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Conservation of Plant Diversity in Azraq, North eastern of Jordan

Conservación de la Diversidad de Plantas en Azraq, en el Nor este de Jordania

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Abstract

Azraq region comprises the oasis, surrounding mudflat of Azraq wetland and the marginal zones of hammada and saharo-arabian deserts was investigated in terms of plant biodiversity conservations. Three types of plant vegetation were recognized to be conserved: hammada, sand dunes and halophytic exhibiting different patterns of vegetations. In terms of Azraq oasis and it's surrounding mudflat regions, it faces a tremendous tragedy resulting from water loss through pumping leading to devastating effects on environmental and biodiversity level especially on green cover. In terms of other Azraq area relative to the marginal hammada and sahao-arabian deserts, it faces the overgrazing. Azraq is representing a good example of the negative aspects affecting conservation of plant biodiversity in Jordan. Reviving and rehabilitating of the Azraq wetland ecosystem and its plant biodiversity which is ultimately related with the water quality of the Azraq basin to decrease the saline front to become slowed; thus giving the opportunity of the threatened fresh plant species to regenerate. Preventing or decreasing the transplantation of Azraq region with exotic species especially the tropical ones imported from tropical areas especially from southern american countries will decrease the possibility of the previous local plant species to be regenerated with it's pure formity. Rehabilitating the local human element is the main core to guarantee any fruitful success in this regard. So the local people, especially after a lengthy period of frustration, were empowered and started to participate in the overall socioeconomic development of the area especially in restoration and conservation of plant biodiversity.

Keywords: Conservation, Plant Diversity, Azraq, North eastern, Jordan.

Resumen

La región de Azraq, que comprende el oasis, la cercana marisma de Azraq y las zonas marginales de la hammada (desierto pedregoso) y los desiertos sahariano-árabes, ha sido estudiada en lo referente a la conservación de la diversidad de plantas. Se han reconocido tres tipos de vegetación para su conservación: hammada, dunas de arena y halófitas, las cuales exhiben distintos patrones de vegetación. En lo que respecta al oasis de Azraq y las regiones de marismas circundantes, enfrentan una tremenda tragedia, debido a la pérdida de agua por causa del bombeo, lo que trae efectos devastadores a nivel ambiental y de biodiversidad, especialmente en la cobertura verde. Mientras tanto, las otras áreas de Azraq relacionadas a la hammada marginal y los desiertos sahariano-árabes enfrentan el sobrepastoreo. Azraq representa un claro ejemplo de los factores negativos que afectan la conservación de la diversidad de plantas en Jordania. Restablecer y rehabilitar el ecosistema de humedales de Azraq y su diversidad de plantas, está íntimamente vinculado con la calidad del agua de la cuenca de Azraq y la disminución del frente salino; lo cual, brinda la oportunidad de que las especies de plantas amenazadas se regeneren. Prevenir y reducir el trasplante de especies exóticas en la región de Azraq, especialmente aquellas importadas de regiones tropicales, sobre todo de países sudamericanos, contribuirá a que las especies de plantas locales se regeneren a su estado original. Rehabilitar el elemento humano local es clave para garantizar cualquier éxito en este tema. En ese sentido, la población local, luego de atravesar un largo periodo de frustración, ha sido empoderada y ha empezado a participar en el desarrollo socioeconómico general del área, especialmente en la restauración y conservación de la diversidad de plantas.

Palabras clave: Conservación, Diversidad de Plantas, Azraq, Nor este, Jordania.

Introduction

The unique geo botanical position of Jordan gives this country an extraordinary importance, so it is estimated to have about 152 plant families of seed vascular plants (phanerogams), 700 genera and some of 2500 plant species, plus several hundred species of vascular cryptogams. This richness is due to the country's position as the meeting point of at least four different phyto-geographical regions: the Mediterranean, the Irano-Turanian, the Sahara-Arabian and the Sudanian regions which include several taxa that have agro-ecological value and are considered to be of great regional and global importance. This topographical diversity of Jordan, which creates varied ecological conditions within a limited area, also contributes to this wealth of diversity especially at the level of plant species (Al-Quran, 2005; 2009; Al-Eisawi, 1982; Karim & Al-Quran, 1986-1988; Zohary & Feinbrun-Dothan, 1962-1988).

