



RESEARCH ARTICLE

IDENTIFICATION OF THE EXISTING FLORISTIC BIODIVERSITY OF THE AFENOURIR'S WETLAND, MOROCCO

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ABSTRACT

Our work is closed to the framework of the good management for the Afenourir's lake (Morocco), and its biodiversity, for its restoration and maintenance of all kinds of anthropic activities (overgrazing, pumping, etc.). It consists of the analysis and identification of the floristic biodiversity of lake during the period April-June 2015 in order to study its quality. Indeed, floristic species play a major role in the production and protection of soils against erosion, as well as maintaining substrate and the balance of the aquatic ecosystem, and can also be bioindicators of pollution. The flora of this wetland shows a lower floristic richness in terms of aquatic flora, which represents only 5 species including *Ranunculus aquatilis*, *Zannichellia palustris*, *Myriophyllum Spicatum*, *Chara Globularis*, *Eleocharis uniglumis* and *Scirpus Lacustris*; On the other hand terrestrial flora shows a diversity of species such as *Cedrus atlantica*, *Quercus rotundifolia*, *Crataegus laciniata* Ucr, *Eryngium Bourgatii*, *Thymelaea virgata*, *Euphorbia nicaensis*, *Anacyclus pyrethrum* L, *Plantago coronopus* L, *Ilex aquifolium* and *Acer monspessulanum* L.

INTRODUCTION

An aquatic ecosystem follows an evolution punctuated by a succession of disturbances. Under the effect of a disturbance, the system suddenly changes its regime and evolves towards a new state of equilibrium bringing it new self-regulation capacities. The development of recreational and holiday activities as well as overgrazing around the lake can have a significant impact on the quality of water resources and causes the degradation of floristic diversity. Vegetation is the set of plants that grow in a given place according to their nature. From the notion of vegetation come the related notions of vegetal covering, vegetal landscape, type of vegetation and vegetation formation. It is considered what grows on a given surface of soil from which this nomenclature terrestrial flora, or in an aquatic environment that are plants whose entire life cycle is realized in water, or on its surface and do not support of the exudation. They are algae, bryophytes and vascular plants, pteridophytes and spermatophytes that do not usually produce real roots because they can take the nutrients they need directly from the water. Vegetation plays a major role in the production and protection of soils and humus, the carbon cycle and oxygen production. Some plants may be bio-indicative (Trochain and Jean-Louis, 1980; Delarze and Gonseth, 2008).

The presence of aquatic plants contributes to maintaining the equilibrium of the aquatic ecosystem, particularly natural lakes, thus providing habitat and food for aquatic fauna, maintaining the substrate in place and protecting shorelines of erosion. From the point of view, the excessive growth of aquatic plants can distinguish many symptoms associated with accelerated eutrophication of water bodies (Olga, 2013; Richer-Bond *et al.*, 2015). It is within this framework that the good management of the environment and its biodiversity intervenes, hence the aim of making an inventory on the existing vegetation at our site.

MATERIALS AND METHODS

Afenourir's Lake (Aguelmam) is located in the central Middle Atlas of Morocco, Geographical Cordon (33 ° 17'N 5 ° 16'W), and Altitude of 1790-1800 m and an area of 400 ha. This Aguelmam is located in the south of the province of Ifrane at 30 km south of Azrou and relevant to Ain Leuh rural community. The lake is included in the perimeter of the National Park of Ifrane, and is classified RAMSAR (Anonyme 1, 1980; Anonyme 2, 1996; Chillase and Dakki, 2004). It is a mountain site consisting of a eutrophic lake, shallow, less than 2 m, a wet lawn around it and a stream located at the Lake spillway (Martin, 1981; Chillase and Dakki, 2004). To complete this study, four stations were chosen at the lake level,

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taking into account a number of criteria such as the sources of pollution and dominance of aquatic vegetation (Figure 1).

nature of the soil, the physical parameters and the influence by the cattle.

