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RESEARCH ARTICLE

Ecosystem Modeling with External Data Spatial Temporal in Iraqi Marshland

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Abstract

The impacts of human activities and climate change on Iraqi marshes ecosystems that are challenged limitations of present-day ecosystem models, this research presented a part of a larger study to develop a new approach to ability interaction six main stations of the Missan governorate (Al- Auda Marsh, Al-Battat Marsh) between metals (Cu, Fe, Pb) by geographic information systems (GIS) technology into a flexible and modular software approach to illustrate capabilities of the new framework. Have been predictive abilities of the concentration elements between plants and soil model and applied this framework showed changes at the plants level due to changes in production species. The results in all stations under study showed low concentrations and varied mostly similarly limiting factors with natural boundaries, A little increase come from of some pollutants that are discharged from waste populated. The correlation showed significantly between these variables in the aquatic environment, It would be transmitted an ecological balance between plants and soil. This considered as a very important database for environmental risks and health in aquatic ecosystem of marsh which can be updated through a unified future other periodic data.

Keywords: *Iraqi Marshland, Environmental risk assessment, Model comparison.*

Introduction

Marshes are transitional districts between terrestrial and aquatic systems where water table near or above the land surface have many of the important functions that benefit human and wildlife and plants [1]. Iraqi marshes considered as a filter and store water on ecosystems, collected flood waters beside places of beauty and many recreational activities also Plants found in wetlands to help control water erosion once covered an area (20,000 Km2), and it extends between the three Iraqi Cities of Amarah in the north, Basra in the south, Naseriyah in the west.

Al-Huweizah marshlands are located in southeastern Iraq but also extend across the border into Iran .It lays to the east of the Tigris River, straddling the Iran-Iraq border [2].Most of the water that supply the marshlands coming from the Tigris and Euphrates Rivers with some input from Al-Huweizah Marsh [3]. Climate change and human activates interactions on ecosystems noticeable in all the world all processes environmental are interconnected and sustainable terrestrial ecosystems are linked with productive healthy, therefore need to understand on these processes to prevent steadily declining in the environmental health [4]. Many studies have been conducted especially for water from Iraqi Al-Huweizah Marshes most recent concentration of radioactive elements and heavy metals in water and soil samples have been high which revealed the expected pollution in the area could be raised from natural and anthropogenic [5,6]. Many studies have been demonstrated the potential monitoring land surfaces in studies [7, 9].

Ability of plants to accumulate heavy metals in relation to their concentrations in the ambient lead to the observed variations in metal concentrations in plants and researchers observed a heavy metals concentration in aquatic plants and soil samples in Al-Huweizah marshes, the levels of concentration are lower than the other compared regions of the world [10, 11]. Basically there are three reservoirs of pollution in an aquatic ecosystem represented by water; Soil with sediment, the sediment is recognized as the main repository

for elements. These sediments are an essential part of the pond system and may be partial by pollution over long time and over a wide spread region, these are proved to be monitored easily and efficiently. As elements which are possibly unsafe to human health they are kept in sediments for a long period it may enter the food web in significantly high amounts, it should be monitored intervals. Many studies have showed the possible contribution of emergent and submerged plants [12, 16].

Many studies of the aquatic plants form different areas of southern Iraqi marshes showed that the heavy metals content of plants have a different concentration range which reveals the concentration and accumulation of these metals from their environment [17].

A survey on aquatic plants during 2006 evaluated the status of east Al-Hammar marsh after restoration including two main stations, the higher value of cover recorded for *Ceratophyllum demersum* as submerged 56.48% and *Schoenoplectus litoralis* as emerged 42.46%, *Phragmites australis* recorded the highest value of biomass in summer for emergent macrophytes while *Ceratophyllum demersum* recorded highest values of biomass compared with other submerged macrophytes [18].

Moreover, the marsh dwellers are dependent upon vegetation, in particular the common name Reed (*Phragmites australis*). A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on earth and integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps.

Data-bound or written representation of the formulas for the spatial information core components called simple components such as spatial raster data that represent the points such as the locations of measurement stations and written statements which represent the lines, such as streets or rivers.

