Seasonal effects of Land cover changes on ecological of migratory birds in Al-Hammar Marsh, southern Iraq

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Research Article

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Abstract

Al-Hammar Marsh in Iraq stands out for hosting the largest concentrations of coastal migratory birds along the migration path between the Arabian Gulf and the Mediterranean Sea. Despite this importance, there is no complete review of the dynamics of these birds. In this study, we collected and analyzed the results of six species of migratory birds (Mallard duck, Graylag goose, White pelican, Barn swallow, Common gull, White stork) in the Region, in addition to the results of the land cover in October of 2000 to 2020, The results show the presence across the past two decades of a change in the population makeup of migratory birds. Complete numbers of migratory birds indicated a decline in the residual types between 2000 and 2020. The disproportion among numbers was also too large for trends to be observed. The region also showed a decrease in the areas of vegetation cover during the study period was equal to 5.0%, 3.5%, and 15.6%, And an increase in the areas of water bodies during the study period was equal to 7.8%, 21.0%, and 62.6%, respectively, Finally, A multivariate analysis suggests a general decline in types that depend on the Wetland for feeding and breeding an in the sublittoral and the offshore zones. Use satellite data can be used for monitoring several variables such as water bodies, vegetation cover, Climate factors that influence the activity of Migratory birds.

Introduction

Iraq is of relatively rich countries biodiversity in general and rich the kinds of birds, especially that was due to a combination of ingredients that led to this space be a shelter for many bird species are various, most of these ingredients important is the site of Iraq more than a main line for the migration of birds passing through Siberia and West Europe south to the Arabian peninsula and Africa, Iraq constitutes half of the corridor everybody trapped between the Arabian Gulf and the Mediterranean Seas, especially if we know that birds and small ones avoid crossing water bodies wide as the sea, in addition to this, the site of Iraq in the warm-line cross between the cold areas of North and warm in South would attract many species of birds to stay in the regions various (A. Mohammed 2019). Iraqi marshes importance of national, regional and global by talking about birds marshes, we find that these water bodies includes a number no small birds International endangered demise, Or do not dwell except in this part of the world and others, Because it is a clean environment to house birds Of all kinds, therefore, keeping the number and types of resident and migratory birds in Iraq is a factor the abundance of water and green spaces, where a large number of ducks and birds can be seen migrating to the marshes. Winter or summer, when different species of birds, ducks and summer visitors breed in the marshes. Among the 287 species of birds recorded only 134 have been recorded in the long term in the marshes in southern Iraq (Abdel 2008). Human activity changes the earth's environment, and changes in these environments too affect migratory birds, resulting from the impact of climate change on both land cover and provide food. Consequently, there will be shifts in the destinations of birds in the region, Because Birds Affected spatially to changes in Climatic conditions far quickly than do land cover types. The dynamics of the ecosystem and the tools used in the LULC, Geographic information systems and remote sensing is widely spread because of its multidisciplinary applications such changes detection and, monitoring, analysis of LULC and impact on the ecosystem, too Temporal and spatial information supply the ability to predict the trends in LULC in

order to make a better-maps within an area. therefore, the data, tools and methods used for detecting changes in land cover through Vegetation and water bodies by remotely sensed data from Landsat images from 2000 to 2020 common with GIS technology. Effective in mapping the Vegetation and water bodies (Mesmin et al. 2020).