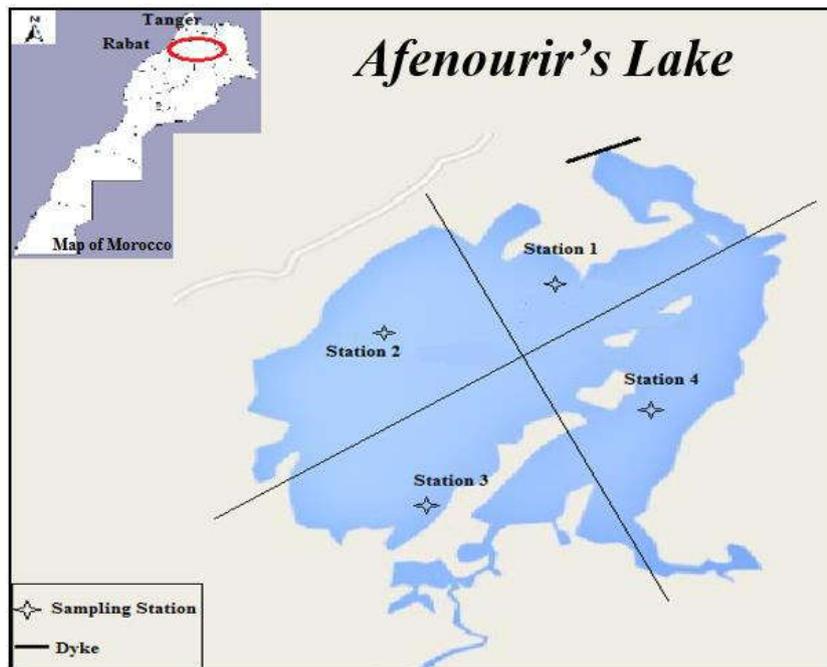


Fig. 1. Sampling stations at Afenourir's lake

	<p>Family: Pinaceae</p> <p>Sc. Name: <i>Cedrus atlantica Manetti</i></p> <p>Fr. Name : Cèdre d'Atlas</p> <p>Type: Terrestrial flora</p>		<p>Family: Fagaceae</p> <p>Sc. Name: <i>Quercus rotundifolia</i></p> <p>Fr. Name: Chêne vert</p> <p>Type: Terrestrial flora</p>
<p>Role</p> <p>Used in Cabinetmaking and embalming mummies</p>		<p>Role</p> <ul style="list-style-type: none"> -Enriches the soil with organic matter. -The first source of wood fuel (wood and charcoal) in Morocco. 	
	<p>Family: Rosaceae</p> <p>Sc. Name: <i>Crataegus laciniata Ucr</i></p> <p>Fr. Name: Aubépine</p> <p>Type: Terrestrial flora</p>		<p>Family: Aquifoliaceae</p> <p>Sc. Name: <i>Ilex aquifolium</i></p> <p>Fr. Name: Houx commun</p> <p>Type: Terrestrial flora</p>
<p>Role</p> <ul style="list-style-type: none"> -Improves coronary circulation and heart muscle nutrition. Adjusts the heart rate. - Reduces stress and facilitates sleep. 			

The sampling is done randomly at the four study stations during the period April-June 2015. We have distinguished that Lake Afenourir is surrounded by a significant terrestrial floristic diversity, as well as an existence of aquatic species represented by a dominance Depending on the depth, the

RESULTS AND DISCUSSION

Our interest in this study is to develop a floristic inventory in the lake in order to verify the impact of certain types of pollution on the existing flora and to be able to determine

measures for the conservation and restoration of the wetland. The first wooded mounds mainly composed of Cedars (*Cedrus atlantica*), holm oaks (*Quercus rotundifolia*) and hawthorns (*Crataegus laciniata*, *Crataegus monogyna*), Holly (*Ilex aquifolium*) and Montpellier Maple (*Acer monspessulanum* L.) are only about 1km away. And others around the lake that are; *Eryngium Bourgatii*, *Thymelaea virgata*, *Euphorbia nicaensis*, *Plantago coronopus*, *Anacyclus pyrethrum*.

