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Track Recent Changes in River Nile Course and Islands in Egypt

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RIVER NILE is the longest river in the world. The River Nile islands form an attractive agricultural area characterized with its nightly fertile soils, easy source and its suitability to a wide range of land use. The present use of these Nile islands does not reach the maximum capability of these resources due to improper land use of these areas. The current study aims at identifying the changes of the Nile course and its islands during the last three decades using remote sensing and GIS techniques in order to provide the scientific bases, which help in planning the most suitable programs of land use, soil management and conservation. Six MSS, eight TM and Eight ETM+ satellite images dated to 1972, 1984 and 2002 respectively were used. The study area was divided into five sectors along the Nile River course. The changes in Nile course from early seventieth to middle eighteenth were decreased by 51.34 Km^2, from middle eighteenth to the millennium were decreased by 40.30Km^2. The overall change in Nile course area decreased by 91.64Km^2during the investigation period. Regarding to the islands numbers and areas during the studied period period, were from early seventieth to middle eighteenth- increased by 171 islands, from middle eighteenth to the millennium were decreased by 86 islands. Meanwhile, the islands areas from early seventieth to middle eighteenth were decreased by 4512.39 Feddan, while from middle eighteenth to the millennium were decreased by 5446.97 Feddan. The overall change during the study period for the total number of the islands was addition of 85 islands, meanwhile the islands areas were decreased by 9959.36 Feddan. It is found that, there is no regular pattern of the changes in soil characteristics due to many reasons.

Keywords: Nile course and islands, Soil characteristics, Remote sensing and GIS.

River Nile is the longest river in the world 6,695 km long from its remotest headstream, the Luvfeza River in Burundi, central Africa, to its delta on the Mediterranean Sea, NE Egypt. The total area of the Nile basin is about 3.3 million km^2, more than 81,500km^2 are lakes and 70,000km^2 are swamps. There are ten riparian countries: Burundi, Democratic Republic of Congo, Uganda, Eritrea, Ethiopia, Kenya, Rwanda, Tanzania, Sudan and Egypt. The mean annual rainfall over the entire basin is about 2,000 billion m^3. The average annual flow at Aswan is about 84 billion m^3. Nile waters support practically all agriculture in the most densely populated parts of Egypt, furnish water for more than 20% of Sudan's total crop area, and are widely used throughout the basin for navigation and hydroelectric power. The Nile River islands form an attractive agricultural area characterized with its nightly fertile soils, easy source, and its suitability to a wide range of land use. The present use of these Nile islands does not reach the maximum capability of these resources due to improper land use practices of these areas. The current study aims at detecting and identifying the changes occurred on the Egyptian Nile course as well as its islands in order to provide the scientific bases, which help in sustainable landuse planning, soil management and conservation.

Material and Methods

Location

The Egyptian Nile course and its islands lie between latitudes 24° 03′ 00″ south and 31° 32′ 00" north and located in the area extends from High Dam, Aswan Governorate, to Nile branches Damietta & Rosetta (Fig.1) The Nile course was divided into five sectors Aswan-Qena, Qena-Asuit, Asuit-Qalubia , Qalubia-Damietta, and Qalubia-Rosetta sectors as shown in Fig. 2.

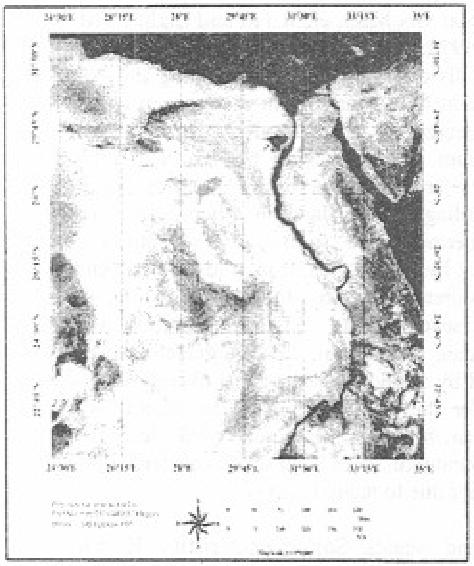

Fig. 1. Location of the Egyptian Nile.

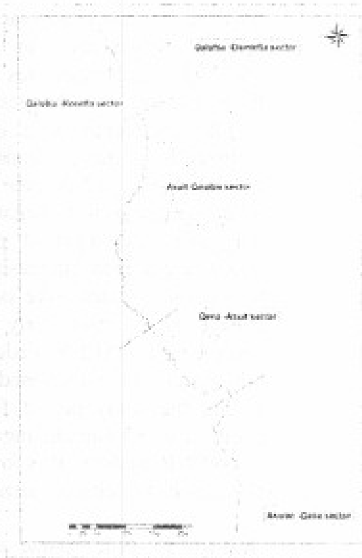

Fig. 2. The investigated sectors.

Satellite images

Six MSS, eight TM and eight ETM+ satellite images were used to fulfill the requirements of the current study (Table 1).

TABLE 1. The satellite images of the study area.

