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Study of biodiversity and limiting factors of Ag-gol Wetland in Hamadan Province, Iran

MAHDI REYAHI-KHORAM[1,♥], VAHID NORISHARIKABAD[2], HOSHANG VAFAEI[1]

[1]Department of Environment, Hamadan Branch, Islamic Azad University, Professor Mosivant st., P.O.Box 65138-734, Hamadan, Iran. Tel: +98-811-4494170, Fax: +98811 4494170, ♥email: phdmrk@gmail.com

[2]Graduate School of the Environment and Energy, Islamic Azad University-Science and Research Branch, Tehran, Iran.

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ABSTRACT

Reyahi-Khoram M, Norisharikabad V, Vafaei H. 2012. Study of biodiversity and limiting factors of Ag-gol Wetland in Hamadan Province, Iran. Biodiversitas 13: 135-139. Ag-gol Wetland is one of the important and seasonal wetlands of Iran. This wetland is located on southeast of Hamadan Province and was declared as a prohibited hunting area by Department of Environment (DoE) of Iran. Identifying the characteristics, capabilities and limiting factors of Ag-gol Wetland is the most important objective of this study. The present study was conducted during 2007 through 2010. Documentary and observation methods have been used to access to information. For general identification of the area, digital maps and Geographic Information System (GIS) were used. Identifying capabilities and limitation factors of the studied area was made through extensive field inspections and direct field observations. Bird species of the region were identified and statistics of the population of bird species were gathered. In this research, valid academic resources were used. According to field inspections and studies, 46 species of waterfowl birds and wader birds of Iran have been identified at this wetland. The results of this research showed that Ag-gol Wetland has a high potential regarding the variety of waterfowl and wader birds. Continuous study in order to determine the depth of wetland water in different time intervals to estimate the volume of wetland water during different seasons of the year is recommended.

Key words: biodiversity, environment, prohibited hunting area, seasonal wetland

INTRODUCTION

Global warming and climate change could severely impact streams, wetlands, and other sensitive areas. The water levels and ecology of the wetlands are sensitive to atmospheric change. Wetlands all over the world have been lost or are threatened in spite of various international agreements and national policies. This is caused by: the public nature of many wetlands products and services; user externalities imposed on other stakeholders; and policy intervention failures that are due to a lack of consistency among government policies in different areas. All three causes are related to information failures which in turn can be linked to the complexity and invisibility of spatial relationships among groundwater, surface water and wetland vegetation (Conly and Van Der Kamp 2001).

Wetlands measure about 885 million hectares which 1888 wetlands measuring and 185 million hectares have been registered in Ramsar Convention. Iran has over 250 wetlands measuring about 2.5 million hectares. 22 out of these wetlands measuring 1.8 million hectares have been registered as international wetland in Ramsar Convention (Ramsar Convention of Wetlands 2010). In this situation, only a small part of the world's wetlands (0.3%) is located in Iran (Reyahi-Khoram and Hoshmand 2012). Ramsar Convention classified wetlands in 3 main types; marine (coastal) wetlands; man-made wetlands and inland wetlands. Many of Inland wetlands are seasonal and particularly in the arid and semiarid area, may be wet only periodically. Seasonal wetland, known commonly as vernal ponds, are isolated from river and other water bodies and characterized by a seasonally fluctuating water level, often drying out completely for some part of the year. Seasonal wetlands are particularly important to amphibian populations and often are small. These habitats provide breeding sites for wetland wildlife that are not populated by predatory fish or other major predators.

Throughout the world, endemic flora and fauna are adapted to the physical and chemical environment found in seasonal wetlands, which are biodiversity hotspots for a broad array of organisms. Several species of small mammals apparently readily use seasonal pools and we do not have a clear understanding of how important seasonal wetlands are to these species (Peter 2005). Seasonal wetlands are beginning to achieve recognition as important habitats because of its richness in biodiversity and the habitat they provide for plants and animals during periods of high water levels. Seasonal wetland dry up in summer and only contain water during wetter months of the year. As a result of this periodic drying, species requiring water year-round are not able to survive.

