Acta Scientifica Naturalis

Former Annual of Konstantin Preslavsky University of Shumen: Chemistry, Physics, Biology, Geography

Journal homepage: <https://content.sciendo.com/view/journals/asn/asn-overview.xml>

Contribution of ecological restoration in preservation of forests ecosystems in Algeria

Aman Bouzid^{1*}, Khéloufi Benabdeli², Benamar Belgharbi², Khadidja Bouzid³

¹ University of Mostaganem, Faculty of Sciences and the Natural Sciences and Life, BP300,

Mostaganem 27000, Algeria

² Laboratory of Geo-Environment, University of Mascara, Algeria

³ Graduate School of Agronomy, Mostaganem, Algeria

Abstract: *Under the combined effect of anthropogenic pressures and climate change, forest ecosystems can no longer play their ecological and economic role if nothing is done to adapt them. The impacts of fires, overgrazing and overexploitation are that over 60% of forest ecosystems are in an advanced stage of degradation. It is in this context that a new strategy focused on ecological restoration must be quickly put in place. It must be based on ecological alternatives designed to adapt the composition and structure of these plant formations to environmental conditions. The concept of stable species, living space, keystone species, natural attributes and habitat identification. The ecological restoration proposed will allow preserving the vegetal cover at first time and then developing the species with resilience through a list of species that could develop under different pressures, both natural and anthropogenic.*

Keywords: anthropogenic pressures, forest ecosystem, ecological restoration, tools, Algeria

Introduction

The preservation forest ecosystem is an obligation for an arid country like Algeria, which is both ecological and economic. Global warming is a reality in the same way as fires and overgrazing whose impacts on all forest ecosystems are worrying. It should be stressed that 21 million hectares receive rainfall between 100 and 600 mm, where is concentrated over 75% of the forest area. The exploitation of data on the

characteristics of forest ecosystems in Algeria confirms the ultimate stage of degradation. In 4.2 million hectares of forest, plus 3 million hectares are only degraded formations (matorrals, maquis and low formations) that must be rehabilitated before sustainable development.

Ecological characterization of forest ecosystems

The main features characterizing the Algerian forest can be summarized as follows:

- An essentially light forest, irregular, with hardwood stands or resinous usually open trained trees of all sizes and ages sometimes messy mixture;
- Presence of a thick undergrowth composed of a large number of secondary species limiting visibility and accessibility and favoring the spread of fire;
- Low average yield of woody volume;
- Existence of significant overgrazing (especially in cork oak) and encroachment on forest areas by local populations.

Algerian forest covers about 4 million ha or less than 2% of the land area. The real forest represents only 1.3 million hectares, the rest (2.8 million hectares) consisting of scrub.

Since independence, the Algerian institutions responsible for the preservation and extension of forest formations are secured to reforestation. In half a century, all actions have been unsuccessful except for some sporadic and localized successes. A simple comparison between 1960 and 2010 of the areas of major forest and steppe formations reveals a quantitative average regression of more than 20% and disturbing qualitative. Forests in the strict sense represent only 1 million hectares of the 4,300,000 ha where successful reforestation is only 750,000 ha on the 3 million hectares reforested [1].

Faced with this alarming situation, the implementation of a strategy is necessary and should take advantage of feedback to avoid errors in all reforestation actions since 1962. To achieve this, simply answer two questions:

- What ecological restoration strategy should be?
- Then what restoration ecology should we adopt?

Two fundamental questions that must be answered through an approach focused on a real and objective diagnosis that can only be done through a hazard and risk assessment matrix.

Forest ecosystems in Algeria face almost permanent pressures.

Problematic

Since the 1970, this ecosystem is highly threatened primarily by human pressures characterized by overexploitation and overgrazing assisted by frequent and repeated fires. This discouraging situation is also

supported with a significant average decrease in annual precipitation estimated over a period of 50 to 87 mm and an increase in average temperature of 0.7°C. Faced with this alarming situation, the implementation of a strategy is necessary and should take advantage of feedback to avoid errors in all development activities undertaken since 1962.

“Forests and scrub cover 4.3 million hectares (in 1830 the area was of the order of 5 million hectares), equivalent to an afforestation rate of 16.4% in the north of Algeria. Strictly-speaking, the forest covers only 1.249 million hectares, including 424,000 hectares of planted forests” [1]. In Algeria the forest formations in pseudo-balance with their environment, there are only fairly advanced stages of degradation threatening in the near future these ecosystems. In this regard [2] notes: “Two thirds of the 3 million hectares of forest formations are incomplete, degraded and poorly used formations resulting in reduced production capacity and generally limited to firewood. Only through appropriate development will it be possible to make these courses profitable and ensure their sustainability”.