Sensor Type	Path	Row	Date	Sensor Type	Path	Row	Date
MSS	188	42	22/10/72	TM	174	43	20/09/84
MSS	188	43	09/11/72	TM	175	42	13/09/84
MSS	189	41	10/11/72	TM	176	38	20/09/84
MSS	190	38	31/08/72	TM	176	39	20/09/84
MSS	190	39	31/8/72	TM	176	40	29/09/87
MSS	190	40	04/01/73	TM	176	41	29/09/87
TM	177	38	11/09/84	ETM	176	39	11/11/00
TM	177	39	11/09/84	ETM	176	40	10/10/00
ETM	174	43	10/09/00	ETM	176	41	10/10/00
ETM	175	42	19/10/00	ETM	177	38	17/06/02
ETM	176	38	11/11/00	ETM	177	39	23/12/01

Digital image processing

Digital image processing was performed using ENVI software version 4.5. Image processing included images calibration to reflectance, filtering & stretching ,atmospheric correction, geometric correction, sub-setting and mosaicing for ETM+, TM and MSS data (Lillesand & Kiefer, 2000). Data Merge was used to enhance the ground resolution of the low resolution image by merging the low-resolution multi-spectral image with a high-resolution gray scale image (Vrabel, 1996).

Change detection analysis

Change Detection offer a straightforward approach to measuring changes between a pair of images that represent an initial state and final state. The input images were first standardized to a zero mean and unit variance and a difference map was produced to characterize the differences between any pair of initial state and final state images. The difference is computed by subtracting the initial state image from the final state image.

Field studies and laboratory analyses

A soil survey was made throughout the investigated islands in order to gain an appreciation of the broad soil patterns and landscape characteristics. GPS was used to locate the site of each profile (latitude and longitude). Detailed examinations of the recognized layers of the profiles and their boundaries according to FAO (1990). The collected disturbed samples were air dried; ground gently, then sieved through 2 mm sieve and gravel content were calculated. The soil samples were mechanically analyzed according to Rowell (1995).Soil color was determine using Munssel color charts, Soil Survey Staff (1951). Soluble cations and anions, EC, Soil reaction (pH), $CaCO_3$, OM %, was determined according to Rowell (1995). Available N was determined by Kieldahl procedure, available P was measured colorimetrically as described by Soltanpour (1985). Available K was measured also according to Soltanpour (1985). Available Fe, Mn, Zn and Cu were determined by DTPA after Lindsay & Norvell (1978).

Results and Discussion

River Nile hydrology

According to Bonnie (2003), Said (1981) and Said (1990), the Nile consists of a series of steeper and flatter segments, and this is thought to indicate that several independent drainage systems existed in the region now drained by the Nile.The flow rate of the Albert Nile at Mongalla has average of 1.048 m^3/s . After Mongalla, the Nile is known as the Bahr El Jebel which enters the enormous swamps of the Sudd region of Sudan. More than half of the Nile's water is lost in this swamp to evaporation and transpiration. The average flow rate in the Bahr El Jebel at the tails of the swamps is about 510 m^3/s. From here it soon meets with the Sobat River and forms the White Nile. The Bahr al Ghazal's drainage basin is the largest of any of the Nile's sub-basins, measuring 520,000 km^2 in size, but it contributes a relatively small amount of water, about 2 m^3/s annually, due to tremendous volumes of water being lost in the Sudd wetlands.

The Sobat River drains about half as much land, 225.000 km^2 , but contributes 412 cubic metres per second annually to the Nile (Shahin,2002).In flood the Sobat carries a large amount of sediment, adding greatly to the White Nile's color, (Encyclopedia Britannica, 2008).The average flow of the White Nile at Malakal, just below the Sobat River, is 924 m^3/s , the peak flow is approximately 1.218 m^3/s in early March and minimum flow is about 609 m^3/s in late August. The fluctuation there is due the substantial variation in the flow of the Sobat which has a minimum flow of about 99m^3/s in August and a peak flow of over 680m^3/s in early March. From here the White Nile flows to Khartoum where it merges with the Blue Nile to form the River Nile. Atbara River merges with the Nile during the dry season (January to June), during this period of time the natural discharge of the Blue Nile can be as low as 113 m^3/s. During the dry period, there will typically be no flow from the Atbara River.The Blue Nile contributes approximately 80-90% of the River Nile discharge. The flow of the Blue Nile varies considerably over its yearly cycle and is the main contribution to the large natural variation of the Nile flow. During the wet season the peak flow of the Blue Nile will often exceed 5.663m^3/s in latter August (variation by a factor of 50). Before the placement of dams on the river the yearly discharge varied by a factor of 15 at Aswan. Peak flows of over 8.212 m^3/s, would occur during the later portions of August and early September and minimum flows of about 552m^3/s would occur during later April and early May. The Nile basin is complex, and because of this, the discharge at any given point along the main stem depends on many factors including weather, diversions, evaporation / evapo-transpiration, and groundwater flow.

