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# Land Quality Indicators for Sustainable Agricultural Development of Wadi El-Natrun District, El-Behira Governorate, Egypt

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THE MAIN goal of this study was to select and quantify the major soil quality indicators, which affect the agricultural production of Wadi El-Natrun District, which covers an area about 2413 $km^2$, and its farms that cover an area about 5463 feddans; taking into consideration the management practices. Twenty-seven soil profiles were dug to study the soil of Wadi El-Natrun District. Seventy-five augers were dug (one auger for each crop in the farm) to characterize the soils of Wadi El-Natrun farms (44 farms). The soil of Wadi El-Natrun District could be classified into *Typic torripsamments, Typic psammaquents, Calcic petrogypsids, Typic calcigypsids, Typic haplocalcids, Calcic haplosalids, Typic petrocalcids, Aquic haplocalcids*, and *Typic aquisalids*. Based on the mathematical statistical analysis, four soil quality indicators were selected for Wadi El-Natrun District (salinity, carbonate content, sand percent and volumetric water content), and five indicators for Wadi El-Natrun Farms (salinity, sand content, saturation percent, hydraulic conductivity and organic matter content). Relative Soil Quality Index (RSQI) was calculated, which indicated that the four cultivated soil units (*Typic petrocalcids, Typic calcigypsids, Calcic petrogypsids* and *Typic torripsamments*), had RSQI classes I, III, and V. On the other hand, the five non-cultivated soil units (*Typic psammaquents, Aquic haplocalcids, Typic haplocalcids, Calcic haplosalids* and *Typic aquisalids*) had RSQI classes III and V. The changes in RSQI (ΔRSQI) could be used to quantify the alteration of soil quality under different agriculture practices and cropping pattern, by comparing the RSQI of cultivated soil (Wadi El-Natrun farms) and virgin soil (Wadi El-Natrun District). It is clear that agricultural management practices (fertigation, and addition of organic matter), as well as the cropping patterns (vegetables, fruit trees, forage and field crops) improved the soil quality indicators.

**Keywords**: Land quality indicators, Sustainable agricultural development, Wadi EL-Natrun.

Soil quality has historically been equated with agriculture productivity, and thus is not a new idea. Soil conservation practices to maintain soil productivity are as old as agriculture itself, with documentation dating to the Roman Empire (Jenny, 1961). Soil quality not only affects productivity, but is also related to the health of other resources including air, water, plants, and animals. The National Research Council stated, "Protecting soil quality, like protecting air and water quality should be a fundamental goal of national policy," (NRC, 1993). Enhancement of soil quality should be the first step toward increasing water quality (Mausbach, 1996).

Soil quality is a composite picture of the condition of a specific soil to function for a specific use. Simply, soil quality is the capacity of a soil to function (Pierce & Larson, 1993 and Karlen *et al.,* 1997). Soil quality is an integration of the kind of soil, its natural ability to function, and its use and management. Larson & Pierce (1991) defined soil quality as "the capacity of a soil to function within the ecosystem boundaries and interact positively with the environment external to that ecosystem." Three soil functions are considered essential: provide a medium for plant growth, regulate and partition water flow through the environment, and serve as an effective environmental filter.

Soil quality as "the sustaining capability of a soil to accept, store and recycle water, minerals and energy for production of crops at optimum levels while preserving a healthy environment." They discuss terrain, climate and hydrology as site factors that contribute to soil quality and suggest that socioeconomic factors such as land use and management should be included in a soil quality analysis. This approach is consistent with the FAO approach to land quality analysis (FAO, 1997).

In order to measure soil quality, a minimum dataset (MDS) of soil characteristics that represents soil quality must be selected and quantified (Larson & Pierce, 1991). The MDS may include biological, chemical or physical soil characteristics. For agriculture, the measurement of properties should lead to a relatively simple and accurate way to rank soils based on potential plant production without soil degradation. Unfortunately, commonly identified soil quality parameters may not correlate well with yield (Reganold *et al.,* 1995).