The data represent the polygonal or areas that can be identified closed line such as lakes and administrative areas, residential neighborhoods [19].

A spatial data are on a network or matrix of dimensions of small cells called (Pixel) or a sham (Picture Element), and each pixel value reflecting the type of the corresponding teacher. That each pixel is the average illumination or reflectivity measured electronically to the same location on a gray scale expressed as a number called a digital number (Digital Number DN).

These values are positive integers. The gray scale is a measure of light intensity represents the color black (a reflection of lower and higher absorption of electromagnetic radiation), and the highest value representing the color white the highest reflection and less absorption of electromagnetic radiation.

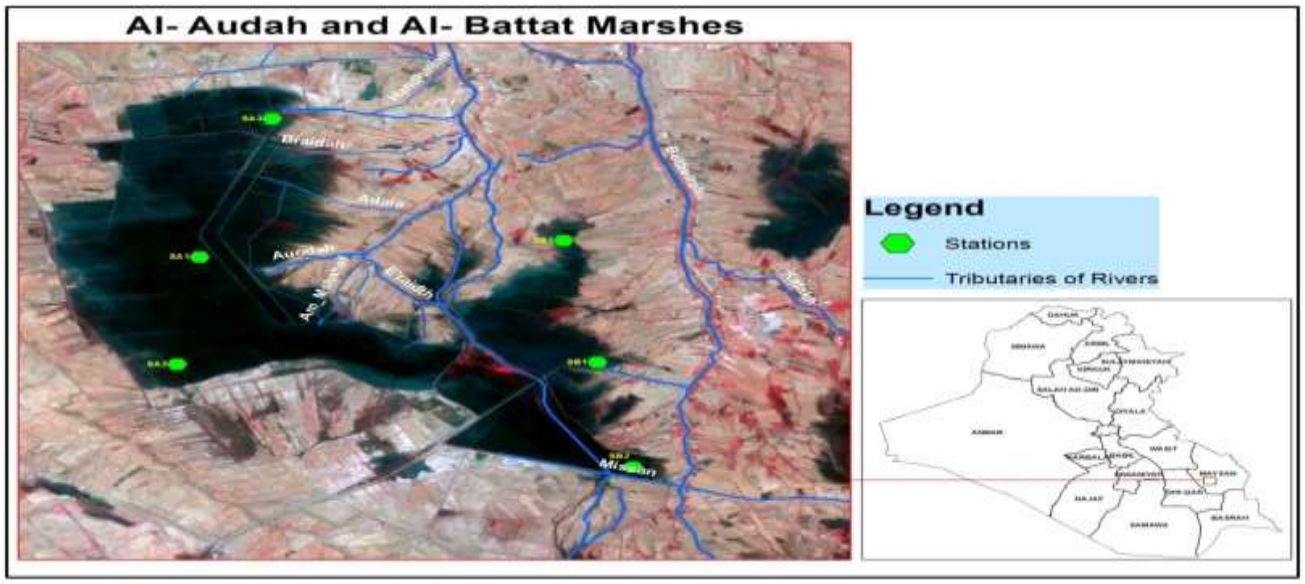
The pixel size is the basis of image resolution, as the smaller pixel size increased the accuracy and clarity of an image [20]. In this study have been estimated spatiotemporal variation in Missan marshes in southern Iraq with high temporal frequency and associated a spatial resolution and allows investigation of the ability of such data to be used to monitor variations in soil with three types of basic plants dominated in all station at a local scale.

Materials and Methods

Study Area and Sample Collection

Six basic stations were chosen in this study in the Missan Governorate marshes(Al-Auda Marsh, Al- Battat Marsh) , It was chosen three main sites of the (start, middle and end) of each region for the purpose of the study. Soil and aquatic Plants were collected from the study sites at 2017, Standard methods by [21].

