BIELEFELDER
ÖKOLOGISCHE
BEITRÄGE

BAND 9 1995

Contributions from the International Workshop „Sustainable Land-Use in the Near East“

Edited by:
Siegmar-W. Breckle & Maik Veste

BIELEFELDER ÖKOLOGISCHE BEITRÄGE Band 9 1995

Herausgegeben von der
Abteilung Ökologie
Fakultät für Biologie
Universität Bielefeld
Postfach 100131
D-33501 Bielefeld

ISSN 0178-0697

BIELEFELDER ÖKOLOGISCHE BEITRÄGE

BAND 9 1995

Contributions from the International Workshop „Sustainable Land-Use in the Near East“

28. Nov. – 30. Nov. 1994
ZiF / Bielefeld

ISSN 0178-0697

Edited by:
Siegmar-W. Breckle & Maik Veste
Department Ecology, University Bielefeld

Inhalt / Contents

In der Reihe "Bielefelder Ökologische Beiträge" (BÖB) sind bisher die folgenden Bände erschienen. Sie können bezogen werden über:

The series "Bielefelder Ökologische Beiträge" (BÖB) has published yet the following numbers, which can be ordered from:

Universität Bielefeld, Fakultät für Biologie, Abteilung Ökologie
Postfach 100131
D-33501 Bielefeld
Fax: +49-521-106-2963
e-mail:sbreckle@biologie.uni-bielefeld.de

Band 1 (1985): Beiträge des Symposiums "Schwermetalle und Saure Depositionen" (hrsg. S.-W.Breckle & H. Kahle)

Band 2 (1986): Beiträge der Abteilung Ökologie zur Dendroökologie (hrsg. S.-W.Breckle & J. Hagemeyer)

Band 3 (1988): Beiträge der Abteilung Ökologie zur Ökologie der Halophyten (hrsg. S.-W. Breckle & I. Wattenberg)

Band 4 (1989): Beiträge aus dem Symposium "Ecology and Evolution of the Mediterranean Vegetation and Flora" (hrsg. S.-W. Breckle)

Band 5 (1989): Beiträge des Symposiums "Komplexschäden an Buchen - Ursachenforschung zum Baumsterben" (hrsg. S.-W.Breckle & H. Kahle)

Band 6 (1992): Beiträge aus dem workshop "Stress - auf allen Ebenen / from the molecular to the ecosystems level" im Rahmen der Deutsch-Israelischen Universitätspartnerschaft, Tel Aviv/Bielefeld, im ZiF in Bielefeld, Juli 1992 (hrsg. S.-W. Breckle)

Band 7 (1994): Beiträge der Abteilung Ökologie zur Populationsökologie
(hrsg. S.-W.Breckle & A. Stockey)
Dissertation Andreas Stockey: Etablierung, Sukzession und Diversität von Bachufervegetation - Eine Untersuchung zur Bedeutung von Samenpotential (Aussaaten) und abiotischen Standortfaktoren

Band 8 (1995): Beiträge aus dem workshop "structure and function on all levels - from the molecular to the ecosystems level" im Rahmen der Deutsch-Israelischen Universitätspartnerschaft Tel Aviv/Bielefeld, am Department of Botany der George Wise Life Science Faculty in Tel Aviv, April 1994 (hrsg. S.-W. Breckle & Y.Waisel)

Band 9 (1995): Contributions from the International Workshop "Sustainable Land-Use in the Near East" in Bielefeld (ed. S.-W.Breckle & M.Veste)

Weitere Bände sind in Vorbereitung. Sie erscheinen in lockerer Folge.
Additional volumes will be published.

International Workshop
organised by the Department of Ecology, Faculty of Biology, University of Bielefeld
sponsored by the BMFT/Bonn

"Sustainable land-use in the arid Near East"

- Present situation,
future improvement and
future projects in
interdisciplinary science and development -

on

-- agriculture and irrigation --
-- water management --
-- afforestation --
-- grazing --
-- landuse and erosion --
-- nature protection --

participants:
Egyptians, Germans, Israelians, Jordanians, Palestinians

Date:
28. - 30. November 1994

Locality:
Zentrum für interdisziplinäre Forschung (ZiF)
(Center for Interdisciplinary Research)
Am Wellenberg
Universität Bielefeld
D-33501 Bielefeld

More information from the Organiser:
Department of Ecology
POBox 100131
D-33501 Bielefeld
Tel: xx49-521-106-5524, -5537
Fax: xx49-521-106-2963
E-Mail: abt3@hrz.uni-bielefeld.de

Internationaler workshop über "Nachhaltige Landnutzung in ariden Gebieten des Nahen Ostens" "Sustainable land-use in the arid Near East"

