

# Overgrazing accelerating soil erosion in northern Mexico

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Every year in the world an estimated 20 million hectares of arable land are rendered infertile simply owing to water-induced erosion. It is therefore crucial to understand how these processes arise in order better to protect the layer of a few tens of metres of fertile soil essential for plant growth and therefore for sustaining agriculture. In the North of Mexico, about ten years ago IRD teams studied the erosion phenomenon which affects this region where pastoral activities and tree felling aggravate the process.

As part of field studies conducted from 1993 to 2000 on the mountain crests of the western Sierra Madre and in the more arid regions in the south of the Chihuahua Desert, the scientific team established a soil classification according to climatic and topographic characteristics.

They used a rainfall index type hydrological model which gives real-time simulation of the humidity state of soil on the basis of a range of parameters including soil humidity, runoff rate, water storage capacity. This measurement method also takes into account the volume of rain collected at a given moment and the time lapsed since it fell.

This model, named NAZASM, with reference to the Rio Nazas drainage basin where it was first used in 1999, provides a means of classifying each soil type according to the processes that allow infiltration of water but also its runoff on the surface. From pine and oak forests of the Sierra's mountains, to the bare expanses of the Chihuahua Desert located at 1000 m altitude, the rainfall was determined, varying locally from

1000 mm to less than 200 mm.

The NAZASM model led to the assessment that only the drainage basins of the sub-humid zone of the western Sierra Madre had the capacity to let the rainwater pass through the soil before part of it could flow into water courses. The soil degradation associated with overgrazing could substantially reduce this storage capacity. In the other, arid or semi-arid type terrains studied, the soil infiltration capacity was most often lower than the rainfall rate. That is translated by the formation of runoff on the soil surface and this accentuates the process of water erosion.

Other more local-scale results presented by the same team showed that surface-type erosion, or sheet erosion, which applies to all the surface considered, was the cause of almost all the soil losses affecting the western Sierra Madre. The proportion of fertile land lost by flooding-induced gully erosion was estimated at 2% of total erosion, even though a large amount of the material dragged down from the mountain slopes themselves were in fact transported through the gullies so formed.

These original measurements suggest that, in this northern area of Mexico, it is the soils of all the drainage slopes that lose several millimetres every year. In this part of the country, with its steep slopes, this process was found to be the consequence of livestock's trampling of vegetation combined with the sheer intensity of rainfall events. The intense grazing pressure exerted by cattle, which eat mainly grassy and herbaceous plants, means that the unpalatable species that the livestock leave alone no longer have any competition and eventually take over the whole of the space. This overgrazing therefore causes the grassland ecosystem to be replaced by thorn scrub and pine, less effective for holding in place the fine layer of fertile soil. In the space of around ten years, pressure from ever-growing herds and tree-felling for timber have contributed greatly to changes in the landscape.

In the western Sierra Madre, practically all the pasture land located at 500 to 2500 m altitude are already degraded. Yet paradoxically it was in the valley bottoms where there was least rainfall that sheet erosion was most intense. These zones were also the site of the most degraded pastures and where runoff was strongest.

These observations provide scientists with a better understanding of the functioning of soil and the erosion processes in regions like northern Mexico where it is becoming especially intense. This type of approach offers a better way of assessing soil degradation. It should in the long term offer easier identification of the places most vulnerable to erosion and runoff, a capability useful for devising control measures to limit certain detrimental practices such as tree clearance or over-intense grazing practices.

Source: Institut de Recherche Pour le Développement

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