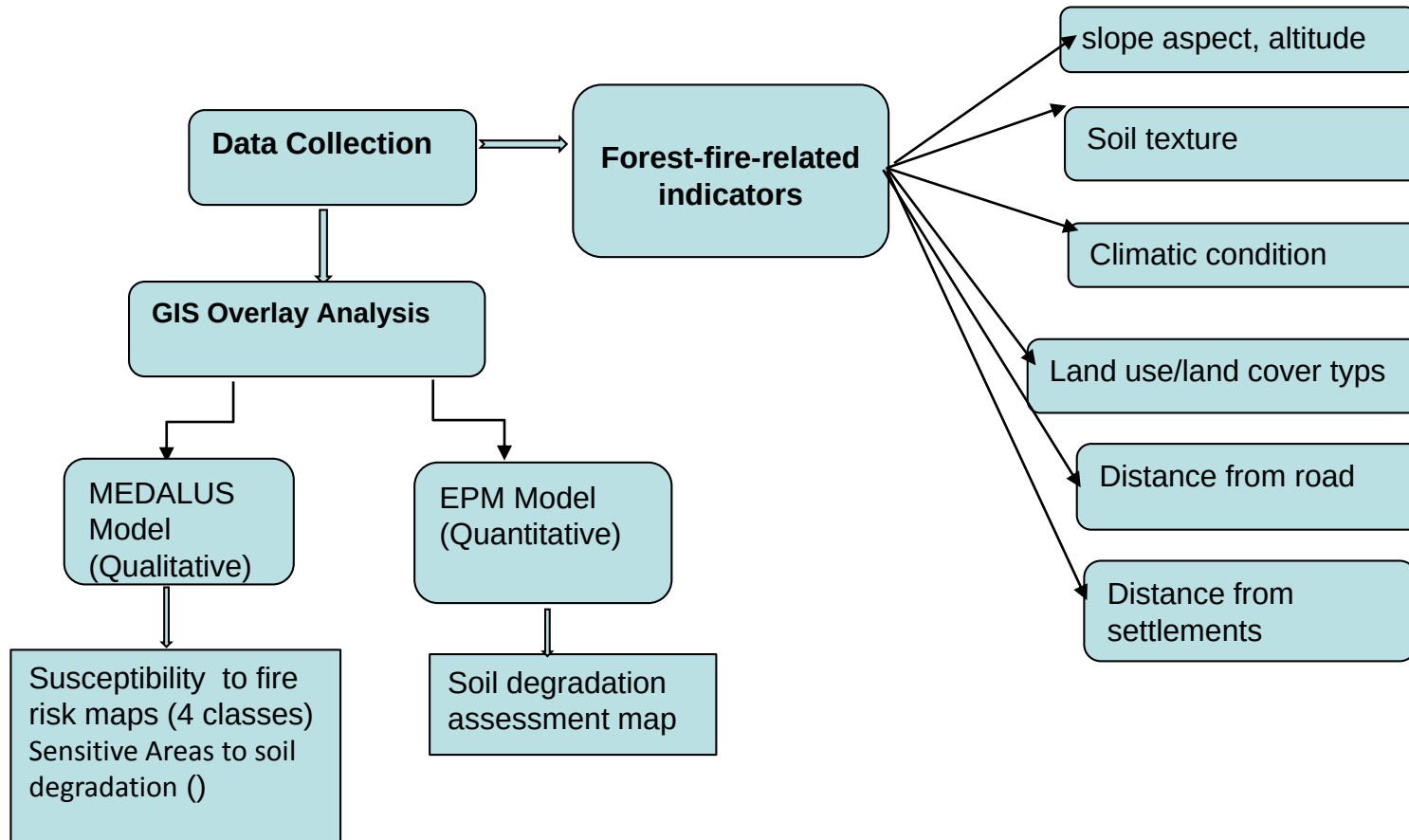


Distribution of the number of fires in the study area between 2014 and 2022

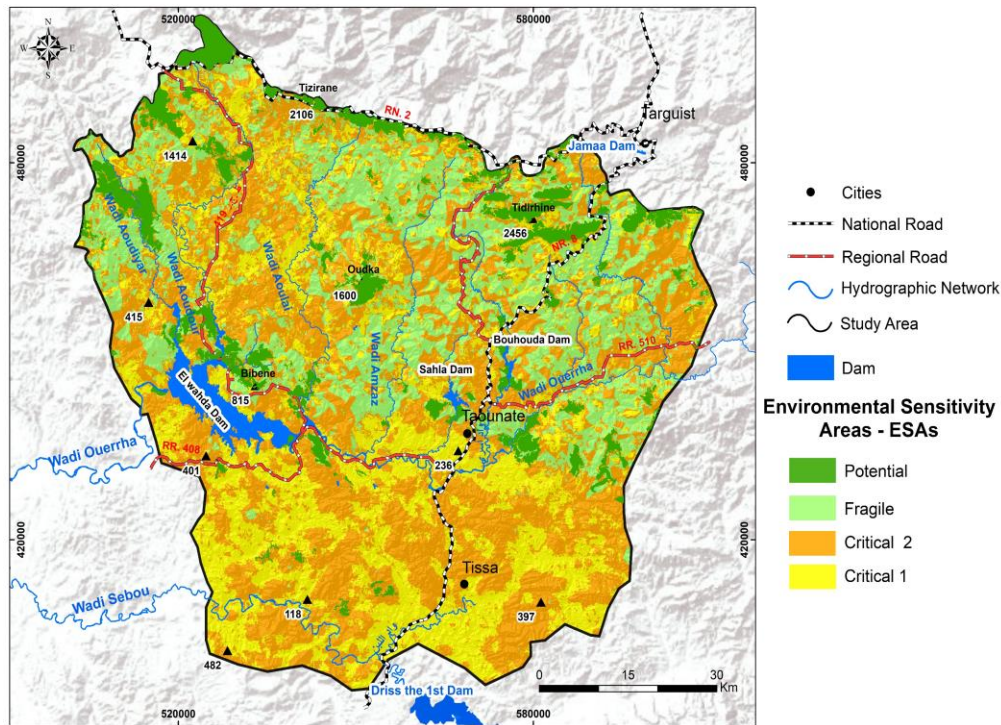
3. Forest fire risk impacts assessment on soil

The adopted methodology

Mapping areas at risk as well as highlighting their sensitivity to recurrent forest fires, and producing synthetic maps to assess the amount of sediment lost due to the decline in forest cover.



Soil degradation as result of forest decline



The study concluded that 40% of the studied area, is in a situation of very high sensitivity to degradation, leading to desertification.

28% are fragile areas, with all the indicators indicating that degradation is a threat unless measures are taken to reduce its further expansion.

Only 32% are potential, long-term threatened areas, but it is **highly sensitive to fire risk**