Materials And Methods

The study region

Al Hammar Marsh includes the great Iraqi wetlands, where are part of the Tigris and Euphrates system. The permanent wetlands occupied by the Al Hammer marsh region were historically measured to be roughly 2,800 km2 and to surpass 4,500 km2. Located to the right of the river Euphrates among 634,272 to 3,413,985 m east and from 758,945 to 3,383,833 m north in zone 38 N, marsh stretches from the western town of Nasiriyah to the outskirts of Al Basra on the Shatt Al-Arab River in the east (Fig. 1). The marshes are approximately 120 km length and 25 km wide and have a mean depth of 1.8m to 3 m. (Al-gburi, Al-tawash, and Al-lafta 2017). It is possible to divide the Al Hammar marsh across two regions; the first is in the town of Al-Nasiriyah, which provides its waters with several rivers, while the second portion is situated within the town of Al-Basra and is nourished by the tidal phenomenon during the Shatt AlArab sea. Al Hammer Dike divides the eastern and western districts of the marsh. Future proposals for the building of the Al Hammar Barrage are in progress, linking all sides of Marsh, there are abundant natural and artificial features in the marsh, such as islands, wetlands, vegetation, and many dykes that surround and spread throughout the marsh. The feeding and irrigation system is very complicated, since virtually all of these rivers work as feeders at times and other periods based on the water size of the marsh and those rivers.(S. K. Ali 2019).

Data sources and method

Data used in this study and for period of time 2000-2020 Per 10 years were Landsat 5 TM (thematic mapper) data and Landsat 8 OLI (operational land imager) data Satellite images downloaded from the website https://livingatlas2.arcgis.com/landsatexplorer/)Table 1(was used for creating LULC maps, The spatial resolution for Sensors is the same and equals (30 m)(A. K. Mohammed, Mashee, and Ramahi 2020). The nature of the study area is Water and vegetation and ground reference data was obtained by visual interpretation of the maps and using Google Earth Pro, a shapefile was created for the classification of the study area. All the Data processing and classification steps were completed using the software ArcGIS 10.2. All the data were projected to the same reference system UTM (zone 38N) and WGS 84 datum, the preprocessing steps included the assignment of the coordinate system, layer stacking of the separate bands of the datasets and splitting the images based on the polygon of the study area. Supervised classification methods and maximum likelihood algorithm were used for producing LULC maps (Juliev et al. 2019).

Data type	Sensor	Scene	Acquisition Data	Source	
Remote sensing	Landsat-5 TM Landsat-5 TM Landsat-8 OLI	scene one	scene two	2000/10/19	Landsat Explorer
scene one	scene two	2010/10/16	Landsat Explorer		
scene one	scene two	2020/10/23	Landsat Explorer		

Table1 List of the Used Landsat 8 & 5 scenes data.

Climate and migratory birds

In many ways, the impacts of climate change on migratory birds will manifest, including changes in geographical and elevational allocations; phenology, as well as the timing of migration and the beginning of breeding, the nature of the population and gender interactions, the correlation of migratory bird populations with seasonal climate fluctuations, could inform forecasts of their long-term climate change response. Such fluctuations, particularly in precipitation,

may affect migratory birds' survival and population dynamics, winter precipitation and, to a lesser degree, spring precipitation in the breeding range are expected to have an indirect effect on the vital levels and abundances of breeding migratory birds in temperate ecosystems, e.g. in at least some cases, both adult survival and recruitment were positively associated with increased annual breeding range precipitation. In Iraq's South(Knudsen et al. 2011). The reproductive success of migratory birds was positively associated with annual precipitation, and declines in species richness and breeding migratory bird occupancy were associated with increased drought, particularly reduced precipitation. Precipitation is likely to be positively associated with primary productivity, which in turn is likely to be positively linked to the abundance of arthropods and vegetation cover and water bodies, which are resources for migratory bird nesting, the abundance of breeding migratory birds can also be influenced by the air temperature. Previous projects indicated that the impact of rising temperatures on migratory birds were badly adapted, In temperate districts, both increases in density and parallel decreases in adult survival are known. Survival can decrease as aridity increases even among genders adapted to warm and dry climates, and temperature may limit the breeding activity of migratory birds in arid districts even though precipitation increases. Increases in evapotranspiration may lessen initial productivity, though it may be difficult to predict such

influences in semiarid systems. Increased temperature concentrations may lead to asynchronies among the emergence of invertebrate food source and avian breeding operation. (Fogarty et al. 2020).

