

بسم الله الرحمن الرحيم



SALWA AKL



شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم



SALWA AKL

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
على هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



SALWA AKL



بعض الوثائق الأصلية تالفة



SALWA AKL



بالرسالة صفحات

لم ترد بالأصل



SALWA AKL

**CONTRIBUTION OF GEOGRAPHIC INFORMATION SYSTEMS
FOR STUDYING SOME ENVIRONMENTAL PROBLEMS IN EL
FAYOUM GOVERNORATE, EGYPT**

BY

B18329

MEDHAT HOSNY ABD EL MOTALEB

B. Sc. (Soil Science), Cairo University, El Fayoum Branch, (1991)

M. Sc. (Soil Science), Cairo University, El Fayoum Branch, (1998)

THESIS

**Submitted in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY**

In

Agricultural Sciences (Soil Science)

Soils and Water Department

Faculty of Agriculture at El Fayoum

Cairo University

2002

**CONTRIBUTION OF GEOGRAPHIC INFORMATION SYSTEMS
FOR STUDYING SOME ENVIRONMENTAL PROBLEMS IN EL
FAYOUM GOVERNORATE, EGYPT**

BY

MEDHAT HOSNY ABD EL MOTALEB

THESIS OF

**Doctor of Philosophy in Agricultural Sciences
(Soil Science)**

**Soils and Water Department
Faculty of Agriculture at El Fayoum,
Cairo University**

Supervised by:

1- Prof. Dr. El Sayed Abd El Hay Khater

Prof. of Soil Sci. and Vice Dean, Faculty of Agriculture at El Fayoum,
Cairo University.

Signature: E. A. Khater

2- Dr. Mahmoud Mohamed Shendi

Associate Prof. of Soil Sci., Faculty of Agriculture at El Fayoum,
Cairo University.

Signature:

2002

**CONTRIBUTION OF GEOGRAPHIC INFORMATION SYSTEMS
FOR STUDYING SOME ENVIRONMENTAL PROBLEMS IN EL
FAYOUM GOVERNORATE, EGYPT**

BY

MEDHAT HOSNY ABD EL MOTALEB

THESIS

**Thesis of Doctor of Philosophy in Agricultural Sciences
(Soil Science)**

Soils and Water Department

Faculty of Agriculture, El Fayoum - Cairo University

Approved by:

1- Prof. Dr. Raafat Sorour El Sayed Abd El Aal

Prof. of Soil Sci., Faculty of Agriculture at Moshtohor, Zagazig Univ.

Signature: 

2- Prof. Dr. El Sayed Abd El Hay Khater

Prof. of Soil Sci. and Vice Dean, Faculty of Agriculture at El Fayoum,
Cairo University.

Signature: 

3- Prof. Dr. Shafik Ibrahim Abd El Aal

Prof. of Soil Sci., Faculty of Agriculture, Cairo University.

Signature: 

4- Dr. Mahmoud Mohamed Shendi

Associate Prof. of Soil Science, Faculty of Agriculture at El Fayoum,
Cairo University.

Signature: 

Date: 7 / 10 / 2002

Abstract

The present work aimed to investigate the contribution of GIS for studying the environmental impacts of both using mixed irrigation water and the vehicles on soil pollution. To achieve this target, different localities affected by mixed irrigation water and traffic pollution were selected at Tarmia and Sinnuris Districts.

Aerial photo-interpretation followed by conventional field check and laboratory analyses were integrated with the GIS to provide a suitable base map.

The main physical and chemical results of the different mapping units were stored into ILWIS 3.1 GIS in a relational data-base format.

The effect of using mixed irrigation water on soil pollution :

The results of the chemical analysis of the different water sources used to irrigate the studied area showed an obvious increase of the micro elements and heavy metals concentration in the mixed water as compared to the fresh water .

Data of the impact of using mixed irrigation water on soil salinity and pollution reflected the hazard effects on soil properties, where remarkable increases in soil salinity, micro elements and heavy metals in all the studied soils irrigated with mixed water were occurred.

The assessment of traffic pollution on the adjacent soils:

The effect of automobile exhausts on soil pollution with Pb and Cd was tested in three sample areas. The roads network were overlayed first over the soil-map of Sinnuris Districts. to specify the soil mapping units that have roads with different construction ages and with different types of side tree as wind barriers. The selected mapping unit of PI 1211 (<0.5% clayey), Nile alluvial clayey soils is slightly saline, non alkaline, with

high CEC, with relatively high organic matter content and classified as Typic Haplotorrerts

Three sample areas were taken surrounding 3 roads, each of them has 3 sampling tracks. Five mini-pits were sampled in each track at distances of 10 , 20 ,50 ,100 and 200 m east of the roadside. All soil samples were tested for total and available Pb and Cd. Data revealed that the effect of automobile exhausts on soil pollution with Pb and Cd was very recognizable.