Map of Environmentally Sensitive Areas to soil degradation in the central Rif mountains

Oudka mountain

Pre-Rif zone near to Wadi Juma'a



The varying dynamics of forest in study area

Forest Mass	Reference Period	Deterioration Rate (% of forest area)	Hectares/Year
Wedka Mountain Forest	1962-2017	-37%	79
Arz Mountain Forest	1962-2017	-25%	36.18
Evergreen Oak Forest Asri Mountain	1962-1993	-14.95%	80.74

The forest has suffered the most significant decline, with a deterioration rate of 37% over **55 years** equating to an annual loss of 79 hectares. **This high rate indicates severe environmental pressures and significant degradation .**

The analysis considers three key areas: **Wedka Mountain, Arz Mountain, and the Evergreen Oak Forest Asri Mountain.**

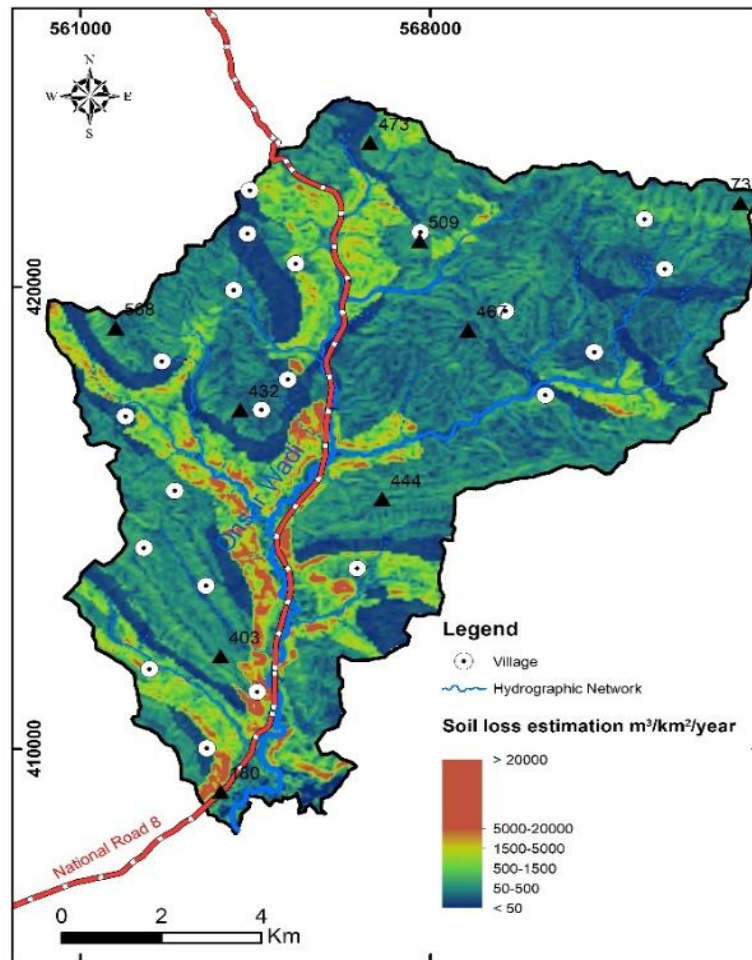
Highlights the spatial regression and alarming trends in **forest degradation** across different forest masses in study area.



