# Restoration in the Mediterranean Overview of experiences mapped and lessons learnt

by Marc PARFONDRY, Carla AMONGERO & Nora BERRAHMOUNI

## From land degradation to restoration in the Mediterranean

Ever since the first human settlements in the Mediterranean basin, the region has been shaped by its diverse and vast ecological resources. Mediterranean forests have been no exception, as they provide a wide range of ecosystem goods and services. In fact, forests are of great economic, social and ecological significance: they are a source of resilience and of essential productive functions such as wood and non-wood forest products, (e.g. cork, nuts, medicinal plants, fodder) as well as protective functions: e.g. soil protection and combating water erosion.

However, Mediterranean forest areas are prone to desertification, land degradation and drought (FAO and Plan Bleu 2013), which makes them particularly vulnerable to the increasingly intense human pressure they have experienced over time. According to the FAO State of Mediterranean Forests (2013), only 5 % of the original vegetation remains relatively intact in the region. Between 1992 and 2009, the area of arable land decreased by 7 million hectares (13 %) in the Northern Mediterranean countries, and by 4 million hectares (9 percent) in the Southern and Eastern Mediterranean countries (FAO and Plan Bleu 2013). In the Northern Mediterranean, land degradation is often caused by land abandonment and forest fires (Vallejo 2005), while increasing demand for agricultural land, fuelwood and fodder (driven by population growth and national policies) are key issues in the South (Safriel 2009; Vallejo 2005).

## The Algerian Barrage Vert in the 1970s

In the 1970s, the Algerian government launched the ambitious "Barrage Vert" program with the objective to combat desertification by planting a strip of trees on an initial target area of 3 million hectares extending from its western to its eastern border. In the first phase of this programme, Aleppo pine was almost the only species used in reforestation and afforestation, in most cases, replacing the native steppe vegetation including the alpha grass *(Stipa tenacissima*) steppe ecosystems across the transhumance routes. Exotic species also were used. The local populations were poorly involved in this effort. As a result, poor growth and survival rates have been recorded (Bensaïd 1995; Vallejo 2005). Learning from the past, the Directorate General of Forests, has developed in the more recent stages of this ambitious programme, an integrated rural development approach, putting local communities at the center and using a broader range of native species adapted to the local conditions and ecosystems, and useful for local livelihoods.

It is expected that climate change will strongly affect the region, through increased mean temperatures and extreme weather events including heat waves, resulting in increased drought and forest fires (FAO and Plan Bleu 2013). If no action is taken, land degradation will cause major losses of the goods and services provided by these landscapes, with severe consequences on the environment, biodiversity and the economy, and in particular in jeopardizing rural livelihoods.

Restoration is widely acknowledged as a way of reversing degradation processes and increasing the contributions of ecosystems and landscapes to livelihoods, land productivity, environmental services and the resilience of human and natural systems (FAO 2015). "Restoration" efforts in the Mediterranean region were initiated by the end of the 19th century, while "impressive" results were obtained during the 60s and 70s (Papageorgiou 2003). Most efforts consisted of reforestation and afforestation of degraded land through monospecific large-scale tree plantations (mostly of Aleppo pine -*Pinus halepensis* - Safriel 2009), transplanting seedlings grown in nurseries. These initiatives were carried out as a response to fires, floods or windstorms, and focused on watershed protection and dune fixation (Vallejo 2005). The cases of Algeria and Spain, for example, offer relevant lessons for the future of Mediterranean forest and landscape restoration (see Boxes below).

## Afforestation in Spain after the Civil War

According to Chirino et al. (2009), in Spain, after the end of the Spanish Civil War (1939), the harsh economic situation of the rural communities and the lack of forest resources made it necessary to implement large afforestation programs. Plantation failures were frequent even though ecological and technical issues were taken into account when designing these programs.

As the main objective was to offer short-term employment and to afforest as large an area as possible, the large scale (up to 100 000 hectares per year) and very high plantation density (up to 5000 seedlings per hectare) of the initiatives made it difficult to manage them in a successful manner. In this case, coping with high unemployment rates and covering the need for timber primed over generating functional, well-developed forests.

## Preliminary mapping of Mediterranean initiatives

A number of rehabilitation and restoration initiatives have been implemented in the world's drylands with variable degrees of success, and these are an important source of knowledge that could be used to improve ongoing and future efforts. However, information on restoration and rehabilitation, including reforestation and afforestation initiatives is not always publicly available nor easily accessible. This makes it difficult to build on lessons learnt and knowledge of past experiences.