Ag-gol Wetland is one of the important and seasonal wetlands of the country; this wetland is located on southeast of Hamadan Province, 30 km northeast of

Malayer city and is situated between 34º, 32', 10" and 34º, 33', 2" northern latitudes and between 49º,1',23" and 49º,1',27" eastern longitudes (Figure 1). Ag-gol Wetland was declared as a prohibited hunting area by Department of Environment (DoE) of Iran in second half of 2009. Thereafter, it was protected as per the law.

Identifying the characteristics, capabilities and limiting factors of Ag-gol Wetland is the most important objective of this study. The said research may provide a means of identifying the threatened species and critically endangered species and also determine the effective causes of protecting and survival of the said species and may contribute to improvement of the programming and management overall study area.

MATERIALS AND METHODS

The present study was conducted in Ag-gol Wetland, Hamadan Province, Iran, during 2007 through 2010. Documentary and observation methods have been used to access to information. This means that identifying capabilities and limitation factors of the studied area was made during the research years through extensive field inspections and direct field observations.

During the period, using the map, camera, Global Positioning System (GPS) and in some cases through afoot surveying, the status of Ag-gol Wetland was identified. Means, the status of Ag-gol Wetland was inspected in all seasons of the year. Regarding that this wetland is one of the seasonal wetlands of Iran, it was not possible to easily inspect all parts of the wetland in all of seasons, but the hummocks islands of the wetland were also inspected and studied afoot over the swamp. Bird species of the region were identified and statistics of the population of bird and animal species were gathered. In this research, valid academic resources were used for identification of birds and animals (Mansoori 2008) and (Brati 2009). In order to determine the volume of annual precipitation, the figures and information gathered via the meteorological stations around the wetland were used. For general identification of the area, digital maps and Geographic Information System (GIS) were used and on this basis, the topological status of the area was identified. The software used was Arc View (version 3.2a) with the Universal Transverse Mercator (UTM) projection and scale was 1/50,000 (Demers 2009).

RESULTS AND DISCUSSION

Physical and hydrologic status

Ag-gol Wetland is a nearly plain wetland, which it's lowest part has a height of 1653.65 meters from free sea level. The villages surrounding this wetland are Eslamabad, Nasirabad, Majidabad, Ghasemabad and Tootal. The bed of Ag-gol Wetland is comprised- up to 70%- of hard formations, namely lime stones, sand stones and hard schist. About 30% are shale formations, which their final