Hydrologic impacts of climate change on the River Nile basin

Kiros *et al.* (2006) reported that, the potential impact of climate change on the hydrology and flow regime of the River Nile basin is assessed by downscaling and bias correcting climate model output from 11 General Circulation Models (GCMs) under two global emissions scenarios to one-half degree latitude-longitude spatial resolution. The downscaled and bias corrected climate model output was then used to force the Variable Infiltration Capacity (VIC) land surface model over the River Nile basin for the 100-year period 2001-2100. The model was first calibrated and tested using historical data for the period 1950-99 at three stream gauging stations: the main stem Nile at Dongola, the main stem at High Aswan Dam (HAD), and the Blue Nile at El Diem. Although there are large variations among the different GCMs, over the entire Nile basin, the multi-model average for the study period 2001-2100 showed an initial increase in precipitation, and then decreases, with the initial increase, and subsequent decreases, larger in the multi model average for emissions scenario A2 (more or less business as usual) as compared with B1 (global emissions leveling off by about 2100). Temperature consistently increased through the century, with larger changes for Scenario A2 as compared with B1. Averaged over all models and ensembles, annual stream flow at HAD for scenario A2 was predicted to increase to 111% of the 1950-99 mean during 2010-2039, but then to decrease to 92% and 79% of the 1950-99 mean during 2040-2069 and 2070-2099, respectively. For scenario B1, the corresponding numbers were 117% (increase) during 2010-2039, and decreases to 96% and 83% of the 1950-99 mean from 2040-2069 and 2070-2099, respectively.

River course areas along Nile sectors

Table 2 shows Nile river course areas acquired from satellite images through the previous three decades. Asyut – Qalubia sector has the maximum area recorded by MSS, TM, and ETM+ satellite images, meanwhile Qalubia-Damietta sector has the minimum areas in the acquired images.

TABLE 2. River Nile areas acquired from satellite images.

Satellite images	**MSS**		**TM**		**ETM+**	
Sector	Area (km^2)	Area (%)	Area (km^2)	Area (%)	Area (km^2)	Area (%)
Aswan -Qena	182.26	27.23	177.61	28.74	167.81	29.04
Qena -Asyut	152.52	22.78	142.15	23.00	127.48	22.06
Asyut - Qalubia	209.76	31.33	184.13	29.79	174.30	30.17
Qalubia - Damietta	51.41	7.68	46.11	7.46	42.81	7.41
Qalubia -Rosetta	73.49	10.98	68.10	11.02	65.40	11.32
Grand Total	669.43	100.00	618.10	100.00	577.80	100.00

Change detection along the river

Change Detection Analysis encompasses a broad range of methods used to identify, describe, and quantify differences between satellite images of the same scene at different times or under different conditions. Change detection offer a straightforward approach to measuring changes between a pair of images that represent an initial state and final state. The changes were detected through multi-temporal satellite images of MSS, TM and ETM+ dated to 1972, 1984 and 2002. The changes occurred within this period of the Nile course and its islands were recorded as an increase (+) or decrease (-). The changes as shown in Table 3 in Nile course from early 70^{th} to middle 80^{th} were decreased by 51.34 Km^2, from 80^{th} to the millennium were decreased by 40.30 Km^2. The overall change in Nile course area is decreased by 91.64 Km^2 in the investigation time. Asyut-Qalubia sector recorded a tremendous difference in Nile course area was detected from MSS and TM images (-25 km^2).

TABLE 3. The changes in Nile course from early seventieth to middle eighteenth.

Sector	MSS – TM 1972–1987		TM – ETM 1984-2002		MSS – ETM 1972-2002	
	Area (km^2)	Area (%)	Area (km^2)	Area (%)	Area (km^2)	Area (%)
Aswan-Qena	-4.65	9.06	-9.80	24.33	-14.46	15.78
Qena-Asyut	-10.36	20.19	-14.67	36.40	-25.03	27.32
Asyut-Qalubia	-25.63	49.93	-9.83	24.39	-35.46	38.70
Qalubia-Damietta	-5.29	10.31	-3.30	8.19	-8.59	9.38
Qalubia-Rosetta	-5.39	10.50	-2.69	6.69	-8.09	8.83
Grand Total	-51.34	100.00	-40.30	100.00	-91.64	100.00

Islands count and areas across Nile sectors

Table 4 shows Distribution of islands number and associated areas across Nile sectors through using MSS, TM and ETM+ satellite images. Sum of the islands distributed allover Nile sectors are 298 islands with an area of 49868.50 feddan. 469 island with an area of 45356.11 feddan and 383 islands with an area of 39909.14 feddan for MSS, TM and ETM+ satellite images respectively.

TABLE 4. Distribution of islands number and associated areas across Nile sectors.

Sector	MSS		TM		ETM+	
	Count	Area (Feddan)	Count	Area (Feddan)	Count	Area (Feddan)
Aswan-Qena	86	11527.84	92	13520.15	92	8966.98
Qena-Asyut	72	14429.54	111	10525.49	76	12950.20
Asyut-Qalubia	107	20721.07	215	18236.43	156	15297.55
Qalubia-Damietta	15	1020.99	22	948.64	27	896.45
Qalubia-Rosetta	18	2169.06	29	2125.40	32	1797.95
Grand Total	298	49868.50	469	45356.11	383	39909.14

Change detection in islands count and associated area

Differences in islands count and associated area allover the river sectors were observed clearly in the investigated period .The overall change in islands count and associated areas within the period of 1972 and 1987 (MSS – TM) was +171 island with area loss determined by -4512.39 .Change in island count and associated area during the period of 1984 and 2002 (TM-ETM+) was - 86 and -5446.97 feddan representing loss in both islands count and accompanied area The changes allover the investigated period 1972 and 2002 were recorded as 85 islands and-9959.36 feddan representing increase in islands count and loss in area. Table 5 and Fig. 3, 4 , 5 and 6 show differences in islands count and associated area allover the river sectors.