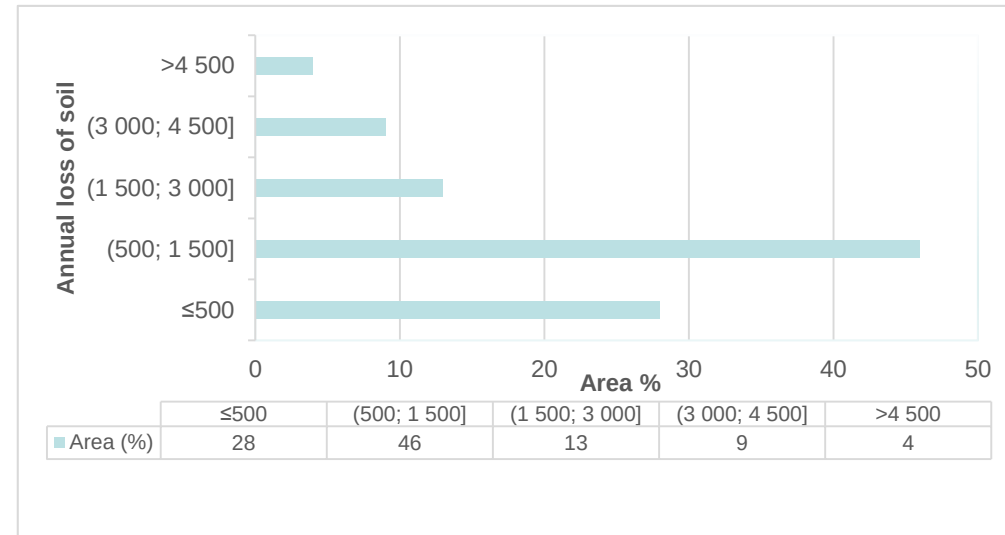
A example of a forest fire in the Jabal Wadka forest

5. Quantitative assessment of soil erosion using EPM

$$W = T \times H \times \pi \times \sqrt{Z^3 \times F}$$



Annual soil loss estimation



The estimation of the (EPM) Model has resulted in alarming values for the amount of soil loss in the Central Rif mountains area, with about 50% of the Oued El Ain basin in the Rif Front experiencing between 500 and 1,500 m³/km²/year of erosion.

The most productive areas of sediment in this area are the slopes that are experiencing significant deterioration, and the bare areas, which has increased the rate of abandonment of a number of these exploitations, as a result of their loss of agricultural productivity capacity.

Conclusion

- The fire risk is a results of the interaction of a set of natural and human factors leading to accelerating forest decline.
- Fire forest is very frequent during the last decades with dramatic consequences in soil erosion rates losses.
- The Pine forest and the inaccessible parts of dense forests have a high vulnerability to fire.
- Forest in central Rif mountains is frequently subjected to man-induced fires in order to obtain more agriculture land for Cannabis and grazing .
- The transition from natural forest to cultivation has a negative impact on the structural stability of the soil, on the physico-chemical properties and on the hydrodynamic behavior of the soil.
- Based on the soil degradation map produced, approximately 40% of the study area is considered in critical situation high sensitivity to degradation, 28% are fragile areas, and 32 % is a potential area vulnerable to degradation.



A photograph of a large fire burning in a forest. The fire is intense, with bright orange and yellow flames rising from the trees. Thick, dark smoke billows upwards, filling the sky. In the foreground, several tall, green pine trees are visible, some of which are partially obscured by the fire. A light blue rectangular box is overlaid on the image, containing the text "Thank you" in black, bold, sans-serif font. The box is tilted slightly to the right.

Thank you