Jordan in general exhibited the climate of desert or semi-desert with an arid climate, with few large natural wetlands, the best known being Azraq oasis in the north eastern desert of Jordan territories. This large desert oasis formerly comprised a complex of spring-fed marshes and pools adjacent to a large seasonally flooded mudflats, this mudflat receives its water from surface run-off, so it is not affected by the exploitation of groundwater, and continues to flood during periods of heavy winter rains (Al-Eisawi, 2004; 2012; Al-Eisawi *et al*., 1998; Friedman *et al.,* 1986).

It is clearly that Azraq oasis located in the heart of the jordanian badia is considered as an example of the potential for success of continuous environmental rehabilitation efforts. The national and international support, the availability of adequate financial resources, proper management of available supplies of water, and over all, the willingness to act to preserve the natural environment are the major factors determining this success. But sadly despite this significant success, the area was almost destroyed by environmentally damaging activities. Most of the Azraq Oasis had dried out, and its soil quality had drastically deteriorated (Al-Genidi, 1992; Lemons *et al*., 2003; Zohary, 1973).

Although Azraq wetland reserve (12 Km^2) has offered for aquatic and rare species in Jordan of 133 vascular plant species belonging to 100 genera and 33 families. Seven species were recorded as new to the flora of Jordan. In addition many species found during the field investigations comprised belonging to phytoplanktons. Aquatic plants in the region also exhibit high diversity, with a recent project study revealing the presence of 12 species new to Azraq. According to the flora survey conducted by the Azraq Project, terrestrial plant communities comprise a total of 133 species of vascular plants, and unique to the Azraq Wetland Reserve (Al-Eisawi, 2012; Andrews, 1991; Conder, 1982; Al-Quran, 2005; 2009).

So Azraq is, in general is considered as a major wetland in Jordan and a water surplus area. But sadly its wetlands have fallen victim to the water needs in the water-scarce country of Jordan especially the ever-increasing demands for water in the country, and particularly in the rapidly growing city of Amman, resulted in large-scale pumping from the Azraq Basin. This level of exploitation is clearly highlighting the major cause of the environmental degradation that the area has been suffering.

The comprehensive floral diversity of Azraq wetlands has not as yet been

thoroughly surveyed although the key species of such wetland plant vegetation are well known, including *Nerium oleander*, *Phragmites communis* and *Juncus maritimus* and, In addition, the extensive spring-fed marshes contained a variety of habitats including dense stands encouraging the vegetation of *Typha angustifolia, Phragmites communis Scirpus* sp., *Cyperus* sp., *Arundo donax*, *Juncus maritimus* and *Carex* sp.

It is very clear that Azraq wetland region including the surrounding areas of marshes, ditches, mudflats, sandy deserts and marginal hammada area are exhibiting three types of vegetations:

1) **Hammada type** of vegetation mostly contained in the saharo-arabian region in Jordan and covers the majority of the total area. Three patterns of hammada type can be identified:

a) **Sandy hammada**: the leading speciesfor this hammada pattern are *Atriplex halimus*, *Noaca mucronata, Saline arabica, Anabasisi articulate Hammada salicorina, Zilla spinosa, Bassia muricata* and *Salsola verniculenta*. These are found in lower regions of valleys within the desert.

b) **Marshes and small water reservoirs:** this type of vegetation is confined mainly to the places of water accumulation. An example of its vegetation are: *Iris sisyrichium, Tamarix* spp*, Achillea fragrantissima, Atriplex halimus* and *Artemisia herba-alba.*

c) **Pebble and gravel hammada:** This pattern of hammada is mostly covered by annuals such as: *Ononis serrata, Asteriscus pygmaeus Anthemis deserti, Astragalus annulari, Medicago polymorpha, Filago desertorum* and *Lycium shawii*, which extends over the north eastern part of the Jordanian desert.