It is composed of *Ranunculus aquatilis*, *Zannicellia palustris*, *Myriophyllum Spicatum*, *Chara Globularis (algae)*, *Eleocharis uniglumis*. A part inside the lake is colonized by massifs of *Scirpus Lacustris* favorable to the nesting of several species of waterbirds. The floristic inventory carried out during this study made allowed to identify a total of 13 terrestrial species divided into 11 families, while the aquatic represents a total of 7 species.



Family: Aceraceae
Sc. Name: *Acer monspessulanum*
Fr. Name: Erable de Montpellier
Type: Terrestrial flora



Family: Plantaginaceae
Sc. Name: *Plantago coronopus* L.
Fr. Name: Plantain corne de cerf
Type: Terrestrial flora

Role

- As an astringent.
- Considered as a witness plant to the movement of the dunes.



Family: Asteraceae
Sc. Name: *Anacyclus pyrethrum* L.
Fr. Name: Pyrèthre d'Afrique
Type: Terrestrial flora

Role

- Gargarism relieves toothache and sore throat.
- An antidiabetic activity.
- Have virtues against the corrosion of certain metals.



Family: Euphorbiaceae
Sc. Name: *Euphorbia nicaensis*
Fr. Name: Euphorbe glabre
Type: Terrestrial flora



Family: Apiacées
Sc. Name: *Eryngium Bourgatii*
Fr. Name: Panicaut de Bourgat
Type: Terrestrial flora



Family: Thymelaeaceae
Sc. Name: *Thymelaea virgata*
Type: Terrestrial flora

The water surface of Afenourir 400 ha is a home of a little diversified vegetation, forms a continuous carpet on the edges of the lake and in certain parts emerged from the spring.

Identification has shown an abundance of certain terrestrial families such as Pinaceae, dominated by Cedrus Atlantica Manetti, Fagaceae, dominated by Quercus rotundifolia,

Rosaceae, Asteraceae, Plantaginaceae, Thymelaeaceae, Euphorbiaceae and Apiaceae respectively represented by *Crataegus laciniata* Ucr, *Anacyclus pyrethrum* L., *Plantago coronopus* L., *Thymelaea virgata*, *Euphorbia nicaensis* and *Eryngium Bourgatii*.

use. According to the literature of terrestrial species on the one hand, the Atlas cedar plays an important role in cabinetmaking and to embalm the mummies (Cheddadi *et al.*, 2008), while for the green oak enriches the soil with organic matter and is considered As the first source of wood fuel (wood and

 <p>Family : Renonculacées Sc. Name: <i>Ranunculus aquatilis</i> Fr. Name : Renoncule Aquatique Type: Aquatic flora</p> <p>Role Provides information on the status of the biological quality of lake water.</p>	 <p>Famille : Zannichelliaceae Sc. Name : <i>Zannichellia palustris</i> Fr. Name : Zannichellie des marais Type: Aquatic flora</p> <p>Role Invasive and tells us the degree of water degradation.</p>
 <p>Family: Haloragaceae Sc. Name: <i>Myriophyllum Spicatum</i> Fr. Name: Myriophylle en épis Type: Aquatic flora</p> <p>Role Invasive and tells us the degree of water degradation.</p>	 <p>Family: Characeae Sc. Name: <i>Chara Globularis</i> Fr. Name: Algue verte Type: Aquatic flora</p> <p>Role Also considered as bio-indicators of the quality and functioning of wetlands.</p>
 <p>Family: Cyperaceae Sc. Name: <i>Eleocharis uniglumis</i> Fr. Name : Héléocharis à une écaille Type: Aquatic flora</p> <p>Role May be as a purifying plant as part of a natural lagoon.</p>	 <p>Family: Cyperaceae Sc. Name: <i>Scirpus Lacustris</i> Fr. Name : Jonc des chaisiers Type: Aquatic flora</p> <p>Role -As refuge of the fish exist in the body of water. -As a place for the nesting of waterbirds.</p>