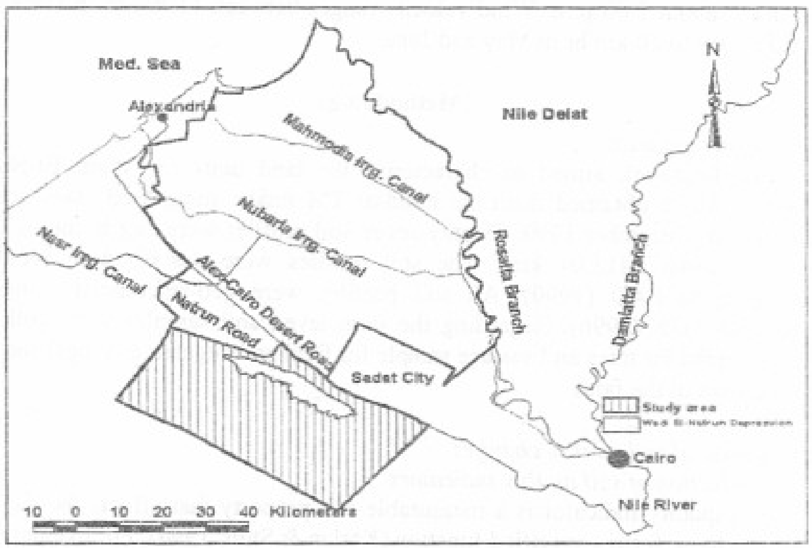
Four points were considered concerning the selection and quantification of soil characteristics: (1) types of soil characteristics (2) controlling or managing soil characteristics, (3) rates of change in soil characteristics, and (4) the temporal or spatial variation in soil characteristics.

Soil quality cannot be measured directly, but must be inferred from soil quality indicators. Soil quality indicators are measurable soil attributes that influence the capacity of soil to perform crop production or environmental functions and are sensitive to change in land use, management, or conservation practices. However, many soil attributes are highly correlated (Larson & Pierce, 1991 and Seybold *et al.,* 1997).

Soil quality indicators could be physical, chemical, and biological properties, processes, or characteristics of soils. They can also be morphological or visual features of plants. Indicators can be assessed by qualitative and/or quantitative techniques. A qualitative assessment is the determination of the nature of an indicator. A quantitative assessment is the accurate measurement of an indicator (Wang & Gong , 1998).

**The Study Site**

Wadi El-Natrun is an elongate depression located in the north eastern part of the Western Desert, its bounded by the longitudes 29° 43' to 30° 29' E and latitudes 30° 01' to 30° 35' N some 81 km North west of Cairo as shown in Map 1. The depression is about 50 km in length, ranges from 7 to 10 km in width. The lowest point in the wadi is about 23 m below sea level. A series of salt lakes occupies the central part of the wadi for a distance of 30 km in northwesterly direction. The study site included part of the district bounded by Alex-Cairo Desert Road to the north, having total area of 2413.04 $km^2$.




**Map 1. General location of the study area.**

The major subgroups in Wadi El-Natrun District are *Typic torripsamments, Typic psammaquents, Calcic petrogypsids, Typic calcigypsids, Typic haplocalcids, Calcic haplosalids, Typic petrocalcids*, *Aquic haplocalcids*, and *Typic aquisalids*. The surface of Wadi El-Natrun is essentially formed of sedimentary rocks and deposits belonging to the Late Tertiary and the Quaternary, which are briefly discussed by Shata *et al.* (1969). Quaternary Deposits are divided into recent deposits (aeolian sand and lacustrine deposits). Pleistocene deposits (crust formations that are composed of grey indurated calcareous sandstone). Tertiary deposits are differentiated into Pliocene deposits (clays and sands), Miocene deposits (coarse sands and gravels with thin clay and carbonate intercalations). Oligocene deposits (grey clay with occasional lenses of quartzitic sand) and Eocene deposits (clays, shales and chalky limestone). Three physiographic units are recognized, structural plains, the tableland and dissected plateau according to Gomma (1995).

Agroclimatic data indicated that Wadi El-Natrun area is a dominated by hyper-arid climate, with aridity index 0.02. The principal meteorological features recorded at the local station as a 10 years average indicate the following: Mean annual temperature of 21.2° and mean monthly temperature ranging from 13.7° in January to 27.8 ° in August. The highest temperature recorded over the period 10 years were 34.50° in July and the lowest was 7.80° in January. The annual average precipitation was 35.0 mm with January having the greatest precipitation. The mean monthly relative humidity ranged from 52% in May and 70% in November and December. The minimum relative humidity, about 30%, occurs at about 2.00 p.m. Wind velocity ranges between 11 km/hr in December and January to 20 km/hr in May and June.