Three basic species of plants were chosen *Ceratophyllum demersum* (Class: Angiosperm, Family: Ceratophyllaceae) (Linnaeus, 1758), *Typha domengensis* (Class: Angiosperm, Family: Typhaceae) (Linnaeus, 1758) *Phragmites australis* (Class: Angiosperm, Family: Poaceae) (Linnaeus, 1758). Plants were collected and then rinsed thoroughly with deionized water and dried in the outdoor at room temperature for (3-5) days then ground with an agate mortar to be ready for analysis. Pic(1) Boundaries of the six marshes where samples were collected.



Picture 1: Arc10 Map GIS development in study area

Experimental and Preparation of Samples for Analysis by Top Wave Analytic Jena Type

Samples of all types were collected by weight 0.5 mg into the digestion vessel, add 5ml of nitric acid HNO3 %65 after that the mixture was shaken carefully or stirred with clean glass bar necessary and wait at least (20 min) before the vessel is closed, Heated in the Microwave oven with the following program to avoid foaming and splashing wait until the vessels have cooled the same room temperature about (20 min). The digestion vessel was carefully opened in fume hood wearing hand Eye and body protection since a large amount of gas would be produced during the digestion process, then they were quantitatively transferred to Falcon tubes and diluted to 15 ml with deionized water.

For the quality control analysis, 0.250 g of CRM and SRM types (Environmental and Biological) were transferred into a Teflon vessel, reconstituted with 2 mL of deionized water. For all samples digestions, five replicates were performed .Also calibration blanks of 2.0 mL deionized water were taken through the same digestion process. Detection limits for Pb, Cu and Fe in this study were calculated based on three times the standard deviation of the average of 5 blank measurements to one test depending methods [22, 23], then investigate by Atomic Absorption Spectroscopy AAS.

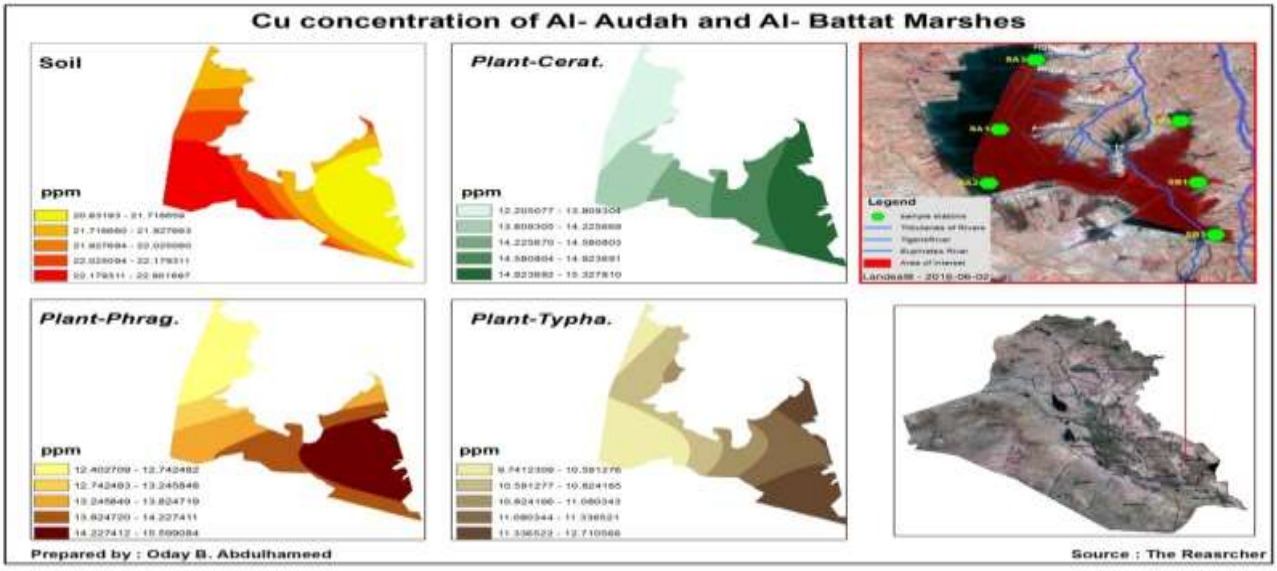
Statistical Method

The statistical analysis was performed according to the AOAC Protocol [24] was assessed using different measures of statistical and coefficient of determination correlation coefficient, mean prediction error concentration of component standard method. The coefficient of determination, r^2, was calculated where N is the total number of paired observations. A value of $r^2 = 1$ indicates 100% precision between the methods.