Accordingly, member countries of FAO requested the organization to conduct, with their collaboration and that of local and international partner organizations, a comprehensive analysis, evaluation and documentation of relevant afforestation, reforestation and restoration projects, programs and initiatives in drylands. A recommendation was also made to compile and share knowledge on restoration initiatives during the workshop on "Desertification and Restoration in Mediterranean Drylands" (Ankara, Turkey, October 2015).

In response to the request, FAO launched the "Drylands Restoration Initiative" (DRI) with the aim of capturing, evaluating and sharing knowledge on dryland restoration, based on the extensive experience accumulated in dryland restoration initiatives worldwide. Since the launch of this initiative, best practices and lessons learned have been collected and disseminated to support ongoing and future restoration initiatives. A first set of cases studies was published in 2015 as part of the FAO's "Global guidelines

for the restoration of degraded forests and landscapes in drylands – building resilience and benefitting livelihoods".

As part of the DRI, FAO has been compiling, analyzing and sharing knowledge/case studies on restoration worldwide and in the Mediterranean in particular. A preliminary mapping of past and ongoing restoration initiatives in the Mediterranean region was carried out based on an email consultation through the Silva Mediterranea network, combined with online research. It is important to note that this study does not claim to be an exhaustive assessment of all the initiatives in the Mediterranean.

Data was compiled on a total of 40 restoration and rehabilitation initiatives in 13 Mediterranean countries, and analyzed in terms of the initiatives' (i) lead organization, (ii) main donor(s), (iii) timeframe, (iv) type of initiative (research or pilot project, national forest programme, etc.), (v) area covered (i.e. number of hectares restored), (vi) main causes of degradation, and (vii) main restoration measures (planting, assisted natural regeneration, soil and water management and protection, etc.) The map below (figure 1) indicates the location of each mapped initiative.

## Preliminary mapping results

**1. Scale and type of initiatives.** A very large part of the initiatives analyzed consisted in small-scale (less than 100 hectares) projects, including research and pilot or demonstration projects led by (or carried out in collaboration with) research organizations. In fact, about half of all initiatives where the intervention area was indicated (18 out of 34) covered an area smaller than 100 hectares. On the other hand, large scale programs (10.000 hectares and above) were very few (4 out of 40 initiatives – in Turkey, Algeria and Lebanon), all led by governments at national level.

**2. Causes of degradation.** All the projects analyzed mentioned multiple, and often interlinked causes of degradation. In Northern Mediterranean countries the most frequently occurring causes of degradation were water erosion, fire, natural dieback, and mining, whereas unsustainable grazing or agricultural practices, overharvesting of wood products and water and wind erosion were more frequently mentioned in the initiatives of Southern Mediterranean countries.

**3. Measures.** Whatever the type of land degradation occurring, tree planting is by far the main approach used in these initiatives. Other types of activities, such as land protection (e.g. through fencing), soil and water management or removal of invasive species are often carried out, but almost always in combination with seeding and planting. Efforts to address the root causes of degradation (which are often of a socio-economic nature) are rarely mentioned.

**4. Funding.** Most projects are financed through environmental funds, the EU being one of the main donors in Northern Mediterranean countries. Development cooperation (development finance institutions such as the World Bank, and technical cooperation agencies) also accounts for a number of restoration and rehabilitation projects, as well as state budgets and resources, and non-governmental funding (NGO's and foundations). Other less-frequent types of funding include research grants, private sector funding as well as non-traditional funding.

## Lessons learnt

The compilation and preliminary analysis of rehabilitation and restoration experiences in the Mediterranean illustrate the shift from large-scale monospecific afforestation (e.g. in Spain and Algeria) to more holistic