TABLE 5. Differences in islands count and associated area.

Sector	MSS – TM 1972 –1987		TM – ETM 1984-2002		MSS – ETM 1972-2002	
	Counts	Area (Feddan)	Counts	Area (Feddan)	Counts	Area (Feddan)
Aswan-Qena	6	1992.31	0	-4553.17	6	-2560.86
Qena-Asyut	39	-3904.05	-35	2424.72	4	-1479.34
Asyut-Qalubia	108	-2484.64	-59	-2938.88	49	-5423.52
Qalubia-Damietta	7	-72.35	5	-52.18	12	-124.53
Qalubia-Rosetta	11	-43.65	3	-327.46	14	-371.11
Grand Total	171	-4512.39	-86	-5446.97	85	-9959.36

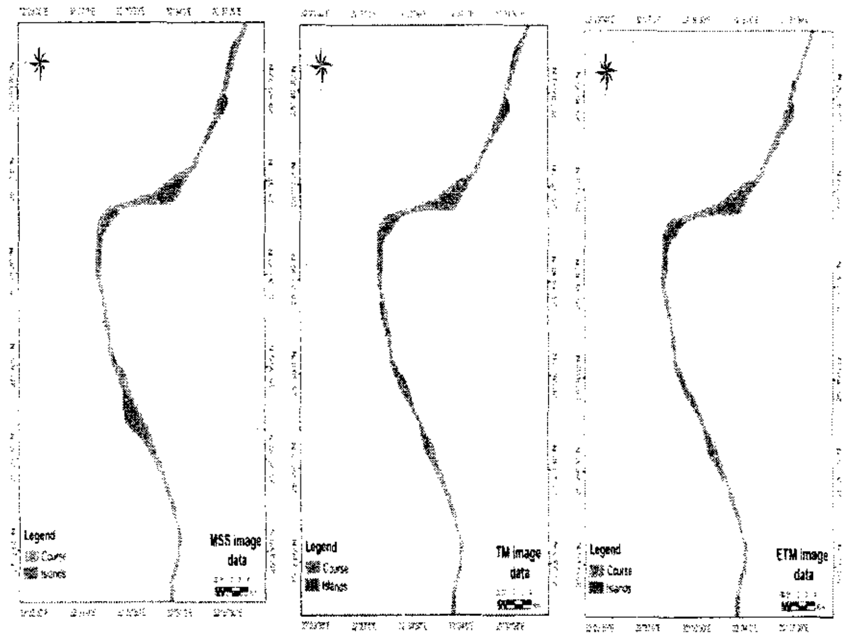

Fig. 3. Differences in Nile course areas, islands count and areas (Aswan-Qena subsector).

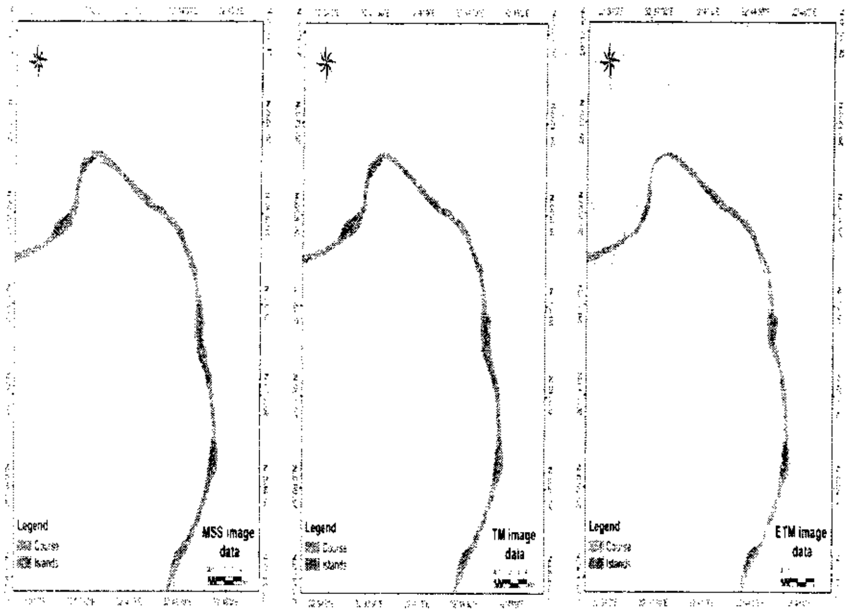

Fig. 4. Differences in Nile course areas, islands count and areas (Qena-Asuit subsector) .