Results and Discussion

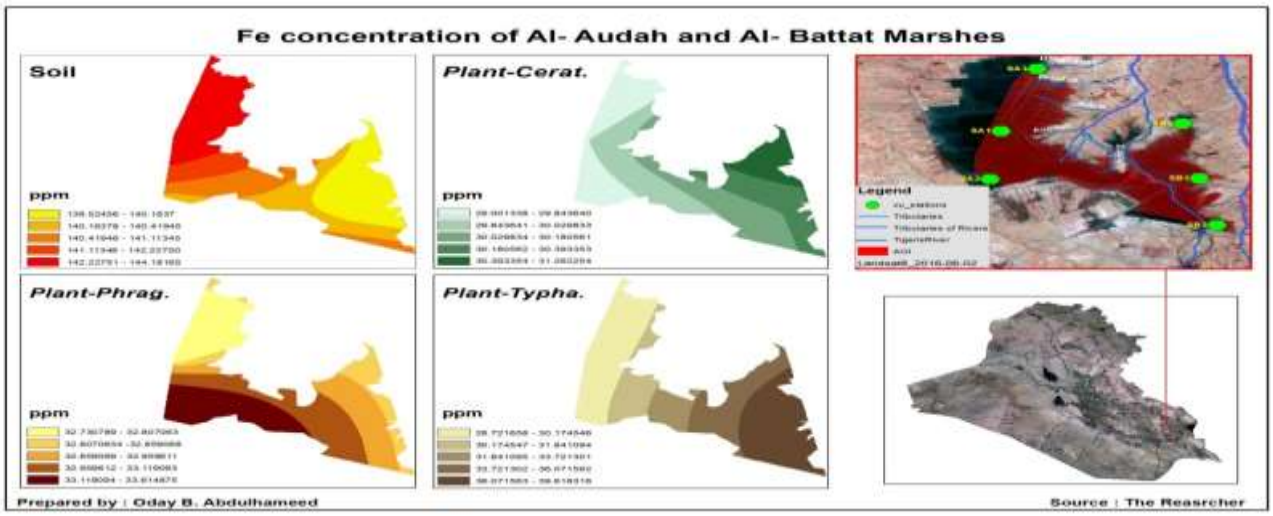
Results showed the presence of different elements concentration in all plants with a difference from one to other depending on the ability to absorb this element and content in three dominate plants species, Consecutively: *Typha domengensis*> *Phragmites australis*> *Ceratophyllum demersum*, that means it is used as a positive indicator of this element pollution in studies areas in marshes. Through statistical analysis scored a significant between element in soil and three types plants in percentage of corresponding (0.54% 0.36% and 0.10%), respectively, this is consistent with some researchers in the same Pb element for plants *Typha domengensis* between (2.01–18.3) ppm in Spanish [25].

Cu element *Phragmites australis* (3.9) ppm in Portugal [26]. Also in local studies [15] found Fe element *Ceratophyllum demersum* between (4.3-16.9) ppm, Pb element in *Typha domengensis* between (14.1-17.5)ppm and Cu element in *Phragmites australis* between (8.6-13.8)ppm, and range concentration Fe element (122.65) ppm , Cu (12) ppm and Pb (49) ppm in the soil . Table (1) shows the concentration of Copper Cu ppm in Soil and three types of plants.