## Methodology

*Soil taxonomic units*

The fieldwork aimed to characterize the land units for Wadi El-Natrun District, which obtained from the Landsat TM image supervised classification acquired in December 1999. Twenty-seven soil profiles were dug in the field for an area about 2413.04 $km^2$. The soil profiles were described in the field according to FAO (1990). All soil profiles were geo-referenced using the GARMIN GPS (1996). Regarding the farm level, soil samples were collected (three depths for trees and surface sample for field and vegetables crops) for each crop grown in the farm.

*Evaluation of soil quality changes*

*a. Selection of soil quality indicators*

Soil quality indicator is a measurable soil property that affects the capacity of a soil to perform a specified function (Karlen & Stott, 1994). For evaluation of soil quality, it is desirable to select indictors that are directly related to soil quality. Because soil quality assessment is purpose and site specific, indicators used by different researchers or in different regions may not be the same. Based on the mathematical statistical analysis, four indicators were selected for the Wadi El-Natrun District and five indicators for the Wadi El-Natrun Farms as shown in Table 1.

*b. Weights of soil quality indicators*

The contribution or importance to soil quality of each indicator is usually different, and can be indicated by a weighting coefficient. The calculation of weights assigned to each indicator is as follows (Kock & Link, 1971):

1. The sum squared deviation from the mean was obtained for each observation.
2. This amount was summed up for all observations for a specific indictor.

3. Obtaining the total sum squared deviation from the mean for all indictors.
4. The weight was obtained by dividing step 2 by step 3 and multiplying by 100.
5. Soil indicators that had a value less than 1 was dropped from consideration.
6. The sum of all weights was normalized to 100%.

*c. Subdivision of indicators and their indication*

Each of the indicators was divided into four classes (I, II, III, IV). Class I is the most suitable for plant growth, class II suitable to plant growth but with slight limitations, class III with more serious limitation than class II, and class IV with severe limitations for plant growth. The range for each class, which was based on previous studies on soil quality and land evaluation as shown by FAO (1976) and Sys *et al.* (1993) is shown in Table 2. Marks of 4, 3, 2 and 1 were given to class I, II, III and IV respectively.

**TABLE 1. Soil quality indicators and their weights and classes for the evaluation of soil quality at Wadi El-Natrun District.**

| Indicator | Weight | I | II | III | IV |
|---|---|---|---|---|---|
| EC, dS/m | 91.45 | < 2 | 2 - 4 | 4 - 8 | > 8 |
| Iv* % | 5.78 | < 20 | 20 - 40 | 40 - 50 | > 50 |
| $CaCO_3$ % | 1.67 | < 5 | 5 - 10 | 10 - 20 | > 20 |
| Sand % | 1.10 | > 80 | 80 - 85 | 85 - 90 | > 90 |

* Iv the percent of volumetric soil water content.

**TABLE 2. Soil quality indicators and their weights and classes for the evaluation of soil quality at Wadi El-Natrun farms.**

| Indicator | Weight | I | II | III | IV |
|---|---|---|---|---|---|
| EC, dS/m | 52.26 | < 2 | 2 - 4 | 4 - 8 | > 8 |
| Sand, % | 23.11 | > 80 | 80 - 85 | 85 - 90 | > 90 |
| SP*, % | 14.71 | > 70 | 70 - 50 | 50 - 25 | <25 |
| Kh**, cm/hr | 8.45 | 3 – 3.5 | 0.5 - 3.0<br>3.5 - 7.0 | 0.2 - 0.5<br>7.0 – 10.0 | - 0.2<br>10.0 - 12.5 |
| O. M. % | 1.48 | > 1.5 | 1.5 - 1.0 | 1.0 – 0.5 | < 0.5 |

* Saturation Percent. ** Hydraulic Conductivity.

*d. Quantitative evaluation of changes in soil quality*

By introducing the concept of relative soil quality index (RSQI), the indicators were combined into an RSQI. The equation for calculating RSQI value is (Wang & Gong, 1998):

$$RSQI = (SQI / SQI_m) \times 100$$

where SQI is soil quality index, $SQI_m$ is the maximum value of SQI is calculated from the equation:

$$SQI = \% W_i I_i$$

where $W_i$ is the weight of the indicator, $I_i$ the mark of the indicator class.