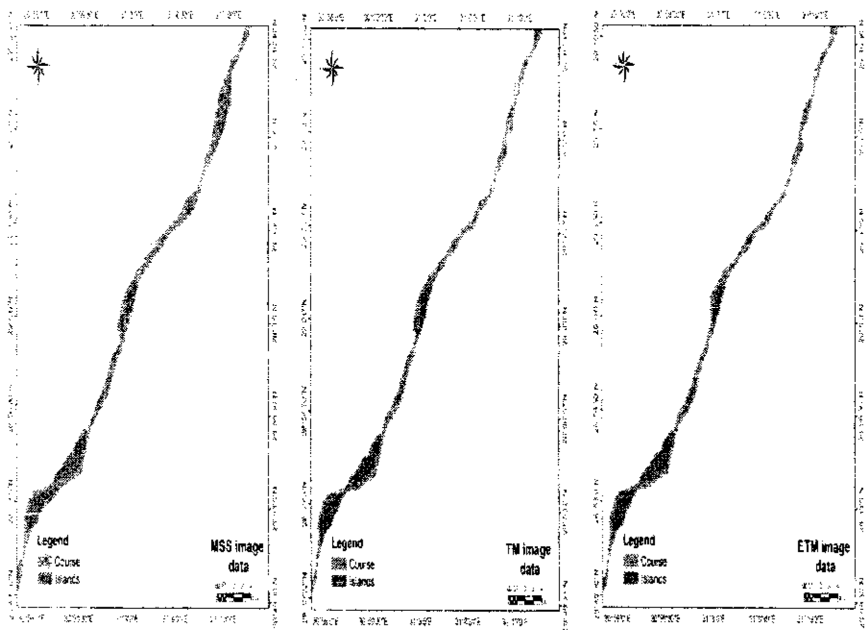

Fig. 5. Differences in Nile course areas, islands count and areas (Asuit-Qalubia subsector).

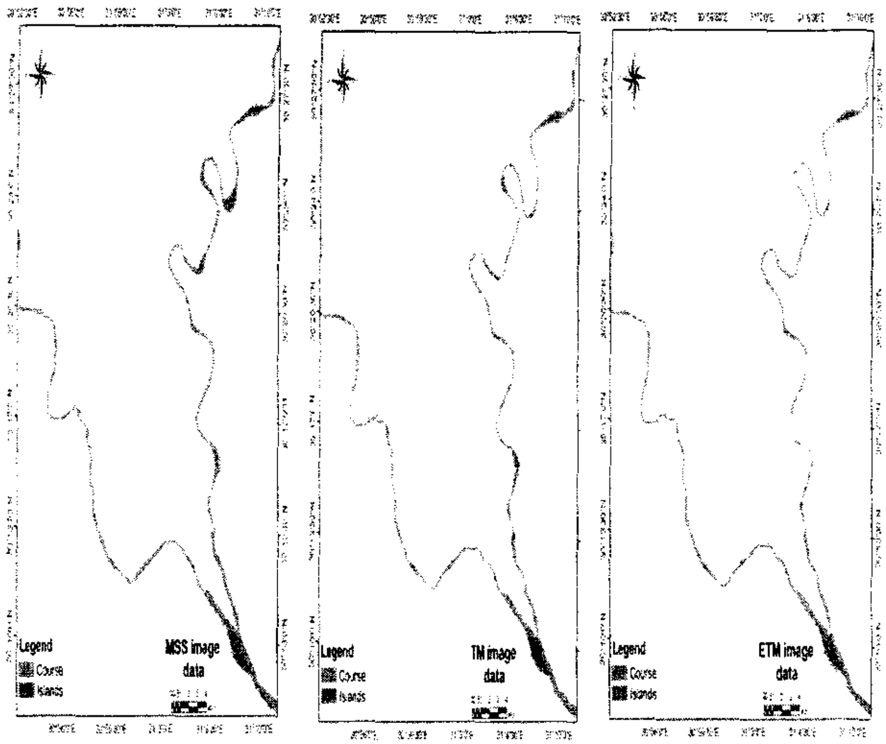

Fig.6. Differences in Nile course areas, islands count and areas (Qalubia-Nile branches subsector) .

Overall changes

It is concluded that, the changes in Nile course from early seventieth to middle eighteenth were decreased by 51.34 Km^2, from middle eighteenth to the millennium were decreased by 40.30Km^2. The overall change in Nile course area decreased by 91.64 Km^2 in the investigation time.

Belonging to the islands number and their areas in the investigation time, the changes in islands number from early seventieth to middle eighteenth were increased by 171 islands, from middle eighteenth to the millennium were decreased by 86 islands. Meanwhile, the islands areas from early seventieth to middle eighteenth were decreased by 4512.39 Fed., from middle eighteenth to the millennium were decreased by 5446.97 Fed. The overall change in the investigation time for the total number of the islands was increased by 85 islands, meanwhile the islands areas were decreased by 9959.36 Fed.

Soil morphology and classification

Ten representative islands were chosen as the soil patterns in the studied islands are represented. Soil classification was performed according to the Soil Taxonomy System (USDA, 1999) to subgroup level. The soil morphological features and the analytical data cover the representative islands and represent the soil pattern of the investigated island lead to the following:

Soil of Aswan Island

Soil texture is sandy loam. $CaCO_3$content ranges between 1.30 and 4.30 %. OM- ranges between 0.97 and 2.40 %. EC ranging between 1.29 to 1.60 dS/m. pH values vary between 7.85 and 8.16. ESP varies between 1.93 and 2.50 %. The data of macro and micro nutrients of the surface layer revealed that; available N content ranges between 14.00 and 14.93µg/g; P content ranges between 11.44 and 14.06 µg/g and K ranges between 92.46 and 97.60µg/g. The data of micro nutrients revealed that available Fe content ranges between 378.74 and 488.37 µg/g; Zn ranges between 5.92 and 7.53 µg/g; Mn ranges between 16.00 and 17.37 µg/g, while Cu ranges between 7.34 and 9.77µg/g.