Land cover and migratory birds

Many species of migratory wild birds migrate for very long distances (Fig. 2). The most common pattern of migratory birds In autumn when heavy cold and less day period becomes food processing difficult in the Northern Hemisphere heading to the most areas warmer and provided with a portion of food and begin this migration in the seasons before breeding season often, this type of bird component gene has is the engine has to migrate In terms of timing and route, this could be modified by the environmental impacts and by changing the length of days (Zurell et al. 2018). The Marshes or wetlands in southern Iraq, a resource important for birds, resting place and the warming, protection and source of food available for birds are located on the migration route of many of these species, where thick vegetation, and water bodies with as little relatively population activity and lack of Prey Birds, and the period in which you spend birds in Marshes allows these The varieties are improving their numbers and spending the winter seasons. The total number of water bird species in the world amounts to 158-134, including those that reach the Iraqi Marshes, according to what is documented in the Treaty for the Protection of African-European Migratory Water birds (WAAE) (Howard et al. 2020). Land Cover is involved in an ongoing global trend in which migratory bird species, due to human activity and climate change, experience a higher population depletion ratio than their resident counterparts. The loss of migrant categories poses a major threat to global biodiversity and related ecosystem services as many vertebrates in the world make long-range flights for food and a temperate climate. Knowing the causes of these losses is complicated by the dependence of migratory birds on multiple habitats like (Lake, marsh, wetland) In addition to vegetation for food and housing even on their breeding and non-breeding grounds, as well as at rest places. The reliance of migratory birds on the conditions in multiple spaces and on the phenology of the events in these spaces makes them more sensitive than their resident counterparts to environmental fluctuations, valuating drivers of their population variation is further complicated by the need to know in which of the diverse Components of the annual life cycle the population is deeply limited. Also, environmental variation and anthropogenic habitat variation are potential drivers of decrease, alongside other factors such as heightened persecution and hunting (Miranda and Miranda 2017).

Results

Vegetation changing trend analysis based on NDVI

Calculation of NDVI on Landsat (5, 8) satellite data between 2000 and 2020 by equation (1) was done after the Landsat data was corrected so that accurate NDVI rates could be obtained. NDVI was the quantity of vegetation greenness rates obtained from digital signal processing of NIR and RED band reflectance values (A. K. M. Ali et al. 2019). The operation of red light absorption by chlorophyll and reflection of near-infrared light by mesophyll tissue contained in the leaves would make the brightness values received by the Landsat sensors on these bands would be very various. At the non-vegetation

spaces, comprising water bodies, and areas of urbanization and soil, would not show a high percentage value (minimum). Reciprocally, in the area of dense vegetation with healthy conditions, the percentage of the two bands would be very high (maximum). The results of the statistical analysis of the index showed that the percentage of vegetation in 2000 was equal to 5.0%, while the percentage decreased in 2010 by 3.5%, while the percentage increased in 2020 by 15.6% (Tkins, Pstein, and Elsch 2018). As shown in (Table 2 and Figs. 3 - 4).

See formula 1 in the supplementary files section.

Table 2 The values of vegetation change during the study period

year	Vegetation (m²)	%Area	Non Vegetation (m²)	%Area
2000	105484708.1	5.0%	2009687231	95.0%
2010	74694241.16	3.5%	2040389936	96.5%
2020	330849909	15.6%	1784234268	84.4%

Water changing trend analysis based on NDWI

NDWI was used to classify the major Water bodies of the study area using Landsat images from 2000 to 2020. The purpose of NDWI calculation was to identify the Water bodies changes over the study region. NDVI mapping was successful in identifying the “Water bodies” over the study region. Two types of NDWI such as no-water (NDWI<0), Water bodies (NDWI>0) were demarcated using equation (2) (A. K. M. Ali, Mashee, and Ramahi 2020). From the NDWI analysis, a gradual increase in water bodies has been observed from the year 2000 to 2020, water bodies were about 7.8%, 21.0%, and 62.6% of the total study area respectively in the year of 2000, 2010 and 2020 (Figure 4). On the other hand, the no-water area decreased rapidly to about 92.2%, 79.0%, and 37.4% during the study period was applied in ArcGIS version 10.2 to extract areas. (Afroz and Mia 2019). The results are shown in (Table 3 and Figs. 5 - 4).

