European Commission

Science for Environment Policy

November 2015
Thematic Issue 52

Soil and Water: a larger-scale perspective

Subscribe to free weekly News Alert

Source: Navarro Hevia, J., Carlos de Araújo, J. & Mongil Manso, J. (2014). *Assessment of 80 years of ancient-badlands restoration in Saldaña, Spain*. Earth Surface Processes and Landforms 39: 1563-1575. DOI: 10.1002/esp.3541

Contact:
jnahev@iaf.uva.es

Read more about:
Forests, Land use, Soil

Rejuvenating arid badlands: from barren slopes to living forest in 80 years

A reforestation project has revitalised its surroundings just 80 years after its inception. In the late 1920s, the Saldaña badlands in northern Spain were a barren region, with a thin layer of intensely weathered soil, and only 5% vegetation cover. Now that cover has increased dramatically to 87%, the soil quality is improving, and the water flow in the area has stabilised, bringing greater environmental security to the local community.

Badlands is a geological term for dry, eroded terrain, often featuring steep slopes, which is associated with landslides, **high rates of sediment disposal, minimal vegetation and concentrated runoffs that lead to flash flooding**. However, the Saldaña badlands were not always so degraded — in this case, it was not geological processes that made the terrain barren, but the cumulative impact of at least 18 centuries of human activity.

A recently published study of this region, which was supported in part by the European Erasmus Mundus 17 Programme, analysed historical documents, maps, photos, and video of the 3.17 km^2 area to create an account of how the badlands came to be, and conducted field analyses of the soil quality, vegetation cover and erosive processes to help determine the success of the reforestation project that started as recently as the 1930s.

Evidence suggests human presence on the landscape began around 12 000 years ago, but increased substantially during the time of the Roman Empire. Over the centuries, the combined pressures of war and agriculture led to intensive deforestation of the original forests. By 1472, populations downstream noted the negative effect that deforestation had on the quality of their water supply, but the situation continued to get worse, and by 1751, the slopes were described as a 'degraded mountain'.

In 1928, the forest restoration project, conducted by the forest engineer José Mª Ayerbe, was initiated. Between 1932 and 1936, 3 000 trees were planted per hectare, including Scots Pine (*Pinus sylvestris*), elm (*Ulmus campestris*) and acacia (*Robinia pseudoacacia)* species. Hundreds of check dams (small temporary structures across water channels, used to slow the water flow) and wattle fences (a traditional technique that weaves small branches between large sticks) were constructed to help slow the movement of water and sediment.

The first major socio-economic success of the project was acknowledged in the early 1960s. The Saldaña-Osorno road was frequently blocked by mud flows and landslides during heavy rains in the past, but the restoration project put a halt to these disruptive events. Further restoration work was carried out on the land in 1963.

Continued on next page.

European Commission

Science for Environment Policy

November 2015
Thematic Issue 52

Soil and Water: a larger-scale perspective

Subscribe to free weekly News Alert

Source: Navarro Hevia, J., Carlos de Araújo, J. & Mongil Manso, J. (2014). *Assessment of 80 years of ancient-badlands restoration in Saldaña, Spain*. Earth Surface Processes and Landforms 39: 1563-1575. DOI:10.1002/esp.3541

Contact:
jnahev@iaf.uva.es

Read more about:
Forests, Land use, Soil

Rejuvenating arid badlands: from barren slopes to living forest in 80 years *(continued)*

Desk and field analyses show that, since the turn of the century, the changes in the Saldaña badlands have produced substantial benefits. Forest vegetation now covers nearly the whole area, and evidence of soil regeneration is indicated by an increase in organic matter from leaf litter increased soil moisture, and the presence of species such as earthworms and fungal mycelium. The researchers found that sediment yield from the land diminished by three orders of magnitude compared with the 1940s, which helps to keep the nearby Carrión River free of suspended mud and silt. The rate at which water is absorbed into the ground is also 43 times greater on the forested slopes than bare slopes, greatly reducing the risks of flash flooding.

In addition, the biodiversity of the badlands is increasing. Species which can be found in established habitats of the region are now returning, including Pyrenean oak (*Quercus pyrenaica*), a local variety of wild peony (*Paeonia broteroi*), and the edible mushroom saffron milk cap (*Lactarius deliciosus*).

Although the landscape has shown dramatic results in its overall regeneration, analysis of the soil suggests that the recovery is not yet complete in terms of the evolution of the soil structure. Therefore pH, bulk density and erodibility of soils sampled from the vegetated areas are not significantly different than soils from the degraded areas. However, vegetation cover, leaf litter and check dams in the restored areas compensate for this and have arrested the most severe erosion processes.

Overall, the main objectives of the original restoration project seem to have been achieved. In under a hundred years, mass erosive processes have been drastically reduced, as well as their major consequences, such as landslides and mudflows. The researchers suggest that other landscapes with comparable problems could be recovered in a similar way.