2 - Available at www.fao.org/3/a-i5036e.pdf

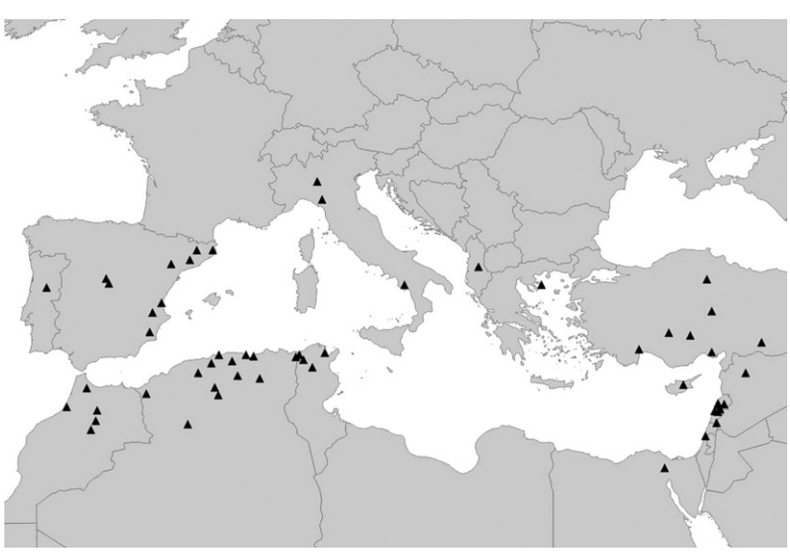
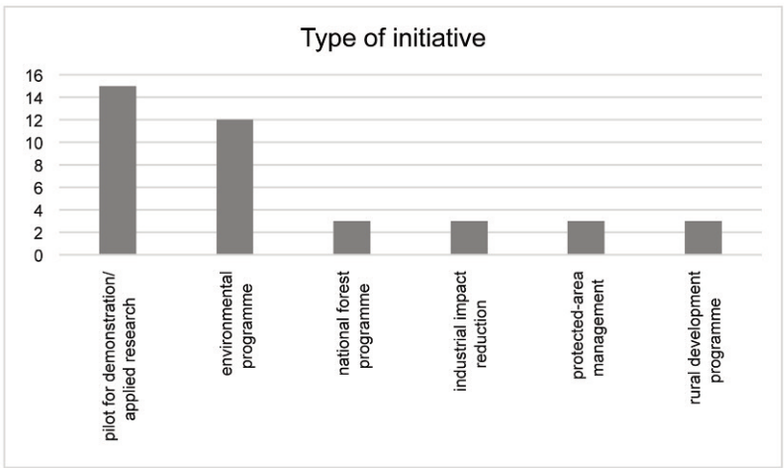
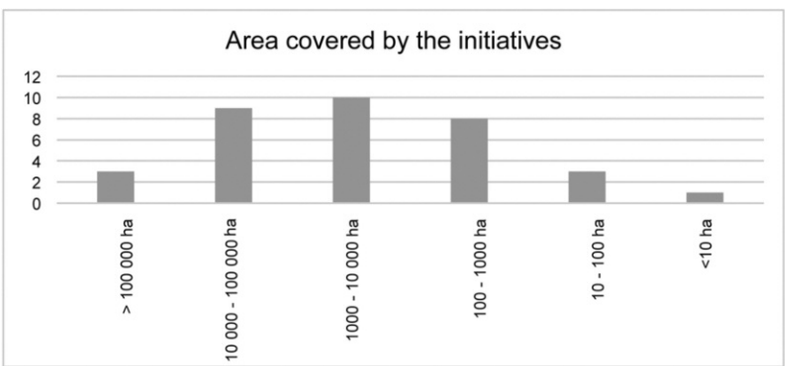


**Figure 1:** Restoration and rehabilitation initiatives mapped. © *Alexis Bary.*








approaches and diverse initiatives. This trend, also mentioned by VALLEJO (2005) reflects a new perception of nature in the European Mediterranean countries and the need for forest managers to respond to a broader range of objectives and demands, including recreation, biodiversity, cultural and landscape valuation, along with climate change adaptation and mitigation.

This review sheds light on a number of key issues which can be translated into recommendations. These are in line with those developed in the "Global guidelines for the restoration of degraded forests and landscapes in drylands: building resilience and benefitting livelihoods" published by the FAO in 2015. They include:

**Choosing the best (and most cost-effective) restoration strategy**

While diverse strategies are increasingly being implemented, tree planting remains the most commonly used measure for restoration. Recent studies indicate that reforestation is often an inadequate and sometimes inappropriate approach in the complex Mediterranean landscapes (PAPAGEORGIOU 2003). In many cases, it needs to be combined or replaced with protection and management activities. In the cases where planting is necessary, direct seeding may be used as an alternative to nursery-produced seedlings which may require a higher investment.

