

C1. Mediterranean desertification landscapes: forests/natural landscapes.

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1. Overview of Mediterranean forests, woodlands and shrublands.

In the Roman times, Mediterranean landscapes were categorised as *agro* (agriculture), *silva* (forest) and *saltus* (shrublands and sparse woodlands).

The forests of the Mediterranean basin are very diverse as a consequence of the great altitudinal gradient. From higher to lower altitudes their succession in altitude levels is characterised by: Sub-alpine conifer forests; mountain forests of deciduous hardwoods and conifers; sub-Mediterranean forests of deciduous and conifers; Mediterranean evergreen hardwoods and conifers; and finally, sparse woodlands in the lower and drier extreme of the range.

2. Historical changes in Mediterranean landscapes: The role of fire, grazing, cultivation and abandonment. The crisis of multifunctional rural landscapes.

Traditional Mediterranean landscapes in hillsides, are characterised by a mosaic of land uses.

Landscape has been multi-functionally and exhaustively used by rural population, who applied different forms and combinations of forms of land uses according to the socio-economical context of every period.

Diverse driving forces such as population growth, increase in wood and timber needs and significant expansion of grazing and cultivated fields, have led to over-exploitation and land degradation.

Forest burning was used to create and keep grass pasture lands, and fuel was obtained from shrubs and trees. Forests were especially degraded and the denudation of watersheds led to frequent flash floods and catastrophic damages.

This model of rural land use was dominant in the European Mediterranean countries until the middle of the twentieth century. Since then the development of industrial economies has led to a generalised process of rural abandonment, drastic reduction of grazing, and wood extraction and the subsequent spontaneous recovery of natural vegetation in former fields of pasture, agriculture and shrub. As a result of the increase of fuel load, Mediterranean landscapes are experiencing a dramatic spread of large wildfires since the last quarter of the XXth century.

3. The role of afforestation and reforestation in combating desertification.

3.1 Lessons from the past: The Mediterranean experience in forest-hydrology restoration

Already in the middle of the XIX century, naturalists and forest engineers realized and claimed on the extreme degradation of Mediterranean forests and its consequences of soil erosion and increase of catastrophic floods. The obvious solution pledged by them was to attempt to recover the forests, by the promotion of afforestation, particularly on the headwaters of torrential watersheds

Case studies (several sites from Spain, Greece, France, Italy and Portugal, - REACTION project)

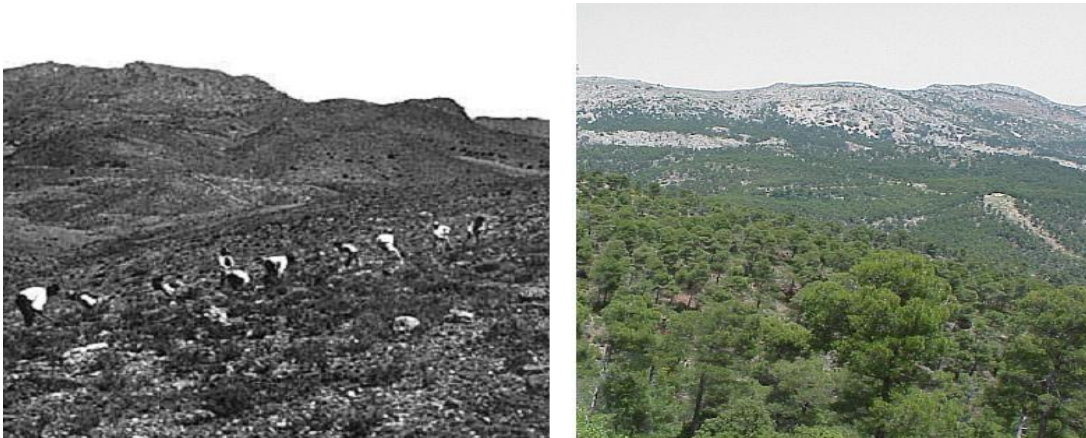


Figure X. Sierra Espuña afforestation. Left: works of tree plantation and general look of the site in 1895 (picture from the Regional Ministry of Agriculture, Water and Environment, Murcia Region); right: present situation (2004).

4. Modern strategies for forest restoration: Matching combating desertification with the conservation of biodiversity and the enhancement of carbon sequestration

During the last decades, the areas covered by forests (*silva*) and shrublands, (*saltus*), that we can refer jointly as “*wildlands*”, have experienced new demands together with new threats. The conservation of biodiversity and the sequestration of carbon dioxide are becoming the main objectives of *wildland* management, while fires and desertification are the main threats. This is accompanied by a parallel shift in the uses of *wildlands* from those focused on the exploitation of direct resources as timber, to those enjoying cultural and recreational values. Consequently, current strategies of forest restoration should give responses to those demands while preventing the present threats.

Principles of forest restoration:

- Prioritise soil conservation and water regulation
- Use of native species
- Promote biodiversity
- Promote landscape diversity
- Design reforestation according to fire prevention principles
- Enhance multifunctional uses of forests and their productivity

5. Mediterranean forests management and restoration approaches, technical opportunities and shortcomings

5.1 Managing natural regeneration after disturbances

In the Mediterranean climates disturbances of natural vegetation often require intervention to avoid irreversible land degradation, particularly on the abundant steep slopes. The most important and widespread disturbance in the Mediterranean forests are wildfires. Depending on the recovery capacity (resilience) of the ecosystems, restoration actions might be needed to control post-fire erosion and runoff, to control pests, and to

enhance secondary succession promoting higher quality and lower combustibility ecosystems. Introduction of target species can be direct, by seeding or planting, or indirect, through the facilitation of spontaneous regeneration and natural colonisation.

5.2 Seeding techniques

Emergency seeding to control erosion in fragile hillsides .Ground and aerial seeding of trees and shrubs.

5.3 Plantation techniques

The problem of seedling survival and growth in degraded sites. Techniques to overcome transplant shock: seedling quality (substrate, fertilisation, deep containers, drought preconditioning), soil preparation, soil amendments and tree shelters. The treatment of pre-existing vegetation.

5.4 Silvicultural treatments to help regeneration.

After disturbances, and especially after fire, tree regeneration is often limited by excessive intra- or inter-specific competition. Selection thinning and clearing treatments aims at helping natural regeneration.

5.5 Promotion of passive restoration.

The knowledge of limitations and factors which govern the dissemination and establishment of restoration target species will be analysed as a basis to promote or facilitate the natural regeneration of degraded areas. For example, burned poles may facilitate nesting bird activity in disseminating tree seeds on the burned stand.

5.6 Landscape approaches and considerations in restoration planning.

Reforestation actions should be deployed in the landscape attending plant species requirements for site quality, landscape impacts, landscape ecology principles (flows regulation, connectivity, patch size and form, landscape diversity) and fire prevention (green and cleared fuel-breaks, combustibility of patches).

Case studies: Demonstration projects of Albaterra and Picarcho (eastern Spain)
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6. Selected references.