The total and available contents of both Pb and Cd were relatively high in the top soil than the subsurface in all the observed samples.

The data indicated a highly negative correlation between the distance from the road and both Pb and Cd contents in the surface and subsurface soil samples

A correlation model, calculated between the total Pb and Cd contents and distance east of the tested roads, was created using total number of 9611 interpolated points, and the results indicate the following equations.

Location 1- new El-Fayoum – Cairo highway (without side roads trees).

$$1\text{- Total Pb (ppm)} = -0.0631X + 20.881 \quad r = (-0.992)$$

$$2\text{- Total Cd (ppm)} = -0.007X + 2.3327 \quad r = (-0.98)$$

Location 2- old road of El-Fayoum - Cairo (with wind break).

$$1\text{- Total Pb (ppm)} = -0.082X + 30.646 \quad r = (-0.98)$$

$$2\text{- Total Cd (ppm)} = -0.013X + 3.9359 \quad r = (-0.985)$$

Location 3- old road of El-Fayoum – Cairo (without side road trees).

$$1\text{- Total Pb (ppm)} = -0.076X + 36.537 \quad r = (-0.987)$$

$$2\text{- Total Cd (ppm)} = -0.0121X + 5.845 \quad r = (-0.989)$$

Where: X= distance (m) east of the roads up to 300 m.

Acknowledgment

I am honored to express my sincere gratefulness to all persons who supported me in attaining this scientific degree.

I would like to thank Prof. Dr. El Sayed Abdi El Hay Khater, Professor of soil science, Soils and Water Science Department, Fayoum Faculty of Agriculture, Cairo University, for his sincere supervision, valuable kind advices, encouragement and constructive criticism.

My sincere thanks, gratitude and ever indebtedness to Dr. Mahmoud Mohamed Shendi, Associate Professor of soil science, Department of Soils and Water, Faculty of Agriculture at El- Fayoum, Cairo University who has suggested the problem of this study, for presenting a lot of his valuable time, effort and experience throughout the period of my research work. As I am grateful to him for his valuable scientific advices, continuous guidance and overall supervision.

I would like to seize this opportunity to thank Ali. Gaber. Mohamed , Assistant lecturer , Department of Soils and Water, Faculty of Agriculture at El- Fayoum, Cairo University for helping me in using GIS.

Thanks and gratitudes are also extended to include the staff members of the Faculty of Agriculture at El- Fayoum, Cairo University for facilitating my work throughout the period of study.

Finally, I would like to express my deepest love to my family; my parents, my wife, and my brothers for their encouragement, patience and valuable support.

TABLE OF CONTENTS	
1- INTRODUCTION.....	1
2- REVIEW OF LITERATURE.....	3
2.1: General view of the studied area:.....	3
2.1.1 Location of the study area:.....	3
2.2 The geological setting of the study area :.....	3
2.3 Climate of El-Fayoum area:.....	8
2.4 Geomorphology of the studied area.....	10
2.5. Hydrology:.....	11
2.6. Geographic Soil Data-base:.....	13
2.7. Geographic Information System (GIS):.....	13
2.7.1. What is (GIS):.....	14
2.7.2. Different applications of (GIS):.....	14
2.7.3. Geographic Information System (GIS) in environmental studies:.....	14
2.7.4. Soil data-bases structure:.....	16
2.7.5. ILWIS GIS data models:.....	17
2.8. Remote sensing:.....	19
2.8.1. Integration of remote sensing and GIS in environmental studies:.....	14
2.9. Environmental problems:.....	19
2.9.1. Effect of polluted water on soil pollution.....	20
2.9.2. Environmental problems in El-Fayoum area :.....	22
2.9.3. Air Pollution.....	22
3- MATERIALS AND METHODS.....	24
3.1. Interpretation of aerial photographs:.....	24
3.2. Digitizing of maps into ILWIS GIS, for obtaining the final soil map compilation and pre-fieldwork map analysis :.....	26
3.3. Field work :.....	26
3.3.1. Testing the soil map.....	26
3.3.2. Studying the soil pollution as resulted from using mixed water.....	28
3.3.3. Investigating the effect of road traffic on soil pollution.....	28
3.4. Laboratory analysis :.....	30
3.4.1. Physical analysis of soil:.....	30
3.4.2. Chemical analysis of soil :.....	30
3.3.3. Irrigation water analyses :.....	32
3.5. Updating and satellite image interpretation:.....	32
4- RESULTS AND DISCUSSION.....	33
4.1. Assessment and characterization of the soil-mapping units (SMUs).....	34
4.1.1. Soil of the plain land scape:.....	40
4.1.2. Soil of the penplain landscape Pe:.....	53
4.2. The effect of using mixed irrigation water on soil pollution.....	59
4.2.1. Chemical composition of mixed water versus Nile fresh water:.....	60
4.2.2. The impact of using mixed irrigation water on soil salinity:.....	60
4.2.3. The impact of using mixed irrigation water on soil pollution:.....	60
4.2.4. Incorporation of remote sensing to map the spatial distribution of the Polluted and saline soils:.....	60
4.3. The GIS assessment of traffic pollution along roads.....	67
4.3.1. Effect of soil roads trees on reducing Traffic pollution.....	82