Prof. Dr. S.-W.Breckle
Abteilung Ökologie
Fakultät für Biologie
Universität Bielefeld

Zeitraum: 28. - 30. Nov. 1994
im Zentrum für Interdispl. Forschung (ZiF)

Kurzbeschreibung

Im Vorderen Orient, diesem uralten Kulturraum, bestehen erhebliche Probleme der Landnutzung. Sie äußern sich u.a. in einer bedrohlichen Erosionsrate (Sandverfrachtung, Bodenverluste), in Versalzung der ackerbaulichen Nutzflächen, in existentiellen Produktionsrückgängen der zunehmend devastierten Weideflächen und in Stagnation und Feuerkatastrophen der Forst- und Restwaldflächen. Die Probleme sind im gesamten palästinensischen Trockenraum und in den Nachbarländern Jordanien und Ägypten gleichermaßen ausgeprägt. Aus der Sicht einer zukünftigen wissenschaftlichen Zusammenarbeit auf internationaler und interdisziplinärer Basis versucht der workshop die jeweiligen Spezialisten der betroffenen Länder auf neutraler Basis zu einer konstruktiven Diskussionsrunde zusammenzubringen, um damit den Anstoß zu geben für zukünftige gemeinsame Forschungs- und Entwicklungsprojekte zur schnellstens erforderlichen Lösung der dringlichsten Aufgaben auf dem Umwelt- und Landnutzungssektor. Aufgrund der Kontakte der Abteilung Ökologie zu den verschiedenen Arbeitsgruppen kann im Rahmen dieses workshops ein wichtiger und vermittelnder Anstoß zur Zusammenarbeit gegeben werden.
Die Formulierung möglicher zukünftiger gemeinsamer (internationaler und interdisziplinärer) Forschungs-Projekte ist eine der Zielsetzungen dieses workshops. Darüberhinaus wird das gemeinsame Diskutieren dazu führen sich besser kennenzulernen und auch später die Möglichkeit der gegenseitigen Information besser zu nutzen.
Auch auf der unteren Ebene, bei der Forschungszusammenarbeit der Wissenschaftler spielt der Friedensprozess eine wichtige Rolle; es besteht dabei eine wichtige Wechselwirkung mit möglichen besseren Rahmenbedingungen.

List of Participants:

Organisers:

Prof. Dr. S.-W. Breckle, Department of Ecology, Faculty of Biology, POB 100131,D-33501 Bielefeld, Fax: +49-521-106-2963, e-mail: sbreckle@biologie.uni-bielefeld.de

Dipl. Biol. Maik Veste, Department of Ecology, Faculty of Biology, POB 100131,D-33501 Bielefeld, Fax: +49-521-106-2963, e-mail: ecology@biologie.uni-bielefeld.de

Participants:

Prof. Dr. Kamal Batanouny, Fac. of Science, Kairo University, Giza, Tel.: +20-2-703519

**Simon Berkowicz, Arid Ecosystem Reserch Center, Hebrew Univeristy Jerusalem,
Fax: +972-2-662581, e-mail: berkowi@vms.huji.ac.il**

**Prof. Dr. Reinhard Bornkamm, Institut für Ökologie, Rothenburgstr. 12, TU Berlin,
Fax: +49-30-314-71355**

Prof. Dr. Dan Cohen, Director of the Arid Ecosystem Research Center, Hebrew University of Jerusalem, Fax: +972-2-662581, e-mail: dancohen@vms.huji.ac.il

Dr. Frank Darius, Institut für Ökologie, TU Berlin, Rotheburgstr. 12, Fax: +49-30-314-71355

Prof. Dr. Peter Felix-Hennigsen, Institut für Bodenkunde, Wiesenstr. 3-5, Univ. Giessen, D-35390 Giessen, Fax: +49-641-702-6054

**Prof. Dr. Sumaya Ferhat-Naser, Fac. of Science, Bir Zeit University, Bir Zeit,
Fax: +972-2-957656**

Dr. H.J. Hamann, Internationales Büro, GSF- Forschungszentrum für Umwelt und Gesundheit Neuherberg, Oberschleißheim, Fax: +49-89-3187-3365

**Dr. Marwan Hassan, University of Glascow, Geomorphology,
e-mail: marwan.hassan@mtsg.ubc.ca**

Prof. Hanoch Lavee, Dept. of Geography, Laboratory of Geomorphology, 52900 Ramat Gan, Tel: +972-3-5318724, Fax: +972-3-5344430, e-mail: F49068@vm.biu.ac.il

Dr. Raouf A. Moustafa, Botany Department, Faculty of Science, Suez Canal University, Ismailia, Fax: +20-64-327-896