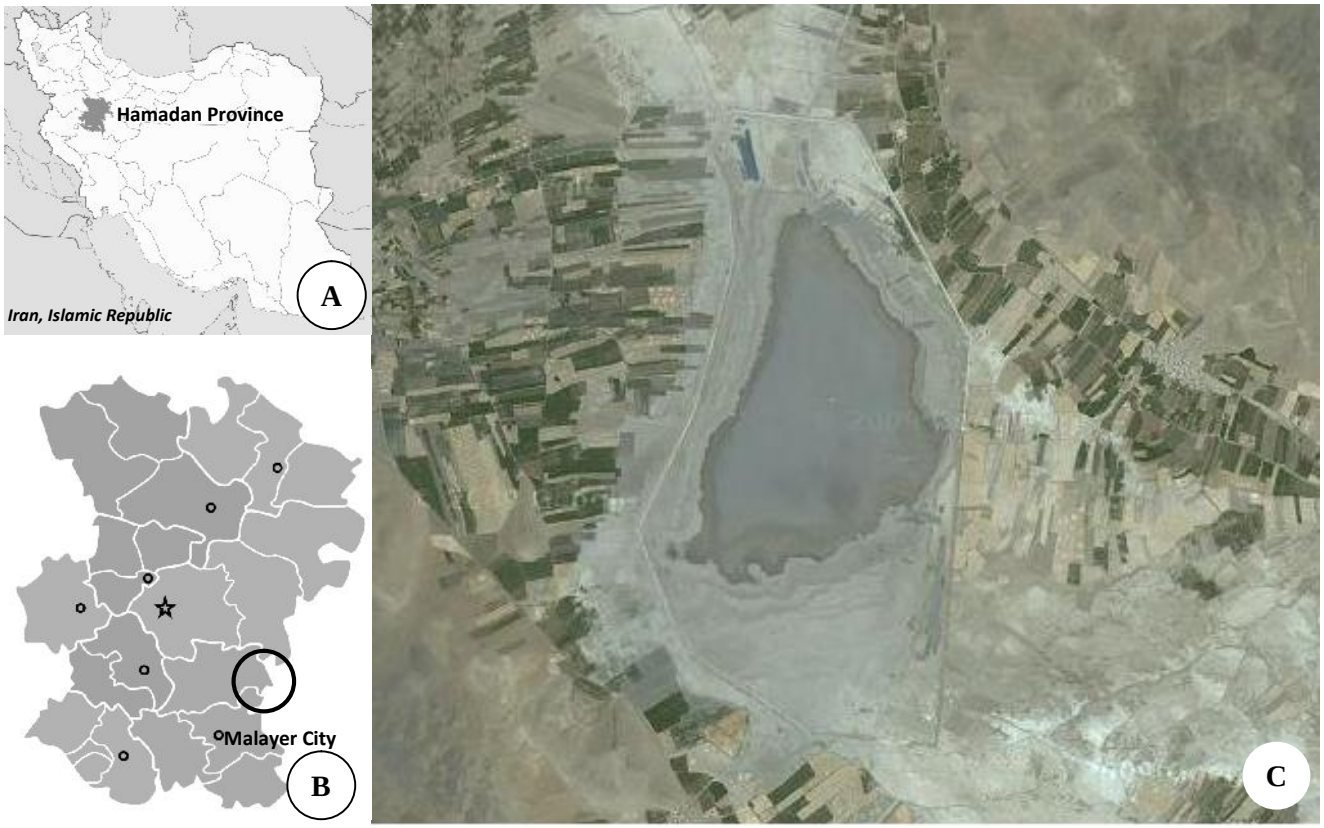

Figure 1. Location of the study area, A. Hamadan Province, Iran, B. Malayer City, C. Ag-gol Wetland

destruction and decomposition leads to small granules such as silt and clay. The wetland's adjacent lands include alluvium plains, flood plains and closed basins. Alluvium plains include Kardkhord soil series (with mean texture), Ghahavand soil series (including heavy texture) and Ahmadabad soil series (with mean alluvium texture). Also flood plains include Ghasemabad soil series (with very heavy alkali texture) and Abdolrahim soil series (with heavy texture and high salinity and alkali). Closed basins are meant the soil around the wetland, which are comprised of heavy-texture alkali soils with low slope.

Its general slope from the focal point of wetland toward the north is 0.03% and from the center toward the south is 0.02%. The real area in closed curve of 1653.7 meters is 116 hectares, and the area in the curves of 1653.7 and 1654 is about 500 hectares, and the area in the curves of 1654 and 1654.5 is 313 hectares. In recent years, governmental organizations have constructed flood gate around the wetland in order to protect the wetland and also to prevent from water flood in the adjacent lands and villages. This flood gate measure 10 meters in width and 1.5 meters in height and has encompassed the surrounding area of wetland. On this basis, the area of the wetland restricted in this flood gate is estimated over 500 hectares. From the time of construction of this flood gate, during winter and spring seasons, water height has increased in the wetland (Figure 1C).

Due to irregular entry of water and evaporation, the surface of wetland is changing; but the wetland area during winter and spring seasons reaches to over 500 hectares and as the water advances into the middle parts, two hummocks islands will appear that their height reaches 6 meters. Also during these days, the average water height in Ag-gol Wetland reaches 1 meter and in the best conditions, the amount of water available in the wetland is about 5 million cubic meters.