**Selecting the right species for the right place**

In general, species and genetic diversity should be maximized to increase resilience given the uncertainty of future climate regimes and the limited knowledge of the performance of many species. High intra- and inter-specific as well as habitat diversity are likely to provide a wider range of options to cope with environmental change, thus increasing resilience. Furthermore, while most restoration initiatives only consider trees, the planting of shrubs and grasses also should be promoted. It is important to plan the approach and species to use based on a good understanding of the natural ecosystems, avoiding the use of inadequate vegetation types (e.g. planting trees in ecosystems where trees are not part of the natural vegetation).

**Favoring the use of native species**

Whenever possible, native species should be used in restoration initiatives. They are generally the most adapted to the local ecological conditions in which they have evolved naturally, and they are most suitable for the natural re-establishment of native flora and fauna species. Moreover in the Mediterranean native species have often multi-purpose socio-economic and cultural uses and values.

**Using appropriate genetic material**

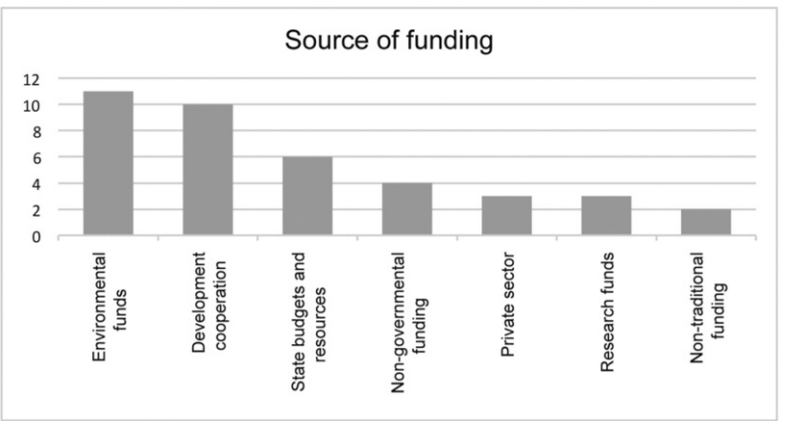
Propagation material should be matched to the environmental conditions and, to the extent possible, to the future conditions of the target site. Seeds from local populations are not always the best option: where local populations are genetically impoverished or too degraded or fragmented to constitute good sources of seed for restoration, seeds from other sources that are growing under similar ecological conditions (or expected to be similar in the future) may be a better choice in terms of climate change adaptation. In this regard, marginal and peripheral forest genetic resources have been highlighted as key resources for the resilience in the adaptation to climate change (Bastianelli *et al.*, 2016) and should be promoted in restoration initiatives in the Mediterranean.

**Sustainability**

Restoration should not be treated solely as a technical matter as it can only be sustainable when supported by a strong enabling environment. In most of the case studies analyzed, the strategy adopted consisted in single measures (i.e. tree planting) addressing only the direct causes of degradation (e.g. erosion). However, in many cases, the root causes (i.e. the drivers of degradation) were not addressed, and these are often of a governance or policy nature. The lack of intersectoral coordination is a recurrent issue, for example competing environmental and social or economic policies. Furthermore, long-term planning is also needed to ensure sustainability. Many of the initiatives analyzed were in fact ad-hoc projects with short to medium term objectives rather than a long-term perspective. Finally, integrated approaches that are planned within the broader landscape context rather than at stand level, and addressing the needs of all stakeholders and a broader range of issues (such as poverty reduction, biodiversity, etc.) have shown more sustainability.

## Conclusion: gaining and sharing knowledge

From large scale afforestation to applied research and pilot restoration projects, a number of initiatives have or are being carried out in the Mediterranean basin, with different degrees of success. In the complex and diverse Mediterranean landscapes, the "classical" reforestation or afforestation approach is often not the most appropriate nor sustainable approach, and it has shown its limitations. However, valuable lessons can be learnt from all these initiatives to enhance restoration efforts at national and regional levels. Given the vulnerability and the different threats that Mediterranean forests and landscapes are facing, lessons learnt from these experiences urgently need to be translated into large-scale initiatives with a long term focus. Such programmes are still very few in the Mediterranean region.