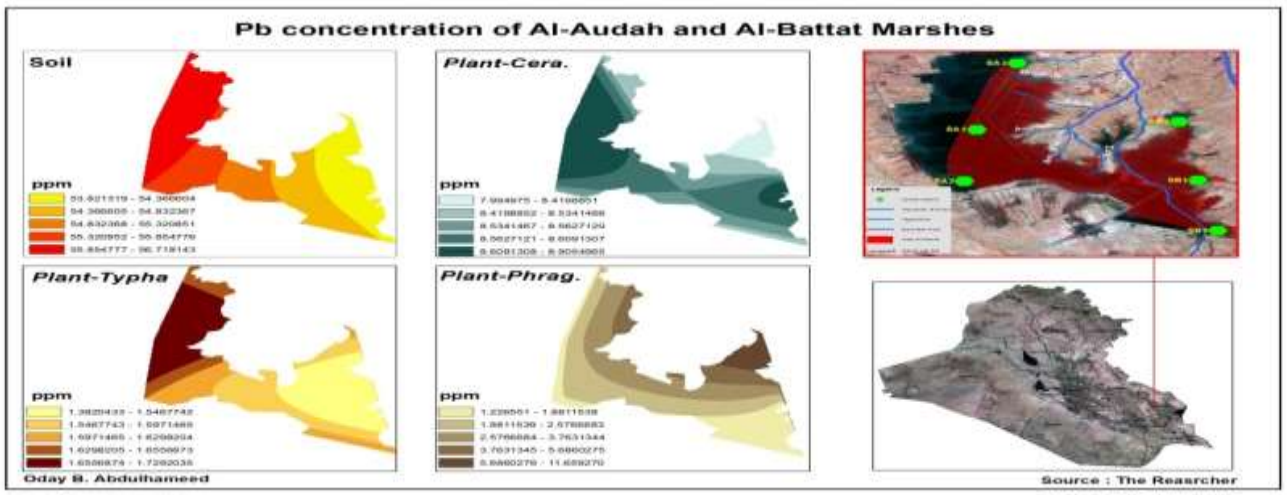
Pic 2: Spatial analysis of Cu concentration in soil and types of plants in study area

The resulting contour maps investigated in all types Plants and made standard deviation maps are illustrated. Depending on the type of plant, portability tolerance and absorption of element. Marshes plants species differ from taking up accumulate various heavy metals in their tissues [27]. Submerged species have been accumulated relatively high concentrations when compared with emergent species [28, 16].



Pic 3: Spatial analysis of Fe concentration in soil and types of plants in study area

These approaches or Model equations in the results allowed to use all available data as a bioindicator from any stations in marshes to predict and function the geographic information system variable and given in coefficients with additional precision in material supplemental because it does not focus on the differences in the relative size of the plants, but rather focus on the distance-weighted variables such as conditions and the nature of the marshes. Also the spatial data property did not change dramatically during the recent ten years as increased population density in some parts of the marshes. The results of soil showed the level of this element concentration was less than expected compared with previous studies between (0.951, 2.017) ppm. There was no significant correlation P-Value (0.01, 0.031). It was not of a critical level set by WHO and EUO [29]. Most concentrations of these in analysis sigma plot were P-value <0.05 and percentage 25% in plants and (75%) in soil compared to some researchers reported [30, 31], relatively constant that may reflect input and deposition in the areas under study and may be relatively constant during ten recent years, which reflects a fact concentration is not the only influencing factor this results agree with [32]. This study agrees with researchers [33, 15].



PIC 4: spatial analysis of Pb concentration in soil and types of plants in study area

Discussion and Recommendation

Used spatial analysis by GIS system to combine multiple datasets to get standardized information have been integrated of quantitative computing and qualitative analysis has enhanced the easy and credibility of the elements bio indicator models to describe the general environmental properties and has been applied in the management of Iraqi aquatic systems. The values for the radioactive equivalent activity in water sample found to be within the world average allowed the maximum value of average and significant P-value <0.05 . Response pollution indices can be used to compare different pollution in areas and essential in the understanding of the current risks to all organisms in aquatic ecosystem in region especially when there spatial database for the distribution of pollutants such as elements with the rapid development of urbanization and industrialization, plants and soil pollution for the dominant organism dominate in area. There are many external factors that affect pollution in it such as organic, inorganic complex as well as chemo physical factors, PH, heat, light, Oxygen and Nutrients and biodegradable of organism [33]. Reflecting their high accumulate capacity, enhancing exposure to dissolved metals [34, 35]. Concentrated elements of soil are higher than plants and the recent being possible that washed away with large amounts of passage in the flood season [36, 37].

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