See formula 2 in the supplementary files.

Table 3 The values of water bodies change during the study period

year	water bodies	%Area	Non water	%Area
2000	164141292.6	7.8%	1950105714	92.2%
2010	443737743.5	21.0%	1671346434	79.0%
2020	1324906544	62.6%	790177633.6	37.4%

Discussion

The results of the study showed in October of 2000 to 2020, the total amount of migratory birds in Iraq has shown a decreased. Especially in the period from 2000 to 2010, This decline is due to decreases in the migratory species dependent on the water bodies, vegetation cover, Which provides food and the existence of suitable weather for the Breeding of migratory birds, while a general increase occurred During 2020 the abundance of vegetation cover and water bodies were15.6% and 62.6%, respectively, however, (Mallard duck, Barn swallow and White stork, Common gull) showed an increase (from 2000 to 2020) during the period of research. Other species such as Graylag goose and White pelican showed strong declines that were not statistically significant because these changes in vegetation cover led some birds to search for other areas with good food and weather. Index of differences in amounts of migratory birds in Al-Hammar Marsh indicated that this approach, anytime soon, due to changes in migratory bird distribution within the studied area, it seems to have limited potential and the significant sampling error in the subsection itself counts. Long-term analyses of the operation of the system, concurrent with an increased number of counts, (e. g., seagrass, and fish) our understanding of the reasons behind the overall change in migratory bird populations will be improved. Finally, an annual count would also mean that all ecological areas are visited and verified on a daily basis, thus improving the potential to detect major losses.

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Declarations

Ethics approval and consent to participate

“Not applicable”

Consent for publication

“Not applicable”

Availability of data and materials

The datasets generated and/or analysed during the current study are available in the [Landsat explorer and Google Earth Pro]

Competing interests

"The authors declare that they have no competing interests"

Funding

“Not applicable”

Authors' contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Ali K. Mohammed Ali], [Fouad K. Mashee Al Ramahi]. The first draft of the manuscript was written by [[Ali K. Mohammed Ali] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Consent to Publish

“applicable”