On the other hand at the aquatic level a variation of abundance is distinguished according to the chosen stations. Visually there is a strong dominance of the *Renonculaceae* family (*Ranunculus aquatilis*) in stations 1 and 3, *Haloragaceae* (*Myriophyllum Spicatum*) at stations 2, 3 and 4, concerning the *Zannichelliaceae* and *Characeae* families represented respectively by *Zannichellia palustris*, *Chara Globularis* are abundant throughout the lake, whereas for the *Cyperaceae* family there are two species, one focuses in Station 4 (*Scirpus Lacustris*) and the other species (*Eleocharis uniglumis*) around the lake. The existing floristic biodiversity in Afenourir's lake, has ecological interest as well as an important role for human

charcoal) in Morocco (Francesca *et al.*, 1995). The Hawthorn, or rather the flowers of the hawthorn, are appreciated for their qualities of regulation of heart rhythm, improvement of the coronary circulation and nutrition of the cardiac muscle. It is a hypotensive, cardiotonic and an antispasmodic, which calms the palpitations, decreases the stress and facilitates the sleep (Christensen, 1992). There is also African Pyrethrum and Plantain horn, having an important role represented respectively as gargling relieving tooth rages and sore throat it also has antidiabetic activity and could have virtues against corrosion of Certain metals (Couplan, 2012), by its interest in medicine as astringent it can be useful as vegetable and

considered as control plant to the movement of the dunes (Selles and Chaouki, 2012). On the other hand, the existence of aquatic species can inform us about the state of the biological quality of the water of the lake such as macrophytes (Aquatic Buttercup) (Lambinon, 2012), as they have other invaders (Zannichellie Marshes, Eurasian watermilfoil) (Hadlington, 2003; Poirier *et al.*, 2008). Green algae (Chara) are distributed in eutrophic zones and are also considered as bio-indicators of the quality and functioning of wetlands (Morton, 1992). Héléocharis with a scale and rush of the chaperones belonging to the family Cyperaceae, possess roles respectively, as purifying plant in the framework of a natural lagoon (Brouillet, 2010), for the nesting of the birds exist in the site (Jermy *et al.*, 2007). The study by Mahaman Ouattara Kouassi in Côte d'Ivoire (Ouattara, 2008) reports that the remarkable presence of Asteraceae and Euphorbiaceae could be explained by edaphic factors, whereas the soil of our site offers favorable conditions for development of the species belonging to these different families. However, in this wetland, other factors of pollution, degradation and deterioration must be taken into account. The area is threatened by anthropogenic activities (overgrazing, water pumping, etc.) and global natural changes, which facilitates its degradation and promotes the development of adventitious vegetation. The abundance of *Ranunculus aquatilis* and *Myriophyllum Spicatum* in the lake shows that the lake is rich in nutrients since these species are considered to be good consumers of some element for their growth, compared with a Swiss scientific research team that have demonstrated the role of macrophytes in water bodies (Kanel, 2009). In view of the importance and usefulness of the terrestrial and aquatic floristic richness of Lake Afenourir, this study of the identification for existing species and assessment of the state of the place belongs to the goal of maintaining, restoring and preserving Reserve.

Conclusion

The floristic identification at the level of the Afenourir wetland, a shallow mountain site, located in the Central Middle Atlas belongs to the perimeter of the National Park of Ifrane and classified RAMSAR since 1980, allowed us to invent 20 families of terrestrial and aquatic species. Some species have an abundant distribution in the study area. These include *Cedrus atlantica* Manetti, *Quercus rotundifolia*, *Crataegus laciniata* Ucr, *Anacyclus pyrethrum* L., *Plantago coronopus* L. and *Euphorbia nicaensis*. Concerning aquatic species, *Ranunculus aquatilis*, *Zannichellia palustris*, *Myriophyllum Spicatum*, and *Chara Globularis*, have variant dominance from one station to another. Each type of species, terrestrial or aquatic, plays an important role in human daily life, also an ecological interest in the conservation and protection of the area where it exists. Indeed, in spite of the efforts made to conserve this wetland, it is undergoing severe degradation, which is still accelerating. The Anthropogenic activities (overgrazing, pumping) and severe natural drought have greatly aggravated the deterioration of the lake. The remediation of these threats can be achieved by developing the necessary actions for the restoration of plant biodiversity in particular and by maintaining and preserving the lake in general.

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