2) **Sand dunes vegetation**: this type can be classified into the following categories:

a) **Tropical and subtropical vegetation**: the leading species are *Balanitis aegyptica, Marea* spp, *Acacia tortilis, Salvadorea persiea, Calotropis procera,* and *Acacia radiana*. the rainfall in this region is very low ranges from 100-150 mm annually. The natural rain is not sufficient enough for cultivation; so it is very good to be supported as a natural zone of a grazing land.

b) **Sudanian vegetation:** confined to the rocky parts. The leading species are *Acacia radiana, Ziziphus spin-christis, Panicum turgidaem, Capparis spinosa, Anabasis syriaca, Acacia tortilis, Haloxylun persicum, Pennisetum dichotomum*, and *Laphochloa pumila.*

3) **Halophytic vegetation**: classified into two main types:

c) **Saline (halophytic) vegetation:** This occurs in the suurounding deserts of Azraq (saharo-arabian). The leading species are *Tamarix nilotica, Beta vulgaris, Plantago* spp., *Arthecnemum strobilicum, Stipa* spp., *Lycium shawi, Aeluropus littoralis Anabasis* spp., *Atriplex halimus*, and *Halopeplis* spp.

d) **Water (halophytic) vegetation:** The leading species here are *Phragmites communis, Typha* spp., *Juncus, Phoenix dactylifera*. These types occur mostly next to streams and water reservoirs of water Azraq reserve.

In fact that participation in international and regional agreements would create a sound strategy for conserving biodiversity, and would promote the implementation of legislation by all treaties, as well as information exchange and facilitate the drawing up of agreements. Consequently; this will direct academic research towards neglected indigenous plant species which will, in turn, promote the sustainable

utilization of and facilitated access to plant genetic resources. In addition, adoption of the international treaties and conventions will create an environment such that will ensure equitable benefit sharing and intellectual property rights (IPR) for indigenous people on their plant species and knowledge (Al-Eisawi,1996; Cooper, 2002; Heywood, 1995; Al-Genidi, 1992).

This would provide research incentives; establish specialized research centers; and strengthen cooperation among national institutions as well as with their regional and international counterparts. Moreover, the strategy contains specific activities related to biodiversity. In order to empower and strengthen agricultural the latter in the field of biodiversity, three policy instruments were identified: capacity building and training; incentives and motivation; and public awareness (Gopal, 2003; Groombridge, 1992; Heirich, 2000; 2002).

Also, many other factors such as motivation, information, financial instruments, awareness and training are the main policy instruments that could be used to promote biodiversity through the domestication of international agreements. However, the private sector is a key player in biodiversity conservation and sustainable utilization activities. Private sector participation should include all activities such as sustainable use of genetic resources, awareness, training, establishment of natural reserves, implementation of projects, and participation in integrating the biodiversity concept in school curricula. At the national level, a local network for exchange of information on biodiversity is already in existence. This network plays a major role in *in situ* and *ex situ* conservation and in the sustainable use of neglected plant species (Hemsley & George, 1966; Jones & Clarke, 1990; Karim & Al-Quran, 1988; Ormond, 1978; Qasem, 1976).

Azraq reserves are playing a major role in conservation and use of genetic resources is taken into consideration when setting policies. The outcome of such studies showed that wild plants are utilized by local communities and not be regenerated due to the devestating of the natural ecosystems existed. The using of improved technologies in water harvesting and consumption techniques and the multiplication of wild proper plant species at the association level, will therefore increase the productivity of local varieties (Al-Eisawi, 1995; Al-Quran, 2009; Dakhgan & Bandak, 1970b; Dutton *et al.*,2008).