Constraints analysis major

Algerian forest appears as a plant formation of which the trees are in state of continual fight against drought (several consecutive dry months of summer). Considering all the historical elements that mark it and exerted pressure constantly on it man and cattle, the forest appears to be heading rapidly towards a progressive deterioration of the main species and its replacement by the scrub and brush whose role is nevertheless extremely important for control and setting ground floors to steep slopes.

The climate

The works of [3-6] confirms the decline in rainfall at 25%. It also features a large interannual fluctuation sometimes several consecutive years of persistent drought. Temperatures in general, regularly changed from the beginning to the end of the last century. Remains a substantial increase of 1 to 1.5°C in winter and 2°C in summer is identified during the last century.

Development plans

The management techniques and forestry are totally absent in the management of forest ecosystems. The complexity of the forest formations and the lack of typology of stands and formations constitute a major obstacle that does not allow for any suitable silviculture or management. The ecological ignorance of the forest ecosystems and the lack of control of the various anthropic pressures make that since independence algerian forest formations have many problems both theoretically and practically. Their heterogeneity both floristico-structural and bioclimatic does not simplify things. "No general pattern cannot reasonably be

proposed" stressed [7]. The Algerian forest was excluded from the effort of reflection on the management and the development because its economic interest seemed negligible to the managers.

Methods and data analysis techniques

The main actions in development are summarized delimitation stands on major state maps at 1/50,000th through interpretation of aerial photo with all the inaccuracies that result.

On the basis of these maps, management operations have been proposed by plot and by series and consist of restocking, reforestation and strip clearing operations. The main aim of development plans was to establish technical data to launch intervention projects and especially wood exploitation to deliver 3 units installed.

Pre-development

Another unrealistic development oriented action cutting forest space by bands of 4 m wide at 300 m allowing to have 10 ha plots followed by a partition 3m wide all 25 m. An infrastructure consisting of runway and road platform is installed resulting in a total destruction of more than 40% of already sparse and degraded vegetation leaving bare ground.

Proposed strategy

The report on the measures to be taken in the face of climate change initiated to the United Nations Framework Convention and that of Algeria's national plan for the environment and sustainable development, the Directorate General for Forests emphasize for the forest sector: "The protection and extension of forests are two essential means to combat desertification, erosion and the protection of agricultural land downstream of forests, the reduction of siltation of dams, the protection of road infrastructure, the development of fauna and flora, infiltration of water storage and creation of microclimates. The action plan on forests concerns the intensification of reforestation in carrying the present area of 20 000 ha to 40,000 ha per year".

What to do to save the forest area?

The stability, resilience and biological production rate of forest ecosystems are key elements to support in any development. To be sustainable, it must be based on their ability to maintain the functions, ecological processes and their ability to continue. "To set up a forest is to decode what one wants to do with it, considering what can be done and what to do with it, sums up the concept of such a vast development".

Ecological restoration

In addition to setting clear objectives for restoration through monitoring indicators that can provide information on the attributes of the ecosystem to be restored and / or the ecological path chosen. Ecological restoration of degraded forest areas is a difficult undertaking, requiring a global and long-term structure, diversity, functioning and dynamics of the target ecosystem. For this purpose, a diagram of the ecological processes allowing the success of the restoration must be drawn. It details the two main phases of restoration (rehabilitation and support of rehabilitated ecosystems) and the various stages of the forest ecosystem (degraded stage, rehabilitated, objective). Actions of the restorer are opposing the degradation process and undertaking a process of ecological restoration. Three ecological stages can be distinguished: degraded ecosystem, rehabilitated ecosystem objective ecosystem. The ecology of restoration is above all, of course, a canvas for reflection and action [8], but it is also a special means, an approach based on knowledge of the ecosystem. Ecological restoration is essential before any development, the strategy is based on:

- The most direct and easiest to handle cases are the evaluations of the ecological importance based on what species affects the structure and function of the ecosystem.

ITTO/IUCN [9] has developed a restoration methodology for degraded forest ecosystems to better understand management interventions. Based on the recommendations by Aronson [10], it is possible to focus on the strengths of a strategy.

- The species that provides a three-dimensional structure important for biodiversity and productivity.
- Global attributes of the ecosystem that are themselves essential to maintaining the structure and function of the ecosystem.
- Species or groups of invasive species that may pose a threat to the structure and function of the ecosystem and may require improved management of their ecological significance, management that governs their abundance and their distribution and not to protect and enhance them.