SQI for every indicator can be calculated. Therefore, summing up SQI values can produce the total SQI for a soil. The maximum value of SQI for the soil is 400 (4 classes x 100 maximum score) and the minimum value 100. An optimal soil in any region will have a normalized RSQI of 100, but real soils will have lower values, which indicate directly their distance from the optimal soil. By computing RSQI values, soil quality in different regions can be compared even if they are evaluated with different evaluation systems, weightings, and classes. Similarly, The ΔRSQI could quantify changes in soil quality in a comparable way between two regions. The ΔRSQI values were calculated as follow:

$$\Delta RSQI = RSQI\ (cultivated) - RSQI\ (virgin)$$

According to the RSQI values, soils in Wadi El-Natrun were classified into 5 classes from best to worst, represented as shown in Table 3 by I, II, III, IV and V, respectively. Changes in soil quality (ΔRSQI) were grouped into six classes differentiated as shown in Table 4.

**TABLE 3. RSQI classes and their values.**

| Class | RSQI value |
|---|---|
| I | 90 – 100 |
| II | 80 - 90 |
| III | 70 - 80 |
| IV | 60 - 70 |
| V | < 60 |

**TABLE 4. Change classes and their values.**

| Change Class | ΔRSQI |
|---|---|
| Great increase | > 10 |
| Moderate increase | 5 - 10 |
| Slight increase | 0 - 5 |
| Slight decrease | -5 - 0 |
| Moderate decrease | -10 - -5 |
| Great Decrease | < -10 |

## Results and Discussion

*Soil Taxonomic units*

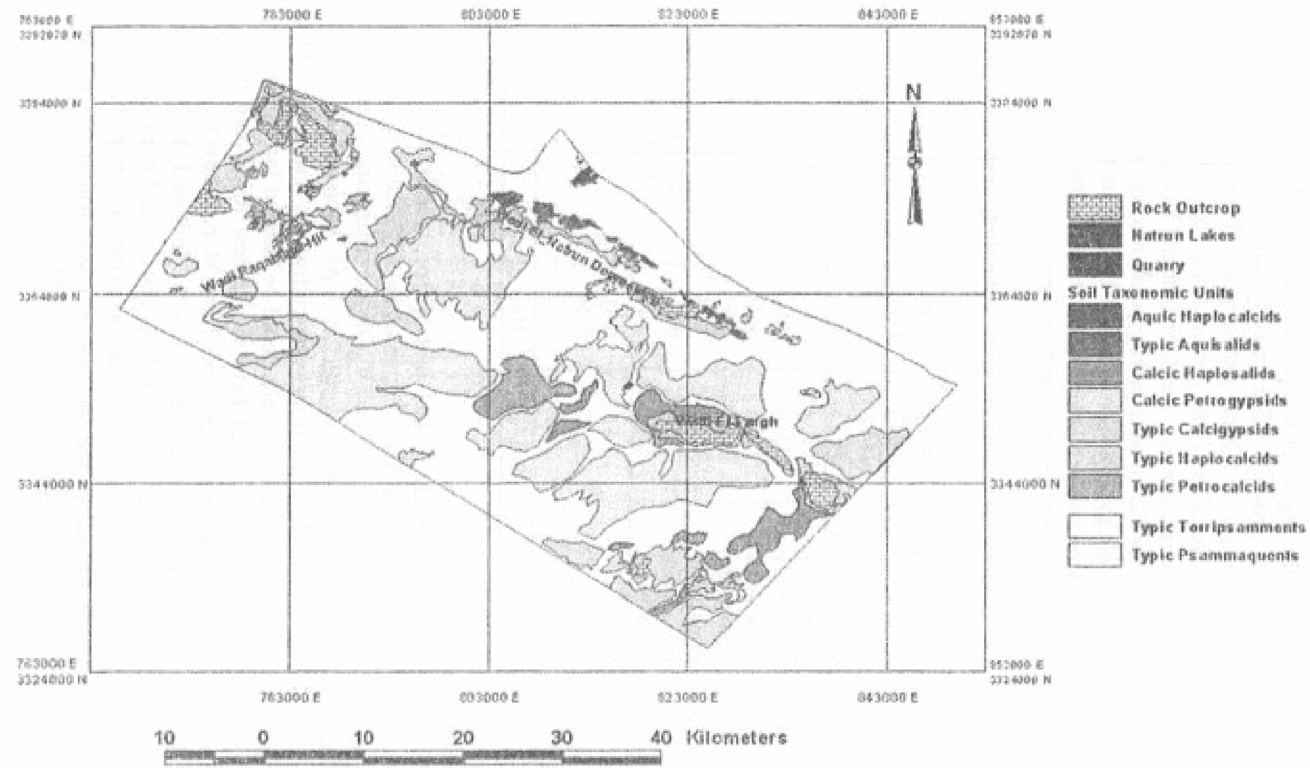
Based on the fieldwork, the digital processing of Landsat TM 7 image and laboratory analysis of soil profiles. The major subgroups are *Typic torripsamments, Typic psammaquents, Calcic petrogypsids, Typic calcigypsids, Typic haplocalcids, Calcic haplosalids, Typic petrocalcids, Aquic haplocalcids,* and *Typic aquisalids*. *Typic torripsamments*, are dominant and having about 56% of the total acreage, followed by *Petrocalcic petrogypsids* having about 21% of the total acreage, then *Typic calcigypsids* having about 10% of the total avreage (Map 2). Table 5 shows the area and percentage of each taxonomic soil units in the study area, as well as the soil profiles representing them.