The effective impacts resulted from Azraq oasis deterioration on plant biodiversity

2. Increasing the loss of many rare and endemic plants species.

3. Increase the degree of soil salinity.

4. Increasing the desertification and soil erosion.

5. Increasing the destruction of the natural primary natural vegetation.

6. Decreasing the restoration of ecosystem natural association.

7. Increasing the number of unpalatable species in the ecosystem.

8. Increasing the production of allergenic pollen grains that have negative affects and cause health problem.

9. Increasing the disappearance of a certain wild species adapted to such specific conditions found in Azraq region.

Proposed solutions to decrease the threatening to the plant biodiversity

10. Reduction of water pumping to be balanced by natural recharge to restore the balance to the ecosystem.

11. Restriction of unregulated water pumping for agriculture use.

12. Preventing water over pumping by supplying all well with all measure necessary.

13. Implying of necessary measures restoring the natural ecosystems.

14. Involvement of government is essential to guarantee the success of all measures taken.

15. Preventing all activities of overgrazing.

16. Encouraging the establishment of protected areas.

17. Preventing the collection of certain plants as peat for fuel sources

Towards achieving plant conservation goals

18. Reviving and rehabilitating of the Azraq wetland ecosystem and its biodiversity.

19. Enhancing the water quality of the Azraq Basin to decrease the saline front to become slowed; thus giving the opportunity of the threatened fresh plant species to regenerate.

20. Preventing or decreasing the transplantation of Azraq region with exotic species especially the tropical ones imported from tropical areas especially from southern american countries, because this process will decrease the possibility of the previous local plant species to be regenerated

21. Rehabilitating the local human element is the most important thing to guarantee any fruitful success in this regard. So the local people, especially after a lengthy period of frustration, were empowered and started to participate in the overall aspects of socioeconomic development of the area especially in restoration and conservation of plant biodiversity.

Population pressures and water shortages are a continuous threat; So the rehabilitating of Azraq oasis, preventing the overgrazing and establishing a trend of socioeconomic flourishing in the area are not sufficient, because the roots of the problems that caused the abuse of nature in Azraq are still exist. Thus it is not only important to manage the available water resources wisely, it is also important to address the issues of the problem from the roots which is the population increase to conserve all natural resources especially the plant biodiversity.

Conclusions and recommendations

22. Human element involvement and raising of public awareness and empowerment of local populations in environmental management is one of the most important factors to achieve the success, and to preserve achievements and make them enduring.

23. The national and international support in the aspects of administrative, financial and scientific terms is valuable in achieving remarkable results. The initiation of projects using international money can trigger some changes, it is vitally important also to keep the momentum of these efforts through the support of national organizations and local people.

24. Issues of environmental rehabilitation including plant biodiversity are inseparable from water/population dynamics and other socioeconomic issues, particularly in Azraq region.

25. Azraq oasis is representing a good examples of the negative aspects affecting conservation of plant biodiversity in Jordan. Although the population explosion is the main cause of most of human pollution problem, but also Azraq oasis is demonstrated that degradation of green cover is automatically linked with increasing of many environmental devistating problems coupled with increase in vehicles exhaust and gas emission.

26. Population demand pressures for water can lead to severe abuse of the available environmental resources, even to the point of irreversibility.

27. In-depth knowledge of natural ecosystems is considered very important for their sustainable management. Finally, in appropriate words knowledge and ideas are leading to proper action and managements.

Literature cited

Al-Eisawi, D. 2012. Conservation of Natural ecosystems in Jordan, *Pak. J. Bot.*, 44: 95-99.

Al-Eisawi, D. M. 2004. Water scarcity in relation to food security and sustainable use of biodiversity in Jordan. International FORUM on Food Security under Water Scarcity in the Middle East: Problems and Solutions COMO (Italy) November, 24-27 2004.

AL-Eisawi, D. M. 1982. List of Jordan Vascular Plants. Mitt. Bot. München, 18: 79-182.

AL-Eisawi, D. M. 1995. Flora and Vegetation of Azraq Wetland Reserve. Azraq Oasis Conservation Project. RAMSAR and The World Bank, pp. 72.