The results showed that the average precipitation in the surface of Ag-gol Wetland watershed equals about 271 millimeters per year. Also the area of Ag-gol Wetland basin is equivalent to 125 Square Kilometers. Therefore, the amount of water from atmospheric precipitations in wetland basin is equivalent to 30 million cubic meters per year, which a part of it flows toward the farms and agricultural lands through the constructed channel. So, the sources of supplying water of this wetland are precipitations in the surface of the wetland's basin and also the seasonal channels and streams floodway which is connected to Ghare-Chay River somehow. The waters coming to the wetland (during watery seasons) accumulate on the surface of wetland and then flow as flood from north of wetland toward north of the region. Based on the approvals made in the 180th session of ministry of Energy's water allocation commission, 2 million cubic meters water right per year has been confirmed as right of environmental water need of Ag-gol Wetland per year. When the water current from Ghare-Chay reaches zero, farmers begin taking water from the wetland. It is obvious that in this case, Ag-gol Wetland act such as a reservoir for agricultural affairs of villagers of the region. Also under some conditions, farmers of the region use pumping systems to take the wetland's water. The studies showed that this wetland is dry during July, August, September, October and November months and hence, wetland impounding begins in December each year.

Biological and ecological status

Ag-gol Wetland is considered as one of the important habitats of the province. Every winter, a large number of migratory birds, including waterfowl and wader birds spend a part of their winter times and birth giving season in this wetland. In Ag-gol Wetland, the wader bird species exceed than waterfowl birds and wader birds are usually was show in the margins of wetland, and these regions are regarded as wader birds. The trend of changes related to species population of index species such as waterfowl birds and wader birds of Ag-gol Wetland has been estimated by using the numerous statistics methods. Study of general changes show the reduction of the number of population from July to December and increase in the number of birds from March to May and further reduction in June. The species that were identified in this wetland in June are mostly reproductive species.

According to field inspections and studies, 46 species of waterfowl birds and wader birds of Iran have been identified at this wetland. The identified species include 14 families. From among these, Scolopacidae are a highly diverse family of birds related to Ag-gol Wetland and this Family is equals 27% of bird species of wetland. Also the most variety of species in this wetland is related to Order Charadriiformes. The diversity of Birds in Ag-gol Wetland is presented in Table 1.

Water quality

Field studies showed that the industrial plants are not located around the wetland. Hence Ag-gol Wetland is not exposed to urban and industrial wastewater pollution. According to the results of experiments, in spring (which the amount of wetland water is in its highest amount) the volume of Dissolved Oxygen (DO) was between 6 to 8.5 mg/L, the average of 5- day Biochemical Oxygen Demand (BOD_5) and Chemical Oxygen Demand (COD) is respectively equal to 8 and 19 mg/L and the amount of Total Dissolved Solid (TDS) was between 164 to 576 mg/L. Also the amount of Total Suspended Solid (TSS) was between 80 to 624 mg/L.

Discussion

The results of this research showed that Ag-gol Wetland has a high potential regarding the variety of waterfowl and wader birds. The ecological status of wetland has made it welcome numerous species of waterfowl and wader birds. These species include winter migrating species and reproductive species, which are seen in this wetland in winter and spring. Regarding this characteristic, it seems that this wetland has a high potential of ecotourism attractions such as bird watching and similar recreations. It is obvious that investments by public and private sectors will promote the potentials of the wetland and the native peoples will benefit from it, and hence they will show more interest in protecting and