**TABLE 5. Distribution of different taxonomic soil units in the study area.**

| Soil order | Taxonomic units | Area ($km^2$) | Area (%) | Profiles No. |
|---|---|---|---|---|
| Entisols | Typic Torripsamments | 1364.04 | 56.53 | 10, 20,21,22,24,27,15 |
| | Typic Psammaquents | 21.82 | 0.90 | 3 |
| Aridisols | Calcic petrogypsids | 509.69 | 21.12 | 18,23,25 |
| | Typic calcigypsids | 243.61 | 10.10 | 13,14 |
| | Typic haplocalcids | 72.46 | 3.00 | 12 |
| | Calcic haplosalids | 64.85 | 2.69 | 11,19 |
| | Typic petrocalcids | 32.34 | 1.34 | 26 |
| | Aquic haplocalcids | 8.51 | 0.35 | 4,7,8,16,17 |
| | Typic aquisalids | 6.90 | 0.29 | 1,2,5,6,9 |
| Different Land use | Natrun lakes | 7.51 | 0.31 | - |
| | Rock outcrops | 78.07 | 3.24 | - |
| | Quarry | 3.23 | 0.13 | - |
| Total | | 2413.04 | 100 | - |

*Soil quality assessment*

Table 6 indicated that there are 4 soil units (*Typic petrocalcids, Typic calcigypsids, Calcic petrogypsids* and *Typic torripsamments*) used in agricultural production, and have RSQI classes I, III, and V. On the other hand, there are 5 soil units (*Typic psammaquents, Aquic haplocalcids, Typic haplocalcids, Calcic haplosalids* and *Typic aquisalids*), which are non-cultivated, and have RSQI classes III and V. The non- cultivated soil units could be utilized for agricultural production, starting with the units, which have the highest RSQI, and finding alternative uses for the lowest RSQI soil units. Table 7 and Map 2 show that class I covers the lowest acreage of the study area (1.34%) followed by class III (11.35%) and class V covered about (83.63%). Two units should excluded from being utilized for agricultural activities due to their extreme salinity and shallow water Table, as they are located in the vicinity of lakes, within the 1.5 km distance which have the lowest ground water quality (C5).




**Map 2. Taxonomic soil units of Wadi El-Natrun District.**

**TABLE 6. Scores of soil indicators and soil quality index of the soil units.**

| Soil units | The weights of the indicators X the marks of the indicators classes (Wi X Ii) | | | | SQI** | RSQI*** | RSQI class |
|---|---|---|---|---|---|---|---|
| | EC, dS/m | Iv* % | Sand % | $CaCO_3$ % | | | |
| **Cultivated Soil Units** | | | | | | | |
| Typic petrocalcids | 365.80 | 23.12 | 4.40 | 5.01 | 398.33 | 99.58 | I |
| Typic Calcigypsids | 274.35 | 23.12 | 3.30 | 3.34 | 304.11 | 76.03 | III |
| Calcic Petrogypsids | 182.90 | 23.12 | 2.20 | 1.67 | 209.89 | 52.47 | V |
| Typic Torripsamments | 182.90 | 23.12 | 1.10 | 3.34 | 210.46 | 52.62 | V |
| **Non-Cultivated Soil Units** | | | | | | | |
| Typic Psammaquents | 274.35 | 23.12 | 3.30 | 5.01 | 305.78 | 76.45 | III |
| Aquic Haplocalcids | 274.35 | 17.34 | 3.30 | 3.34 | 298.33 | 74.58 | III |
| Typic Haplocalcids | 182.90 | 23.12 | 3.30 | 3.34 | 212.66 | 53.17 | V |
| Calcic Haplosalids | 91.45 | 23.12 | 2.20 | 6.68 | 123.45 | 30.86 | V |
| Typic Aquisalids | 91.45 | 17.34 | 3.30 | 5.01 | 117.10 | 29.28 | V |

* Iv the percent of volumetric soil water content.
** SQI soil quality index.
*** Relative soil quality index.