Figures

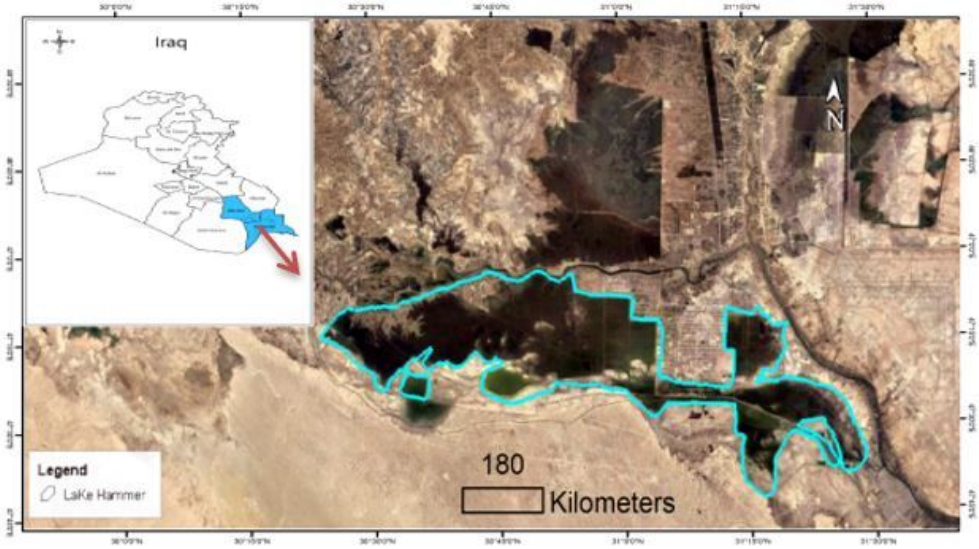

Figure 1

Shows the Location of Al-Hammar Marsh in Iraq

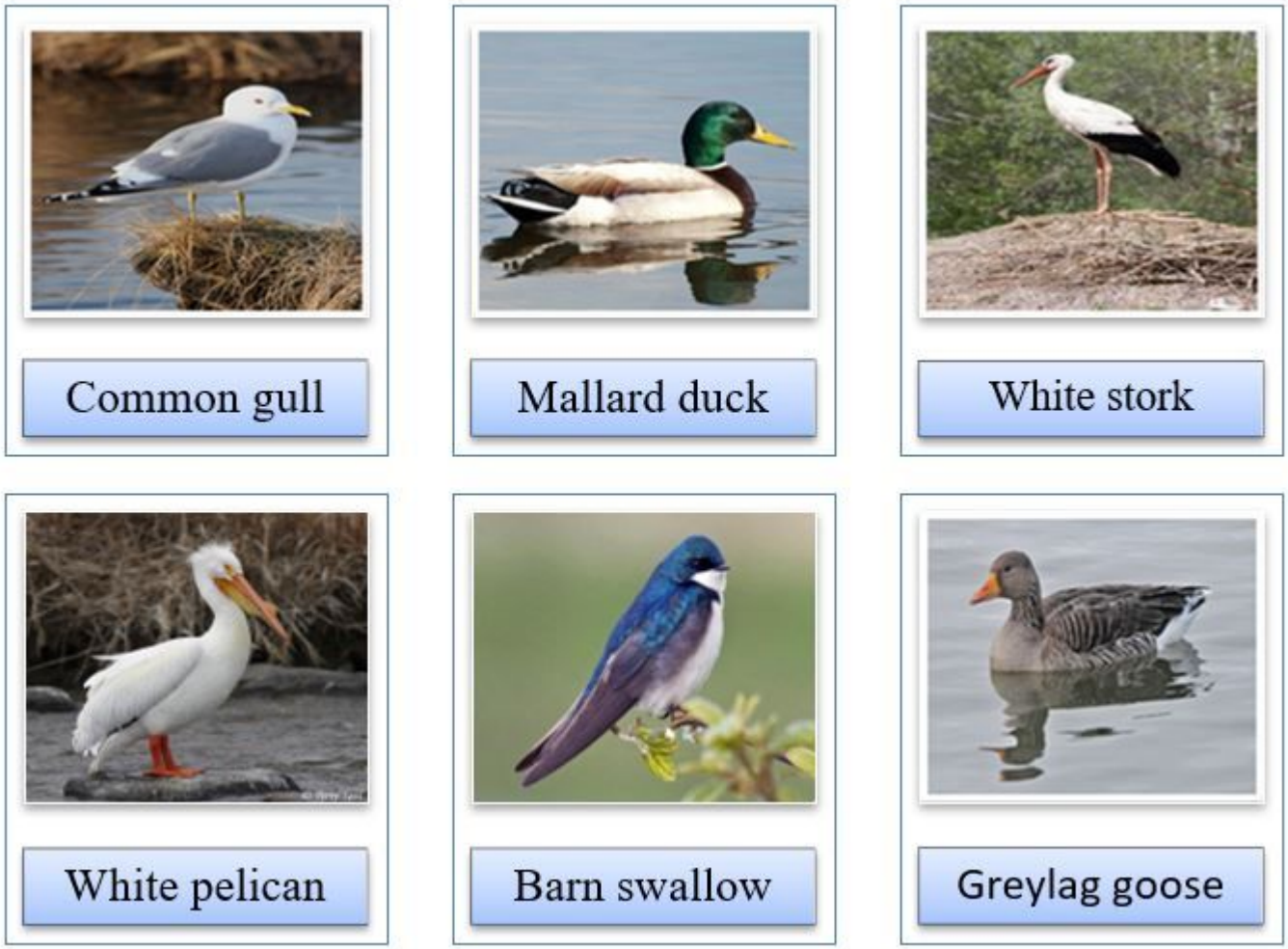

Figure 2