4.3.2. Effect of traffic exposure time on soil pollution.	83
5- SUMMARY AND CONCLUSIONS	88
6- REFERENCES.....	92
APPENDICES	101
APPENDIX (1).....	101
7- ARABIC SUMMARY	

LIST OF TABLES

Table (1). Mean monthly temperature, rainfall, evaporation and relative humidity in the studied area (for the period 1931 - 1989)	9
Table (2): Landforms of the Fayoum depression as indicated in the literature.	11
Table (3): Geo-pedomorphic legend of the studied soils.	38
Table(4): Main soil characteristics of the different soil mapping units SMUs.	39
Table(5). Modal soil profiles for Tamia soil data-base.	40
Table (6): Particle size distribution, CaCO_3 and organic matter contents of the studied soils.	41
Table (7): Some physical characteristics of the studied soils.	42
Table (8): Chemical characteristics of the studied soils.	43
Table (9): Cations exchange capacity (CEC) exchangeable cations and exchangeable sodium percent (ESP) of the Studied soil profile	45
Table (10): Chemical composition of the used Nile waters (N) and mixed Nile drainage water (ND) for irrigating the studied soils.	61
Table (11): Micro and non-nutritive heavy metals contents in ppm for the studied irrigation waters and soils	61
Table (12): Total (T.) and available (av.) in amounts (mg/kg) of micro, heavy metals contents, EC_e , texture class and CaCO_3 for the studied Mini-Pits.	62
Table (13) Soils expansion which are affected and unaffected by salinity and pollution in the studied area	66
Table (14): Particle size distribution and CaCO_3 contents of the main soils investigated for traffic pollution	74
Table (15): Chemical characteristics of the main soils, investigated for traffic pollution.	75
Table (15): Cations exchange capacity exchangeable cations exchangeable sodium percent investigated for traffic pollution.	77
Table (17): Total (T.) and available (Av.) amounts (mg/kg) of Pb and Cd in soil as influenced by distance from the new El-Fayoum - Cairo highway	78
Table (18): Total (T.) and available (Av.) amounts (mg/kg) of Pb and Cd in soil as influenced by distance from the old road with wind break El-Fayoum Cairo	79
Table (19): Total (T.) and available (Av.) amounts (mg/kg) of Pb and Cd in Soil as influenced by distance from the old road El-Fayoum - Cairo (without sideroad trees).	80
Table(20): Legend of the geopedological Soil map of Sinnures distract.	109

LIST OF MAPS

Map (1): Location map of the investigated area.....	4
Map (2) Location map of the studied area " Sinnuris and Tamia District"	5
Map (3): Location map of the soil profiles used in the data-base.....	27
Map (4) Digital Elevation Model of the studied area.	35
Map (5) Slope map of the studied area.....	36
Map (6) Soil map of the studied area.	37
Map (7): Soil salinity of the studied soils.....	56
Map (8): Soil classification of the studied soils.....	57
Map(9): Soil texture of the studied area.....	58
Map (10): Location map of observation points for testing the effect of mixed water. 63	
Map (11) TM5 Satellite Image of the studied area, (color composite 7,4,3). 1998	67
Map (12): Distribution of soil effect by mixed water in $PI_{111}^* < 0.5$ map unit.....	68
Map (13): Distribution of soil effect by mixed water in $PI_{111}^* < 0.5$ map unit.....	69
Map (14): Distribution of soil effect by mixed water in $PI_{111}^* < 0.5$ map unit.....	70
Map (15): Location map of traffic pollution samples.	73
Map (16): Traffic Pb pollution east of the new El-Fayoum Cairo Highway.....	85
Map (17): Traffic Cd pollution east of the new El-Fayoum Cairo Highway	85
Map (18): Traffic Pb pollution east of old road with wind break El-Fayoum Cairo. ...	86
Map (19): Traffic Cd pollution east of old road with wind break El-FayoumCairo....	86
Map(20):Traffic Pb pollution east of old road El-Fayoum Cairo(without side-road trees)87	
Map (21):Traffic Cd pollution east of old road El-FayoumCair (without side-road trees)87	
Map (22): Soil map of Sinnures distract.	108