**TABLE 7. RSQI classes and its area in the study area.**

| RSQI classes | Area $km^2$ | Area % |
|---|---|---|
| I | 32.34 | 1.34 |
| III | 273.95 | 11.35 |
| V | 2017.94 | 83.63 |
| Natrun lakes | 7.51 | 0.31 |
| Rock outcrops | 78.07 | 3.24 |
| Quarry | 3.23 | 0.13 |
| Total | 2413.04 | 100 |

*Effect of agricultural practices on soil quality*

Table 8 indicates the effect of agricultural practices on soil quality. It is clear that RSQI of *Typic torripsamments* and *Calcic petrogypsids* soil units has been greatly increased, which means that the agricultural practices has improved the soil quality. On the other hand, RSQI for *Typic calcigypsids* and *Typic petrocalcids* soil units was greatly decreased (< -10). This is attributed to the dependence of soil quality on %sand, Kh, and SP%. These soil properties are affected by the addition of sand in the trees pits, which lower the RSQI for these units.

**TABLE 8. SQI, RSQI and ĆRSQI for Wadi El-Natrun District and its farms.**

| Soil Units | Wadi El-Natrun District | | | Wadi El-Natrun Farms | | | ĆRSQI |
|---|---|---|---|---|---|---|---|
| | SQI* | RSQI** | RSQI Class | SQI* | RSQI** | RSQI Class | |
| Typic Torripsamments | 210.46 | 52.62 | V | 279.43 | 69.86 | IV | 17.24 |
| Typic Calcigypsids | 304.11 | 76.03 | III | 229.17 | 57.29 | V | -18.74 |
| Calcic Petrogypsids | 209.89 | 52.47 | V | 263.41 | 65.85 | IV | 13.38 |
| Typic Petrocalcids | 398.33 | 99.58 | I | 327.51 | 81.88 | II | -17.70 |

* Soil Quality Index. ** Relative Soil Quality Index

*Effect of cropping pattern on soil quality*

Table 9 shows the effect of cropping pattern on soil quality. For *Typic torripsamments*, the olive had the greatest increase, followed by peach, citrus, grape, guava, clover and vegetables. This is due to that olive is planted for a long period of time, and could reach 50 years old. So, planting these soils will improve the RSQI. Regarding *Calcic Petrogypsids*, citrus had the greatest increase. Concerning *Typic petrocalcids*, ĆRSQI had greatest decrease for citrus, grape and peach, due to the addition of sand in the trees pits. Vegetables also had great decrease due to land leveling and removal of the fertile topsoil, and cultivating the vegetables in removed parts.