Shows some types of migratory birds that reach the marshes of Iraq.

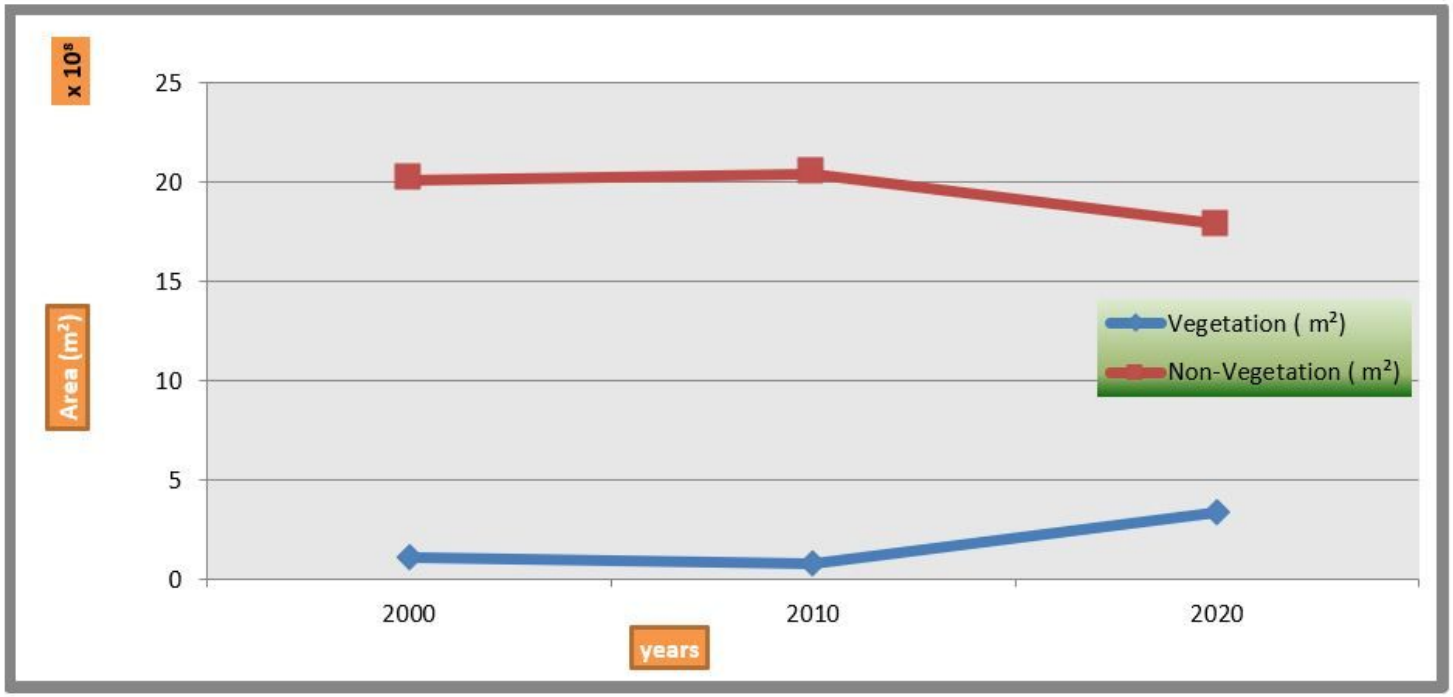

Figure 3

The variation of the NDVI area from 2000 to 2020.