Soil of El-Mansoryia Island

Soil texture is sandy loam, except for the deeper layer where it is clay loam. $CaCO_3$content ranges between 1.30 and 7.82 %. OM ranges between 0.24 and 1.60%. EC values ranges between 1.16 to 1.43 dS/m. pH values vary between 7.66 and 8.16. ESP varies between 1.70 and 2.59 %. Available N ranges between 14and 18µg/g; P ranges between 4.74 and 5.42µg/g and K ranges between 188.40 and 493.40µg/g. Available Fe ranges between 18.04 and 36.52µg/g; Zn ranges between 2.68 and 3.38µg/g; Mn ranges between 4.38 and 9.03µg/g; while Cu ranges between 6.19 and 7.95 µg/g.

Soil of El-Doam Island

Soil texture is sandy. $CaCO_3$ ranges between 1.13 and 1.73%. OM% ranges between 1.12 and 1.60%. EC is very low as it ranges between 0.99 to 1.27 dS/m pH values vary between 7.85 and 7.98. ESP varies between 1.70 and 2.00 % . Available N ranges between 11and 19µg/g; P ranges between 4.44 and 486µg/g; K ranges between 99.67 and 194.35µg/g. Available Fe ranges between 43.16 and 45.48µg/g; Zn ranges between 0.86 and 1.30µg/g; Mn ranges between 3.46 and 3.90µg/g. While Cu ranges between 2.27 and 5.11µg/g.

Soil of Naqnaq Island

Soil texture is loam, clay loam and/or sandy loam. $CaCO_3$content ranges between 1.91 and 4.00 %. OM% ranges between 0.28 and 1.24 %. EC ranges between 0.96 to 2.25 dS/m. pH values vary between 8.11 and 8.23. ESP varies between 2.23 and 8.11 %. Available N ranges between 9 and 14µg/g; P ranges between 2.90 and 4.08µg/g; K ranges between 164.50 and 204.30µg/g. Available Fe ranges between 22.46 and 27.22µg/g; Zn between 0.66 and 1.52µg/g and Mn ranges between 3.03 and 13.07µg/g. While available Cu ranges between 2.10 and 5.22µg/g.

Soil of El- Nosairat Island

Soil texture is loam, sand, loamy sand and/or sandy loam. $CaCO_3$ content ranges between 1.82 and 3.47%. OM% ranges between 0.52 and 1.64 %. EC ranges between 0.05 to 0.11 dS/m. pH values vary between 7.79 and 8.19. ESP varies between 0.080 and 1.82%. Available N ranges between 161and 168µg/g; P ranges between 7.59 and 8.16µg/g and available K ranges between 138.60 and 194.04µg/g. While the available Fe ranges between 2.52 and 6.21µg/g; Zn ranges between 0.25 and 0.92µg/g; Mn ranges between 0.57 and 1.71µg/g. While available Cu ranges between 0.57 and 0.99µg/g.

Soil of Gerga Island

The texture is loamy sand and sandy loam. $CaCO_3$ ranges between 1.13 and 1.30%. OM% ranges between 0.96 and 1.60%. EC ranges between 0.98 to 1.42 dS/m. pH values vary between 7.85 and 8.17. ESP varies between 1.53 and 3.91%. Available N ranges between 7 and 8µg/g; P ranges between 9.78 and 11.88µg/g and K ranges between 140.50 and 179.40µg/g. The available Fe, ranges between 9.96 and 12.39µg/g; Zn ranges between 0.44 and 0.62 µg/g and Mn ranges between 2.76 and 2.81µg/g. While available Cu ranges between 1.25 and 1.36µg/g.

Soil of El-Sawamaa Island

The texture is silty clay loam and loamy. $CaCO_3$ ranges between 1.3 and 2.6%. The organic matter content ranges between 0.48 and 0.80%. EC of the representative soil profile ranges between 1.10 to 1.84 dS/m. pH values vary between 7.83 and 7.92. ESP varies between 1.47 and 2.16. Available N ranges between 10and 12µg/g. Available P ranges between 10.50 and 12.22µg/g; K ranges between 111.6 and 199.3µg/g. Available Fe ranges between 19.6 and 24.23µg/g; Zn ranges between 1.00 and 1.07µg/g and Mn ranges between 4.03 and 3.33µg/g. While available Cu ranges between 2.21 and 2.38µg/g.

Soil of El-Sharonia Island

The texture is loam for the first layer and clay in the other layers of the profiles. $CaCO_3$ content ranges between 3.91 and 5.82%. OM content ranges between 1.92 and 2.72%. ECe ranges between 1.42 to 1.79 dS/m. pH values vary between 7.73 and 8.21. ESP varies between 2.11 and 5.67%. Available N ranges between 207and 320µg/g; P ranges between 2.22 and 2.66µg/g; K ranges between 194.35 and 254.15µg/g. Available Fe ranges between 20.80 and 20.91µg/g; Zn ranges between 1.35 and 1.44µg/g and Mn ranges between 9.73 and 15.17µg/g. While available Cu ranges between 6.19 and 7.49µg/g.