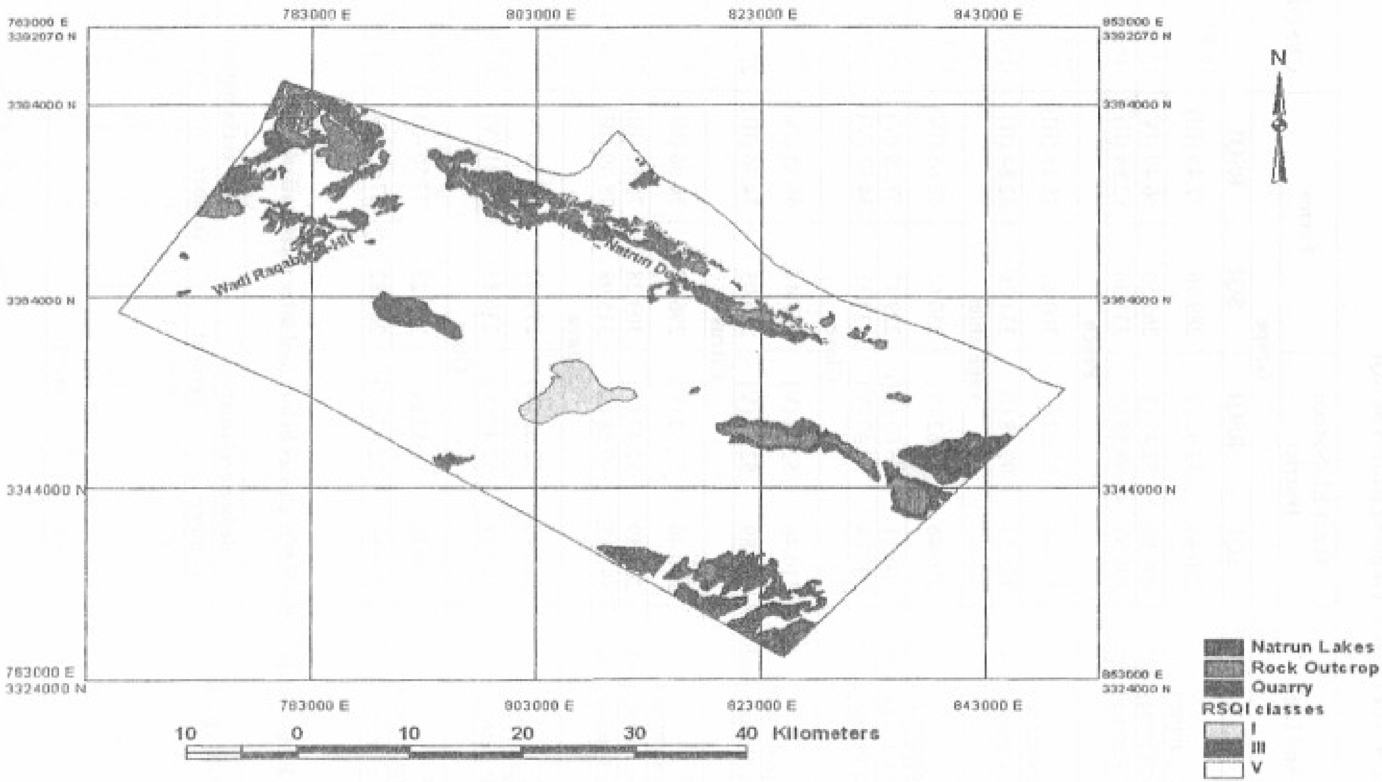
Table 10 shows that before reclamation there were 3 RSQI classes (I, III, and V). The dominant RSQI class was V, which characterized about 90.91% of the total number of the farms in the study area. On the other hand after reclamation, another two RSQI classes (II and IV) had been created, and characterize 15.15% and 27.27% of farms, respectively. Class V decreased to 21.22%, and the dominant class was class III that characterized 33.33% of the total farms in the study area (Map3).

**TABLE 9. The effect of cropping pattern on SQI.**

| Soil Units | Wadi EL-Natrun District | | Farms | | ĆRSQI |
|---|---|---|---|---|---|
| | **Grape** | | | | |
| | **SQI** | **RSQI** | **SQI** | **RSQI** | |
| Typic Torripsamments | 210.46 | 52.62 (V) | 289.96 | 72.49 (III) | 19.87 |
| Calcic Petrogypsids | 209.89 | 52.47 (V) | 265.59 | 66.40 (IV) | 13.93 |
| Typic Petrocalcids | 398.33 | 99.58 (I) | 331.36 | 82.84 (II) | -16.74 |
| | **Peach** | | | | |
| Typic Torripsamments | 210.46 | 52.62 (V) | 300.60 | 75.15 (III) | 22.53 |
| Typic Petrocalcids | 398.33 | 99.58 (I) | 331.36 | 82.84 (II) | -16.74 |
| | **Vegetables** | | | | |
| Typic Torripsamments | 210.46 | 52.62 (V) | 250.61 | 62.65 (IV) | 10.03 |
| Typic Calcigypsids | 304.11 | 76.03 (III) | 229.17 | 57.29 (V) | -18.74 |
| Calcic Petrogypsids | 209.89 | 52.47 (V) | 139.31 | 34.83 (V) | -17.64 |
| | **Clover** | | | | |
| Typic Torripsamments | 210.46 | 52.62 (V) | 267.41 | 66.85 (IV) | 14.23 |
| Calcic Petrogypsids | 209.89 | 52.47 (V) | 299.05 | 74.76 (III) | 22.29 |
| | **Citrus** | | | | |
| Typic Torripsamments | 210.46 | 52.62 (V) | 296.22 | 74.06 (III) | 21.44 |
| Calcic Petrogypsids | 209.89 | 52.47 (V) | 303.28 | 75.82 (III) | 23.35 |
| Typic Petrocalcids | 398.33 | 99.58 (I) | 315.98 | 78.99 (III) | -20.59 |
| | **Guava** | | | | |
| Typic Torripsamments | 210.46 | 52.62 (V) | 271.02 | 67.76 (IV) | 15.14 |
| Calcic Petrogypsids | 209.89 | 52.47 (V) | 236.83 | 59.21 (V) | 6.74 |
| | **Olive** | | | | |
| Typic Torripsamments | 210.46 | 52.62 (V) | 310.23 | 77.56 (III) | 24.94 |
| Calcic Petrogypsids | 209.89 | 52.47 (V) | 269.82 | 67.45 (IV) | 14.98 |