Variety of interesting species

A classification of the species without distinction of strata, according to their presence and resistance to the conditions of the medium gives the following results based on the stability index defined by [2] puts in first position several species of the sub-shrub and shrub layer. Such as *Pistacia lentiscus*, *Phyllirea*, *Quercus coccifera*, *Genista*, *Calycotome*, *Chamaerops*, *Stipa tenacissima*, *Rosmarinus* long before the forest species like *Pinus halepensis*, *Quercus suber* etc. Then the choice of adaptable and profitable species is allowed in front of this ecological forest and socioeconomic situation which can be described as disastrous. In this choice all perennial plant species are accepted.

Approach based umbrella species concept

This is the concept of umbrella species [11, 12], these are species whose important requirements are expected to encompass the less extensive requirements of a set of species. They allow understanding the response of a variety of species to the restoration. The concept of umbrella species is still useful but should therefore be included in a multi-taxonomic approach identifying a set of species (focal) whose spatial, compositional and functional requirements include the requirements of all other species of a region [13]. It is this last notion that has been retained in our approach.

A keystone species

These are species whose presence, at a sufficient density, is necessary to maintain the structure and functioning of the ecosystem. The concept, which was first used in the work on conservation biology, also seems suitable for ecology restoration and rehabilitation. The attempt to reorientation the trajectory of a degraded ecosystem may be facilitated by the careful reintroduction, or increase in density, of keystone species and when necessary by the eradication of introduced "alien" species intentionally or inadvertently [14].

Keep priority natural attributes

It is always more efficient to maintain existing natural attributes than to restore them. When in a management unit, portions of territory represent remnants of natural forest, every effort should be made to keep it the desired attributes. For example, pre-industrial coniferous forests generally had a high proportion of stands with a complex internal structure that became scarce under management regimes. Detect stands (or mass) that still have complex internal structures allows setting quantitative targets and defining geographically. This target type is usually in the context of an ecological restoration plan.

Based approach habitat requirements of focal species

The approach by degrees of alteration is mainly based on knowledge of the attributes of the natural forest as a state reference for establishing development targets. Although the idea of using natural forest as a crude filter¹ to maintain biodiversity is the basis for ecosystemic management, pproach by degrees of alteration cannot, by itself, make any guarantees that biodiversity is effectively conserved. It is important to use the same time the knowledge of species habitat requirements for consolidation. Both approaches should be used concomitantly. The knowledge of species habitat requirements provides additional information that is essential to a validation of the raw filter [15]. In verifying whether different species find the conditions for their maintenance within the targets set by the approach by degrees of alteration, it is possible to correct any

identified deficiencies or choose to pay particular attention species problems .Moreover, some attributes of the natural forest are sometimes difficult to quantify (ie. Size massive, quantity and characteristics desired of dead wood...). Knowledge about the habitat requirements of species becomes very useful in determining targets and quantitative thresholds for certain attributes of the forest. For example, it is sometimes easier to establish dead wood retention targets considering the needs of species such as woodpeckers, rather than attempting to describe all the variability of this attribute in the natural forest.

Identification of degrees of alteration

Three degrees of alteration are used:

- Low: deviations from the historical average are low and ecosystems are likely within the bounds of natural variability, biodiversity loss risks are very low.
- Moderate: deviations from the historical average are larger, but are above a warning threshold. The alert threshold is defined as the minimum proportion of habitat to be preserved in a landscape, proportion below which a viable population cannot be maintained for sensitive species [16]. With such a degree of weathering, the conditions are close to the natural state and the risks to biodiversity are considered moderate.
- High: deviations from the historical average are large, below the warning threshold, and are likely outside the bounds of natural variability. The risks of biodiversity loss are high. Old forests represent only 30% of the historical average.

Threshold identifying

The response of species to disturbances in a territory is not directly proportional to the loss of habitat. Decreasing a quantity of habitat does not automatically affect the species' ability to occupy a territory. However, when a certain threshold is exceeded, the fall can become significant, the numbers of a population, or the number of species in the case of communities, even going to extinction locally [9]. The challenge is to establish safe limits and define degrees of alteration that control risks to biodiversity in a sustainable economy.

Maintaining ecological attributes still at historical averages do not reflect the changes that ecosystems so familiar and constitute a disproportionate economic constraint compared to actually risk. The definition of degrees of alteration provides an approximation of historical fluctuations until scientific knowledge can provide a more complete basis for estimating the extent of natural variation.