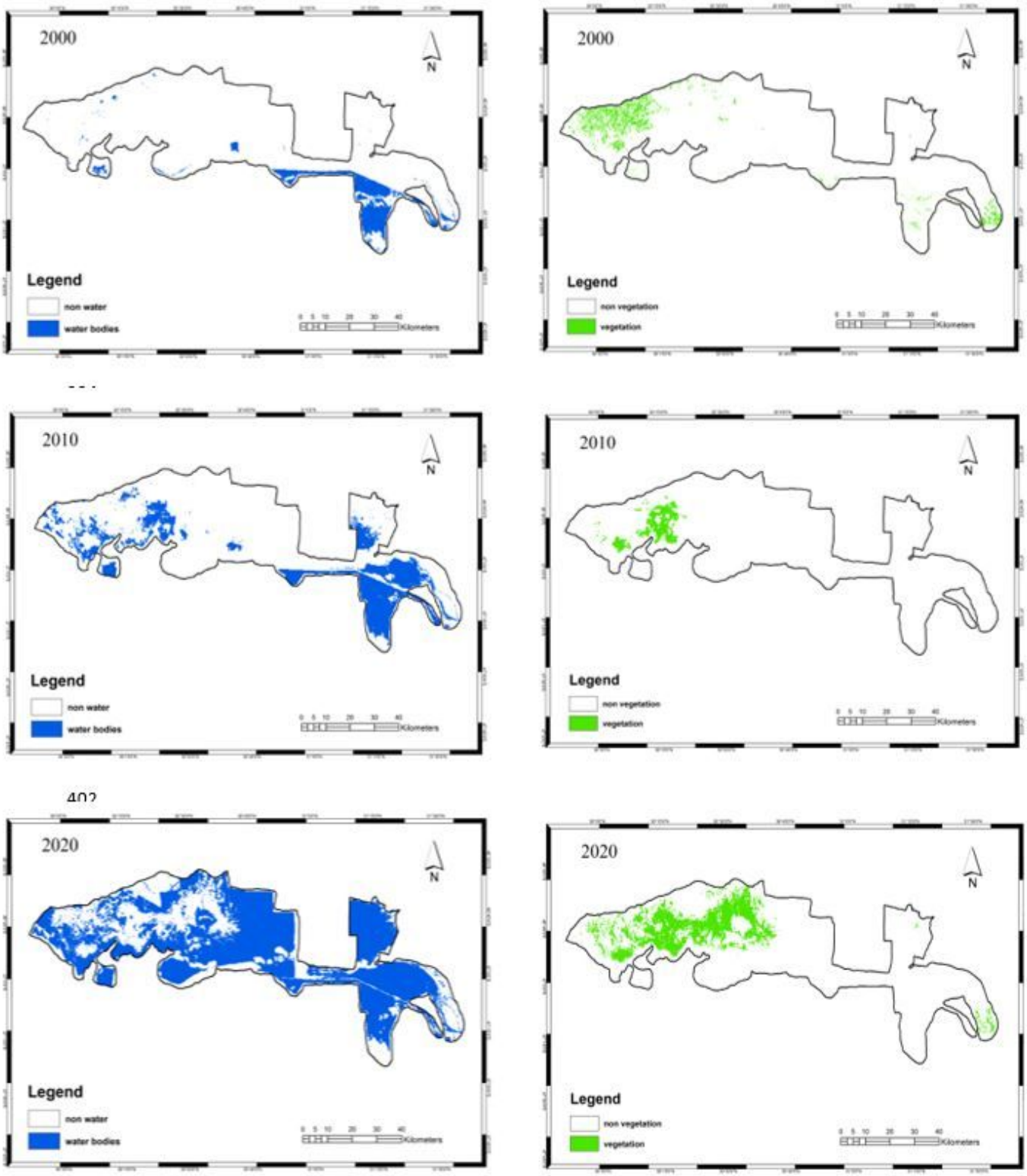

Figure 4

The NDVI and NDWI of the Landsat images from 2000 to 2020.

