

## **ASSESSMENT AND DIAGNOSIS OF POTENTIAL BIODIVERSITY IN THE CHETTABA FOREST (ALGERIA)**

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### **ABSTRACT**

In view of the challenges facing forest management today (global warming, increased demand for wood energy), taking account of biodiversity in forests is an immediate necessity. The aim of this work is to estimate the biodiversity of the Chettaba forest by studying these structural elements which provide indirect information on the state of biological diversity and aims to provide the first elements of an answer for the construction of a potential biodiversity index (PBI). This diagnostic tool is based on the scoring of a set of ten factors, seven of which are dependent on recent forest management and three independent of it. A score from 0 to 5 is assigned to each factor. The results show that the potential forest biodiversity is average in the Chettaba massif. The average or rather low values of the criteria in the investigated forest often depend on climate, soil and human actions.

**Keywords:** *Chettaba, PBI, structure, forest management*

### **INTRODUCTION**

The forest is a complex ecosystem whose biological diversity has long been recognised and has been at the heart of discussions on forest management since the Helsinki conference in 1993, following the Earth Summit in Rio de Janeiro in 1992, which established the concept of biodiversity. It is important to take into account forest biodiversity as many species are forest-dependent [1]. Methods for assessing biodiversity and sustainable forest management have developed considerably over the last two decades, at various scales, from stand to national forest heritage. The potential population biodiversity index is an indirect and composite indicator of ordinary biodiversity based on the structure of the population. The study of these structuring elements thus provides indirect information on the state of biological diversity [2]. The PBI is a simple and quick assessment method, for forest owners and managers, which avoids the difficulties of a taxonomic approach. This indicator evaluates the potential biodiversity of a population corresponding to its carrying capacity, in relation to its current characteristics, and without prejudicing the actual biodiversity. The forest wealth of the Constantine region is made up of a heritage



that consists of 5173 hectares of Aleppo pine, 2258 hectares of holm oak, 1249 hectares of eucalyptus, 1226 hectares of pinion pine, 785 hectares of cypress and 427 hectares of other trees of different species. Our study focuses on the state forest of Chettaba, located in the southwest of Constantine, which covers an area of 2398 hectares. The potential biodiversity of the Chettaba forest is poorly known, no study has been done to determine its potential biodiversity despite the fact that it is the most important ecosystem in the Constantine region. The objective is to easily and quickly estimate the potential biodiversity of a forest structure by studying these structural elements, which can then provide indirect information on the state of biological diversity. The PBI is sufficient to be used in the diagnostic framework of forest managers, parcel description operations preceding the drafting of management documents, as well as during visits prior to the marking of the cuts. The PBI also makes it possible to compare the biodiversity of several stands or to monitor their evolution [3].

## **MATERIAL AND METHODS**

### *Presentation of the study area*

The forest of Chettabah is located southwest of Constantine (Algeria). The estimated terrain elevation above sea level is 865 meters. The study area is located on the map topographic Constantine Scale 1/200 000 sheet N° 17 and located between the coordinates 36°19'4" north latitude and 6°28'36" East longitude.

### *Stand Potential Biodiversity Index (PBI)*

The Stand Potential Biodiversity Index (PBI) consists of assessing a set of ten factors among those usually recognized as the most favourable to the internal diversity of forest stands [4]. We considered stand-specific composition and structure, the supply of tree-related "micro-habitats", the presence of forest-associated habitats, the maturity of current stands, and the continuity of the wooded condition. Open wet and rocky environments are taken into account for the originality of their specific composition and for the functional role they play for forest stands [5].

Each factor is assigned a score, regarding a scale of threshold values. The sum of the scores then makes it possible to assess overall diversity with a theoretical maximum level of biodiversity [6].

Seven factors are directly dependent on stand and management: Aboriginal species (A), vertical structure of vegetation (B), standing deadwood (C), deadwood on the ground (D), very large live wood (E), live trees bearing microhabitats (F), open environments (g) and three others are more context-related: temporal continuity of the wooded state (H), aquatic environments (I), rocky environments (J). A score of 0, 2 or 5 is given to each of the factors according to a scale of threshold values. The PBI was designed to be used at the forest stand scale, which corresponds to the most common operational level. The minimum area that can be scored is set at 0.25 ha, with the maximum limit being reached when the stand changes significantly. The results are synthesized in the form of a "radar" graph in

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a spreadsheet that facilitates both the comparison of stands, their monitoring over time, and the diagnosis of factors that should be improved.