Al-Eisawi, D. M.; El-Oqlah; S. Oran & J. Lahham. 1998. Plant biodiversity in Jordan. In: Plant Genetic Resources of Jordan. Proceedings of a National Seminar, 2-4 August, 1994. Amman, Jordan. (Ed.): A. A. Jaradat. IPGRI, West Asia and North Africa Regional Office. Aleppo, Syria. pp. 272.

Al-Genidi, M. 1992. Plants of Eastern Arab Countries and their Economical Importance. Dar Al-Ibdaa, Amman, Jordan.

Al-Qura'n, S. 2005. Ethnobotanical Survey of Folk Toxic Plants In Southern Part of Jordan. Toxicon, 46: 119

Al-Quran, S. 2009. Ethnopharmacological survey of wild medicinal plants in Shawbak, Jordan. J. Ethnopharmacol., 123: 45-50.

Andrews, I. J. 1991. Is Azraq still an oasis? Bull. Ornithological Society of the Middle East Nº 27: 13-19.

Conder, P. J. 1982. Azraq Wetland Reserve. Bull. Ornithological Society of the Middle East Nº 8: 4-5.

Dakhgan, A. M. & Bandak, A. 1970b. Status of the Main Wildfowl Resorts in Jordan. *In*: Isakov, Y. A. (ed.), Proc. Int. Regional Meeting on Conservation of Wildfowl Resources, Leningrad 1968: 322-324. Moscow.

Dutton, W. R. & Shahbaz. 2008. Jordan's arid Badia: deepening our understanding. Smith-Gordon. Cambridgeshire, Great Britain, pp. 449.

Gopal, B. 2003. Aquatic Biodiversity in Arid and Semi-Arid Zones of Asia and Water Management. *In*: Conserving Biodiversity in Arid Regions, Best Practices in Developing Nations. (Eds.): J. Lemons, R. Victor & D. Schaffer. Kluwer Academic Publishers. Boston, Dordrecht, London, pp. 199-215.

Friedman, J.; Z. Yaniv; A. Dafni & Palevitch. 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an

ethnopharmacological field survey among Bedouins in the Negev desert, Israel. Journal of Ethnopharmacology 16: 275-278.

Groombridge, B. (eds.) 1992. Global biodiversity, status of the earth's living resources. Chapman & Hill. London, Glasgow, New York, Tokyo, Melbourne, Madras. 585.

Heinrich, M. 2000. Plant resources of south-East Asia, no12 (1). Medicinal and poisonous plants 1. Phytochemistry 53: 619-620.

Heinrich, M. 2002. Plant resources of south-east Asia 12 (2): Medicinal and poisonous plants. Journal of Ethnopharmacology 81: 139-140.

Hemsley, J. H. & M. George. 1966. Azraq Desert National Park–Draft Management Plan. International Biological Programme. The Nature ConservancyCouncil, London, U. K.

Jones, T. A. & J. E. Clarke. 1990. Azraq Oasis, Jordan. Ramsar Convention. Monitoring Procedure Report Nº 16. Ramsar Convention Bureau, Gland, Switzerland.

Karim, F. & S. Al-Qura'n. 1986. Medicinal plants of Jordan.Yarmouk University Press, pags 11-30, Irbid, Jordan.

Karim, F. & S. Al-Quran. 1988. Wild Flowers of Jordan. Yannouk University Publications, Jordan.

Lemons, J.; R. Victor & D. Schaffer. 2003. Conserving biodiversity in arid regions, best practices in developing nations. Kluwer Academic Publishers. Boston, Dordrecht, London, pp. 493.

Zohary, M. & N. Feinbrun-Dothan. 1962-1686. Flora Palaestina, Hebron University Press, Jerusalem, pp 77-90.

Zohary, M. 1973. Geobotanical foundations of the middle east. Gustav. Fisher Verlag Stuttgart, pp 30-55.