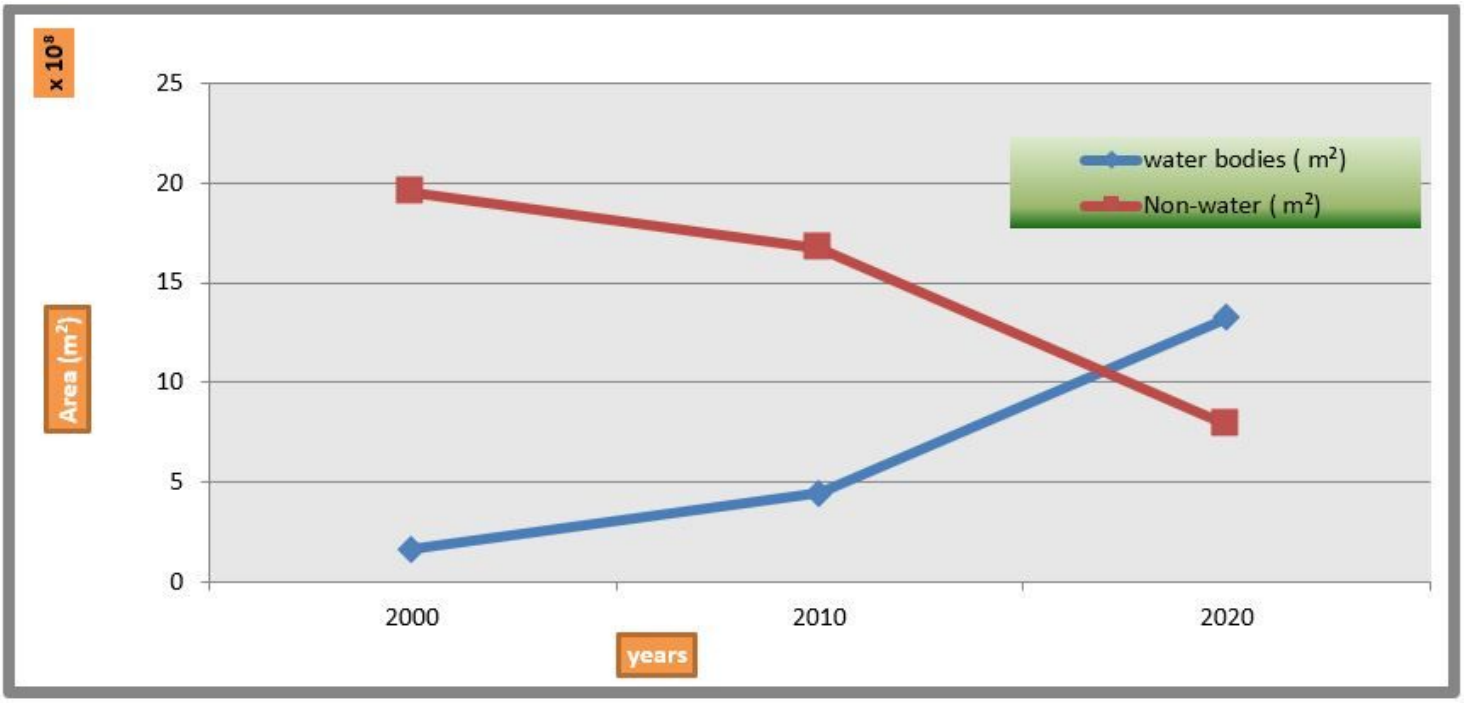

Figure 5

The variation of the NDWI area from 2000 to 2020

Supplementary Files

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- formula.docx