### RESULTS AND DISCUSSION

The Potential Biodiversity Index is a practical tool for estimating the biodiversity of forest communities. It is based on the scoring of a set of ten factors, carried out during a rapid diagnosis [3]. Our results indicate that the Chettaba forest stand has PBI values in the order of 49% and 27% (Tables 1, 2). The potential biodiversity related to management is average and the contributions of contextual factors are low due to the absence of dead trees, aquatic environments and the lack of rocky environments.

In order to improve the potential biodiversity of the stand, an effort could be made to maintain living trees that contain microhabitats. The diversity of species should be maintained. Maintenance of the rocky environment present will also be necessary to preserve the contributions it confers for biodiversity.

*Table 1. Scoring of PBI factors.*

PBI : Stand and forest management factors						PBI : Contextual factor			
Vegetation		Tree-related microhabitats				Associated habitats	Ecosystem continuity	Associated habitats	
A	B	C	D	E	F	G	H	I	J
Species richness	Vertical structure	Standing dead wood	Dead wood on the ground	Very large woods	Microhabitat trees	Open areas	Older of woodland condition	Aquatic areas	Rocky area
2	5	0	0	0	5	5	2	0	2

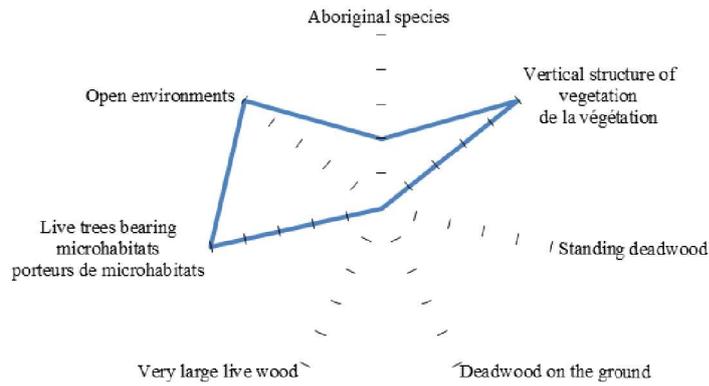
*Table 2. PBI rating.*

PBI value	Absolute	Relative (% of maximum score)	Class
Stand and forest management factors	17	49%	Average
<b>Contextuel factor</b>	4	27%	Low
Total	21	42%	Average

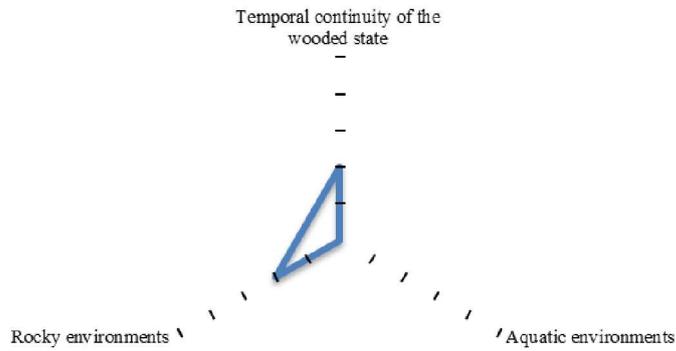
According to the graphs in Figure 1, a score of 2 is assigned to three genera (pine and evergreen oak). Concerning the vertical structure of the vegetation, the number 5 means that there are 4 strata in this forest (herbaceous, semi-woody, low foliage <5 m, intermediate 5-15 m). Standing deadwood, groundwood and very large wood are absent (0). Microhabitats exist on the majority of trees (lichens), open environments (edge and gap type) are maximised for the whole stand for which the score is 5. A score of 2 for the temporal continuity of the woodland state

and the existence of a single rocky environment with the absence of aquatic environments (score = 0).

**PBI- Stand and forest management factors**



**PBI- context-related Factors**



*Fig. 1. Graphical representation.*

## CONCLUSION

The Chettaba forest is a very rich forest area in terms of biological diversity, with an ecotourism vocation. The Potential Biodiversity Index is a criterion for sustainable management. Estimating the potential biodiversity of a forest stand by studying these structural elements can therefore provide indirect information on the state of biological diversity. The total potential biodiversity of the forest is medium. The management-related potential biodiversity values are medium and the contributions of context-related factors are low. Biodiversity carrying capacity is average to low and needs to be improved. To maintain biodiversity at its current level for favourable factors (leave a fraction of the stand to complete its sylvigenetic cycle and preserve secondary species to stratify the stand).

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