At the same time, this preliminary exercise has shown that comprehensive information on restoration and rehabilitation initiatives is still difficult to access. Knowledge and experience sharing is crucial if restoration efforts are to succeed on a large scale. Restoration initiatives must have a strong monitoring component included in an adaptive management strategy, along with systematic capitalization of lessons learnt, knowledge sharing and dissemination of best practices, and networking among practitioners. To support such capitalization efforts, FAO has developed the Drylands Restoration Initiatives Platform (DRIP), a tool to support practitioners, project managers, policy-makers and decision-makers in compiling and analyzing data and capturing and sharing lessons learned from restoration initiatives, thus advancing the monitoring and assessment of these initiatives globally. DRIP was developed and tested with the

Marc PARFONDRY
Carla AMONGERO
Nora BERRAHMOUNI
FAO

marc.parfondry@fao.org
cm.amongero@gmail.com
nora.berrahmouni@fao.org

active participation of dryland restoration experts and practitioners worldwide. The platform will be operational shortly.

**M.P., C.A., N.B.**

## References

Bastianelli C., Ducci F., Fady B., Alizoti P., Cavers S., Picard N., Garavaglia V., 2016. Marginal and Peripheral Forests: A Key Genetic Resource for Enhancing Tree Resilience of European Forests to Global Change. Policy Brief. COST Action FP1202 Map FGR. Available at: www.fao.org/forestry/44385-0d0f329cc9c7563f42f3417c43caf23b3.pdf.

Bensaïd, Sahraoui. 1995. "Bilan Critique Du Barrage Vert En Algérie." Secheresse 6(3):275–255. Retrieved June 7, 2017. http://alger-roi.fr/Alger/agriculture_algerienne/textes/4_barrage_vert_mythe.PDF.

Chirino, E. et al. 2009. Ecological Restoration in Degraded Drylands: The Need to Improve the Seedling Quality and Site Conditions in the Field. NOVA SCIENCE PUBLISHERS, INC, 400 OSER AVE, STE 1600, HAUPPAUGE, NY 11788-3635 USA. Retrieved March 21, 2016 http://apps.webofknowledge.com/full_record.do?product=UA&search_mode=GeneralSearch&qid=4&SID=Q1qhdGD36G4slQtpf2r&page=1&doc=1.

FAO. 2015. Global Guidelines for the Restoration of Degraded Forests and Landscapes in Drylands - Building Resilience and Benefiting Livelihoods. FAO Forest. by N. BERRAHMOUNI, P. REGATO, and M. PARFONDRY. Rome, Italy: Food and Agriculture Organization of the United Nations.http://www.fao.org/3/a-i5036e.pdf

FAO and Plan Bleu. 2013. State of Mediterranean Forests 2013. Rome, Italy. Retrieved February 16, 2017. http://www.fao.org/docrep/017/i3226e/i3226e.pdf.

Papageorgiou, A. C. 2003. "Forest Landscapes in a Mediterranean Context." Pp. 1–11 in Forest Landscape Restoration in the Mediterranean – Thinking Beyond the Traditional Forest Conservation Box (CD-ROM proceedings). Castellabate, Spain: IUCN Centre for Mediterranean Cooperation.

Safriel, U. N. 2009. "Status of Desertification in the Mediterranean Region." Water Scarcity, Land Degradation and Desertification in the Mediterranean Region 33–73.

Vallejo, R. 2005. "Restoring Mediterranean Forests." Forest Restoration in Landscapes 313–319. Retrieved http://www.springerlink.com/index/hm515858p5505563.pdf%5Cnhttp://crs.itb.ac.id/media/jurnal/Refs/Download/Forest Restoration in Landscapes - S.Mansourian, et al., (Springer, 1986) WW.pdf#page=321%5Cn http://link.springer.com/chapter/10.1007/0-387-29112-1_4.

## Summary

Restoration and rehabilitation efforts have been undertaken for decades in the Mediterranean region and with different degrees of success. Nevertheless, they all offer valuable lessons onto which other initiatives can be built, thus improving their success. As part of its effort to compile and analyze data and share lessons learnt on restoration, the Food and Agriculture Organization of the United Nations (FAO) has been collecting data on Mediterranean restoration and rehabilitation, including reforestation and afforestation, projects, programmes and initiatives. Based on an online consultation and desk research, a preliminary mapping allowed to compile and analyze data from a total of 40 restoration and rehabilitation initiatives in 13 Mediterranean countries. These initiatives were analyzed in terms of their objective, scale, type of stakeholders involved, type of land degradation and main measures taken, and sources of funding. The results highlighted some key issues, which were then translated into recommendations to support restoration practitioners and decision-makers. These recommendations focus on the choice of the best restoration strategy, the choice of the most appropriate (native) species and genetic material, as well as some key elements to ensure the long-term sustainability of these initiatives.