Table 1: Diversity of birds in Ag-gol Wetland, Iran

Family	Scientific name
Accipitridae	*Aquila clanga*
Anatidae	*Anas acuta*
	Anas crecca
	Anas platyrhynchos
	Anser anser
	Aythya ferina
	Tadorna ferruginea
	Tadorna tadorna
Ardeidae	*Ardea cinerea*
	Bubulcus ibis
	Casmerodius albus
	Egretta garzetta
Charadriidae	*Charadrius alexandrinus*
	Charadrius dubius
	Charadrius hiaticula
	Charadrius mongolus
	Vanellus vanellus
Ciconiidae	*Ciconia ciconia*
	Ciconia nigra
Glareolidae	*Glareola pratincola*
Laridae	*Arenaria interpres*
	Larus genei
	Larus ridibundus
	Phalaropus fulicarius
	Phalaropus lobatus
Phalacrocoracidae	*Phalacrocorax carbo*
Phoenicopteridae	*Phoenicopterus ruber*
Rallidae	*Fulica atra*
Recurvirostridae	*Himantopus himantopus*
	Recurvirostra avosetta
Scolopacidae	*Actitis hypoleucos*
	Calidris alpine
	Calidris minuta
	Gallinago gallinago
	Lymnocryptes minimus
	Numenius arquata
	Tringa nebularia
	Tringa ochropus
	Tringa tetanus
Sternidae	*Chlidonias leucopterus*
	Sterna albifrons
	Sterna hirundo
	Sterna nilotica
	Sterna repressa
Threskiornithidae	*Plegadis falcinellus*
	Platalea leucorodia

maintaining the wetland. The results of this research showed that industrial pollutions are not a threat to the Ag-gol Wetland. Regarding shortage of surface and underground water resources, the owners of industries show no interest in construction of industrial plant adjacent to the wetland. The results obtained from the experiments made on the wetland water also indicate that the amount of DO in the wetland water is favorable and the amount of BOD and COD is acceptable. It seems that the negligible pollution related to BOD and COD is due to the migration of birds and presence of aquatics in this wetland, and mentioned parameters are not as threat for the wetland. The measurements related to the amount of TDS and also TSS in water show that these amounts are available in an extensive range and this could be attributed to different climatic conditions such as wind blow, storm, precipitation and flood.

Based on the results of this research, the issue of water and lack of its management is the most basic challenge and threat to the Ag-gol Wetland; such that the farmers of the region use pumping systems to take water from the wetland in aridity conditions, which is contrary to environmental rules, regulations and standards. Regarding that Ag-gol Wetland has been introduced as a prohibited hunting area by DoE of Iran, it is necessary that the Hamadan Provincial Directorate of Environmental Protection and also Hamadan water resources management company enforce laws and prevent from wetland water taking and protect the wetland.

As mentioned above, in the 180th session of ministry of Energy's water allocation commission, 2 million cubic meters water right per year has been confirmed as right of environmental water need of Ag-gol Wetland per year, although this amount does not conform to the amount of evaporation (only during non-dry seasons) from the surface of wetland in December, January, February, March, April, May and June; namely, the amount of water evaporation during the said months reaches to 500 millimeters and the volume of evaporated water equals over 2 million cubic meters.

CONCLUSION AND RECOMMENDATION

Seasonal wetlands are flooded in the winter and begin to dry out in the summer. With due regard to the limited water resources in the studied area and according to the results of this research, it can be concluded that, the water quantity management of the study area is very important and is the key strategy in the management of Ag-gol Wetland. In similar survey done in United State, it is found that regional stresses to the shallow groundwater system such as pumping or low Great Lake levels can be expected to affect even drier wetland types (Skalbeck et al. 2008). Quinn and Hanna (2003) suggested the development of a comprehensive flow and salinity monitoring system and application of a decision support system (DSS) to improve management of seasonal wetlands in the San Joaquin Valley of California. In another study, it also suggested the use of a number of sensor technologies that have been deployed to obtain water and salinity mass balances for a 60,000 ha tract of seasonally managed wetlands in the San Joaquin River Basin of California (Quinn et al. 2010). In another study, the importance of two hummocks islands in the middle of Ag-gol Wetland was emphasized and promoting the level of protection of the region was recommended (Reyahi-Khoram et al. 2010a,b).

The authors sure that water quantity management of the study area can improve the environmental conservation and biodiversity of two hummocks islands and enhancement of stockholders. Continuous study in order to determine the depth of wetland water in different time intervals to estimate the volume of wetland water during

different seasons of the year is recommended. Also, it is suggested that future studies should focus on determine and identify the borders of wetland, topographic surveying of wetland in order to draw level curves with 10 cm distances, the status of actual evaporation and potential evaporation of the wetland water.

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