Soil of Nagaa El-Abaadyia Island

The texture is silty clay loam, silty loam and sandy loam. The $CaCO_3$ content ranges between 1.08 and 3.47%. OM content ranges between 0.48 and 1.76%. ECe ranges between 0.94 to 1.15 dS/m. pH values vary between 8.05 and 8.18. ESP varies between 1.44 and 1.92%. Available N ranges between 14and 25µg/g; P ranges between 7.08 and 9.70µg/g; K ranges between 93.69 and 176.40µg/g. Available Fe ranges between 32.20 and 43.16µg/g; Zn ranges between 0.56 and 0.92µg/g and Mn ranges between 4.17 and 7.67µg/g. While available Cu ranges between 1.86 and 4.43µg/g.

Soil of El-Khazendaryia Island

The texture class is silty clay and silty clay loam. $CaCO_3$ content ranges between 1.73 and 4.43%. OM content ranges between 0.80 and 1.76%. ECe ranges between 1.34 to 1.94 dS/m. pH values vary between 8.09 and 8.16. ESP varies between 2.00 and 9.34. Available N ranges between 24and 331µg/g; P ranges between 6.08 and 11.78µg/g; K ranges between 116.60 and 470.30µg/g. The available Fe ranges between 5.31 and 15.49µg/g; Zn ranges between 0.52 and 1.38µg/g and Mn ranges between 2.63 and 7.37µg/g. While available Cu ranges between 1.82 and 1.99µg/g.

Soil characteristics change detection

Five islands (Aswan island, El-Mansoryia island, El-Doam island, Naqnaq island and El-Nosairat island) were selected for studying changes of some soil characteristics. Two analytical datasets were used to detect the changes. The first analytical dataset was obtained from Zallow (1989) and the other data set from the current analytical data. The study of the data based on weighted average calculations revealed the following conclusions:

Soil characteristics change of Aswan Island

The electrical conductivity (EC) of Aswan island soils was increased from 0.68 to 1.42 dS/m with a percentage of 110%. Also, CaCO3content increased from 0.34 to 3.15 % with a percentage of 827 %. While the ESP decrease from 4.10 to 2.30 % with a percentage of 44 %. OM content increased from 1.02 to 1.27 % with a percentage of 25 %.

Soil characteristics change of El-Mansoryia Island

The electrical conductivity (EC) of El Mansoryia island soils was increased from 0.59 to 1.32 dS/m .Also, $CaCO_3$ increased from 0.91 to 4.57 %. While ESP decreased from 3.45 to 2.12. OM content increased from 0.44 to 0.57 %.

Soil characteristics change of El-Doam Island

The Soluble salts of El Doam island soils were increased from 0.74 to 1.17 dS/m. $CaCO_3$ increased from 0.63 to 1.62 %. While ESP change could not be estimated because of the lack of the ESP content from the first data set. The Organic matter content (OM) content increased from 0.69 to 1.25 %.

Soil characteristics change of Naqnaq Island

EC of Naqnaq island soils were increased from 0.72 to 1.66 dS/m. $CaCO_3$ increased from 2.45 to 2.78%. ESP increased from 3.66 to 4.79. While OM content decreased from 0.64 to 0.56%.

Soil characteristics change of El-Nosairat Island

EC of Nosairat island soils were decreased from 1.40 to 0.08 dS/m. While, $CaCO_3$ increased from 1.16 to 2.74 %. Also, ESP decreased from 5.57 to 1.28. The OM content increased from 0.34 to 0.48 %.

Environmental hazards

In addition, the environmental situation is further complicated by the problems surrounding the Aswan Dam. Even though the environmental damage to Egypt's environmental caused by the Dam has been much less than originally predicted, it is still quite significant. One major problem is that the silt from the river which for millennia fertilized Egypt's cropland is no longer being allowed to flow down the river. This means that more chemical fertilizers are being used. It is also causing erosion along the banks of the Nile, which was previously replenished by the silt carried down the river. Much of the Nile delta is now being swept into the Mediterranean. In fact, if barriers near the Nile's outlet continue to erode, much of low lying Egypt could find itself in the sea, as the sea slowly advances. The Nile is also bringing more salt to the fields of Egypt because of the increased evaporation which takes place in Lake Nasser. There are several problems associated with the dam as well. Seepage and evaporation were accounts for a loss of about 12-14% of the annual input into the reservoir.