**TABLE 10. Compare the RSQI classes before and after reclamation.**

| RSQI classes | Before reclamation | | After reclamation | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| I | 2 | 6.06 | 1 | 3.03 |
| II | - | - | 5 | 15.15 |
| III | 1 | 3.03 | 11 | 33.33 |
| IV | - | - | 9 | 27.27 |
| V | 30 | 90.91 | 7 | 21.22 |




**Map 3. Relative soil quality index (RSQI) classes map of Wadi El-Natrun District.**

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# دلائل جودة التربة للتنمية الزراعية المستدامة بمركز وادى النطرون- محافظة البحيرة – مصر

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* معهد بحوث الأراضى والمياه والبيئة – مركز البحوث الزراعية – القاهرة
و** قسم علوم الأراضى والمياه – كلية الزراعة – جامعة الاسكندرية – الاسكندرية-مصر.

تهدف الدراسة الى التحديد الكمى لدلائل جودة التربة المهمة والتى تؤثر على الانتاج الزراعى بمركز وادى النطرون (مساحتة حوالى ٢٤١٣,٠٤ كم٢) والمزارع المنتشرة به وعددها ٤٤ مزرعة (مساحتها تقدر بحوالى ٥٤٦٣ فدان) مع الاخذ فى الاعتبار تأثير الادارة المزرعية على هذه الدلائل. لدراسة خواص اراضى مركز وادى النطرون تم عمل ٢٧ قطاع ارضى وكذلك ٧٥ جسة ارضية لدراسة خواص اراضى المزارع على اساس جسة ارضية لكل محصول منزرع بالمزرعة.

و قد وجد ان اراضى مركز وادى النطرون تقع فى رتبتان أساسيتان وهما Aridsol & Entisol ويوجد بها ٩ مجاميع عظمى وهى :
*Typic torripsaments, Typic psammaquents, Calcic petrogypsids, Typic calcigypsids, Typic haplocalcids, Calcic haplosalids, Typic petrocalcids, Aquic haplocalcids and Typic aquisalids.*

ومن خلال التحليل الاحصائى لخواص التربة تم الحصول على اربعة دلائل رئيسية لجودة اراضى مركز وادى النطرون وهى درجة ملوحة التربة ومحتوى التربة من كربونات الكالسيوم والنسبة المئوية للرمل والمحتوى الرطوبى للتربة على اساس الحجم. اما بالنسبة لمزارع وادى النطرون تم الحصول على خمسة دلائل رئيسية لجودة التربة وهى درجة ملوحة التربة والنسبة المئوية للرمل ودرجة التشبع والتوصيل الهيدروليكى ومحتوى التربة من المادة العضوية.

كما تم حساب الدليل النسبى لجودة التربة RSQI للوحدات الارضية المستخدمة فى الانتاج الزراعى والموجود بها المزارع وعددها اربعة وحدات ارضية هى:
*Typic petrocalcids, Calcic petrogypsids, Typic psammaquents and Typic calcigypsids.*

وكانت قيمتة تنحصر فى اقسام I & II & V . اما فى الوحدات الارضية الاخرى الغير منزرعة كانت قيمتة تنحصر فى اقسام III & V. كذلك تم دراسة تاثير كل من العمليات الزراعية و التركيب المحصولى على دلائل جودة التربة وكذلك مقارنة دلائل جودة التربة بين اراضى مركز وادى النطرون البكر واراضى مركز وادى النطرون المزروعة.