Conclusion

Whatever saying policies, Algerian forests are primarily conservation training that are essential in maintaining biodiversity and ecosystem resilience. They also contribute to several ecological issues and in particular to serve as natural spaces that contribute significantly to the socio-ecological balance of a territory. They can and must play a pedagogical role since they can serve as witnesses to the natural dynamics of ecosystems. The Algerian forests are a source of teaching about the natural evolution of ecological processes animal and plant populations, they validate the approach deployed on the developed territory by serving as a reference.

The pressures on forest ecosystems cannot be properly cared for if they are integrated in their geographical context and this is the subject of this communication.

Heterogeneity in structure and composition imposes a new approach based on the concept of landscape. This division seems to be the most reasonable because it relies on entities imposed by geo-environmental parameters. This approach should make it possible to identify homo-ecological zones based on geographical elements (physical and human).

References

- [1]. Meddour-Sahar, O.; Derridj, A. Bilan des feux de forêts en Algérie: analyse spatio-temporelle et cartographie du risque (période 1985-2010). *Sécheresse*, **2012**, 23, 133-41.
- [2]. Benabdeli, K., Mise en évidence de l'importance de la formation basse dans la sauvegarde des écosystèmes forestiers: cas des Monts de Dayas (Algérie occidentale). *Ecologia Mediterranea*, **1996**, 22(3/4), 101-112.
- [3]. Hirche, A.; Boughani, A.; Salamani, M., Évolution de la pluviosité dans quelques stations arides algériennes. *Science et Changement Planétaire/Sécheresse*, **2007**, 18(4), 314-20.
- [4]. Meddi, M.; Talia, A.; Martin, C., Evolution récente des conditions climatiques et des écoulements sur le bassin versant de la Macta – Nord Ouest de l'Algérie. *Revue Physio-Géo*, **2009**, 3, 61-84.
- [5]. Meddi, M.; Meddi, H.; Toumi, S., Mehaiguen, M. Regionalization of rainfall in North-Western Algeria, *Geographia Technica*, **2013**, 1, 56- 69.
- [6]. Meterfi, B.; Letreuch, N.; Benabdeli, K., Incidence de la fluctuation des précipitations sur l'occupation des sols dans les hautes plaines de Sidi-Bel-Abbès (Algérie). *Physio-Géo*, **2011**, 5, 191-210.
- [7]. Quézel, P., Les forêts du pourtour méditerranéen. In «Matorrals» méditerranéens et «Chaparrals» californiens. Quelques aspects comparatifs de leur dynamique, de leurs structures et de leur signification écologique. *Ann. Sci. forest.*, **1976**, 36 (1), 1-12.

- [8]. Wyant, J.G.; Meganck, R.A.; Ham S.H., The need for an environmental restoration decision framework. *Ecological engineering*, **1995**, 5, 417-420.
- [9]. ITTO/IUCN, Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests. **2009**.
- [10]. Aronson, J.; Floret, C.; Le Floc'h, E.; Ovalle, C.; Pontanier, R., Restoration and rehabilitation of degraded ecosystems in arid and semi-arid regions. A view from the south. *Restoration Ecology*, **1993**, 1, 8-17.
- [11]. Caro, T.M., Umbrella species: critique and lessons from East Africa. *Anim. Conserv.*, **2003**, 6, 171-181.
- [12]. Frankel, O.H.; Soulé, E., Conservation and evolution. Cambridge, United Kingdom: Cambridge University Press, **1981**, Volume 16, Issue 4.
- [13]. Lambeck, R.J., Focal species: a multi-species umbrella for nature conservation. *Conserv. Biol.*, **1997**, 11(4), 849-856.
- [14]. Simberloff, D., Reconstituting the ambiguous-can islands be restored? In: Towns, Dougerthy, Atkinson, eds. Ecological restoration of New Zealand islands. New Zealand Depart. of Conservation, Wellington. **1990**, 37-51.
- [15]. Drapeau, P.; Leduc, A.; Kneeshaw, D.; Gauthier, S., Paramètres à considérer pour le suivi de l'approche écosystémique dans une perspective d'aménagement adaptatif en pessière à mousses in Aménagement écosystémique en forêt boréale. (Gauthier, S. and Vaillancourt, M.-A. and Leduc, A. and De Grandpre, L. and Kneeshaw, D.D. and Morin, H. and Drapeau, P. and Bergeron, Y., Eds.) Québec, QC, Canada, Presses de l'Université du Québec. **2008**, 361-392.
- [16]. Rompré, G.; Boucher, Y.; Bélanger, L.; Côté, S.; Robinson, W.D., Conserving biodiversity in managed forest landscapes: The use of critical threshold for habitat. *Forestry Chronicle*, **2010**, 86(5), 589-596.