The sediments of the Nile River, as with all river and dam systems, has been filling the reservoir and thus decreasing its storage capacity. This has also resulted in problems downstream. Farmers have been forced to use about a million tons of artificial fertilizer as a substitute for the nutrients which no longer fill the flood plain. Further downstream, the Nile delta is having problems due to the lack of sediment as well since there is no additional agglomeration of sediment to keep erosion of the delta at bay so it slowly shrinks. Even the shrimp catch in the Mediterranean Sea has decreased due to the change in water flow. Poor drainage of the newly irrigated lands has led to saturation and increased salinity. Over one half of Egypt's farmland in now rated medium to poor soils. The parasitic disease schistosomiasis has been associated with the stagnant water of the fields and the reservoir. Some studies indicate that the number of individuals affected has increased since the opening of the Aswan High Dam. The River Nile and now the Aswan High Dam is Egypt's lifeline. About 95% of Egypt's population lives within twelve miles from the river. Owing to the river and its sediment, the grand civilization of ancient Egypt is existed. The construction of reservoirs and change of land use has direct effects in terms of habitat loss, elimination of flora and fauna and, in many cases, land degradation, but also feedback effects on the reservoir through alterations in hydrologic function. The resulting loss of vegetative cover leads to increases in sedimentation, storm flow, and annual water yield; decreases in water quality; and variable changes in the seasonal timing of water yield (Mason, 2003 and World Commission on Dams, 2000).

Conclusion and Recommendation

To develop the River Nile in Egypt it is very important to begin from its sources, so integrated flood and drought management for sustainable development in the Nile Basin has to be adopted by all the river basin countries through: Management capabilities, flood & drought definitions, risk assessment methodologies, community based flood mitigation, etc... Establishing goodatabases regarding the river. These databases have to be performed and periodically renewed including meteorological information, hydrological information, remote sensing data (satellite images), land-use and cover, local and community based coping practices. Data analysis to identify and characterize flood and drought prone areas. Mapping and zoning historical flooding and drought events using GIS system. Adopting some practical measures, *i.e.*, Enhancing rainfed agriculture in upper basin areas.-Identifying practical water saving technologies. Adopting new technologies in irrigation schemes. Increasing river yield from swamps and through control of aquatic weeds in open water courses and lakes. Promoting sustainable agriculture. Improving hydropower potential. Developing a risk assessment methodology and management plans for hazard. Implementation of sustainable integrated flood and drought mitigation measures. Developing the water resources of the Nile Basin in a sustainable and equitable way to ensure prosperity, security, and peace for all its peoples; Ensuring efficient water management and the optimal use of the resources; ensure cooperation and joint action between the riparian countries, seeking win gains; To target poverty eradication and promote economic integration; and To ensure that the program results in a move from planning to action.

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مسار التغيرات التى حدثت مؤخرا بمجرى نهر النيل والجزر الموجودة به بمصر

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*الهيئة القومية للاستشعار من البعد وعلوم الفضاء ـ القاهرة و ** قسم الأراضى وإستغلال المياه ـ المركز القومى للبحوث ـ الجيزة ـ مصر .

يعتبر نهر النيل من أطول أنهار العالم كما ان الجزر الموجودة به لها شكل جذاب تتميز بأنها تعتبرمنطقة زراعية خصبة ، لها مدى واسع لملاءمتها لطائفة واسعة من الاستخدام الزراعى و الاستخدام الحالى لهذه الجزر لا يصل إلى الحد الأقصى لقدرة هذه الموارد نظرا للاستخدام الغير واعى لهذه المناطق و الدراسة الحالية تهدف إلى التعرف على التغيرات في مسار النيل والجزر خلال العقود الثلاثة الأخيرة باستخدام تقنيات الاستشعار عن بعد ونظم المعلومات الجغرافية من أجل توفير أسس علمية ، والتي تساعد في التخطيط لبرامج أكثر ملائمة للاستخدام الأراضي ، وإدارة التربة والمحافظة عليها وقد استخدمت ست صور أقمار صناعية MSS ، وثمانية ETM +TM مؤرخة لعام ١٩٧٢ ، ١٩٨٤ و ٢٠٠٢ على التوالي منطقة الدراسة حيث تم تقسيمها إلى خمسة قطاعات على طول نهر النيل.

والتغيرات التي طرأت على مسار النيل من أوائل السبعينات الى منتصف الثمانينات كانت بنسبة ٥١،٣٤ كيلومتر مربع ، وفي الفترة من الثمانينات إلى منتصف الألفية قد انخفضت الى ٤٠،٣٠ كيلومتر مربع مع التغيير الشامل في المنطقة وبطبيعة الحال النيل بنسبة٩١،٦٤كيلومتر مربع فى فترة الدراسة .

وفيما يتعلق بعدد الجزر خلال فترة الدراسة ، كانت من أوائل السبعينات الى منتصف الثمانينات زيادة ١٧١ جزيرة و في الفترة من منتصف الثمانينات إلى الألفية قلت ٨٦ جزيرة ومن جهة اخرى من اوائل السبعينات الى متوسط الثمانينات حدث نقصان فى مساحة هذه الجزر بمقدار ٤٥١٢،٣٩ ألف فدان ، بينما في الفترة من منتصف الثمانينات إلى الألفية حدث نقصان فى مساحة هذه الجزر بمقدار ٥٤٤٦،٩٧ فدانا. فالتغيير الشامل خلال فترة الدراسة للعدد الكلى للجزر باضافة ٨٥ جزيرة ، وفي الوقت نفسه قلت مساحة الجزر بمقدار ٩٩٥٩،٣٦ فدانا. كذلك تبين أنه لا يوجد نمط منتظم للتغيرات في خصائص التربة نتيجة لأسباب عديدة تم الاشارة اليها فى الدراسة.