**Dr. Lynda Olsvig-Whittaker, Nature Reserves Authority, Jerusalem, Fax: +972-2-374887
e-mail: lynda@bgumail.bgu.ac.il**

Dr. Avi Perevolotsky, Volcani-Center, PO Box 6, Bet Dagan, Fax: +972-3-9669642

Prof. Dr. K.F. Schreiber, Institut für Geographie, Robert Kochstr. 26, Univ. Münster

**Dr. Uri Shani, Arava Research Station, Yotvata, Fax: +972-7-356-351,
e-mail: uri@vms.huji.ac.il**

Dr. Othman Sharkas, Universität Bir Zeit, Bir Zeit, Fax: +972-2-957656

**Prof. Dr. Irina Springuel, Fac. of Science, Assiut, University, Aswan Branch, Aswan,
Fax: +20-97312760**

Prof. Dr. Yoav Waisel, Botany Department, George Wise Life Science Faculty, Tel Aviv University, Tel Aviv, Fax: +972-3-6409380, e-mail: Waisel@ccsg.tau.ac.il

Prof. Dr. Chr. Wissel, Umweltzentrum Leipzig, Permoserstr., Fax: +49-341-2353500

Workshop: "Sustainable land-use in the arid Near East"

with 3 sessions :

A) present land-use situation

B) ideas for future improvements from the scientific side

C) future jount projects on interdisciplinary science and development for a better sustainable land-use in the arid Near East

and 6 topics:

1 -- agriculture and irrigation --

2 -- water management --

3 -- afforestation --

4 -- grazing --

5 -- landuse and erosion --

6 -- nature protection --

language for the workshop: English

Programme :

Monday, 28. November 1994

10.15h opening remarks

First session: "present land-use situation"

10.30h introductory remarks

10.40h Dr. Avi Perevolotsky, Volcani Center, Bet Dagan: "Natural Conservation, Reclamation and Livestock Grazing in semi-arid Ecosystems in Israel: Antagonism or Coupling?"

11.10h discussion

11.40h Prof. Dr. Kamal H. Batanouny, Fac. of Science, Cairo University: "The Impact of War Activities on the Arid Land Ecosystem in Irak, Kuwait and Saudi Arabia"

12.20h discussion

12.30h break for lunch (IBZ-Restaurant)

[[[14.15h deleted: Ghassan Azizeh, Applied Research Institute of Jerusalem, Betlehem: "Land Use in Palestine"]]]

14.40h continued discussion

14.50h Dr. Marvan Hassan, Dept. of Geography, University of Britisch Columbia, Vancouver: "Dispersion of fluvial Sediment and Contaminants in arid Streams"

15.20h final discussion and roundtable talk on the first session "present land-use situation"

15.45h coffee-break

Second session: "ideas for future improvements from the scientific side"

16.15h introductory remarks

16.20h Prof. Hanoch Lavee, Dept. of Geography, Bar-Ilan University, Ramat-Gan: "Soil - Vegetation - Erosion Relations along a Climate Gradient in the Near- East"

16.55h discussion

17.30h Prof. Dr. Sumaya Ferhat-Naser, Fac. of Science, Bir Zeit University, Bir Zeit: examples of some of the 6 topics, as seen from the Palestinean side

18.00h discussion and final discussion and remarks from the other countries

19.00h joint dinner (IBZ-Restaurant)

Tuesday, 29. November 1994

Third Session:"Future interdisciplinary joint projects in science and for development"

9.15h introductory remarks

9.20h Prof.Dr.Dan Cohen: "Prospects and Potential for Ecological, Hydrological and Land Use Measurements, Modelling and Predictions in Arid Ecosystems, using Hgh Resolution Remote Seensing Data"

9.55h discussion

10.25h Dr. Uri Shani, Arava Research Station, Yotvata: the Israeli know-how and man-power for joint scientific projects

11.10h discussion

11.20h coffee-break

[[[11.50h deleted: Dr. Awni Taimeh, Soil and Irrigation Dept., University of Jordan: "Management of Arid / Semiarid Regions of Jordan - An Integrated Approach"]]]

11.50h Simon Berkowicz, AERC, Jerusalem: The Arid Ecosystems Research Center at he Hebrew University, as an institution for interdisciplinary research

12.20h Prof.Dr.R.Bornkamm, Berlin: Ecological research in deserts in Egypt

12.35h discussion

12.55h break for lunch (IBZ-Restaurant)

14.30h Dr. Raouf A. Moustafa, Botany Dept., Fac. of Science, Suez Canal University: "Grazing and Plant Communities in south Sinai, Egypt"

15.20h Prof. Dr. Irina Springnuel, Fac. of Science, University Aswan: "Joint Scientific multydisciplinary research program in Upper Egypt, Aswan High Dam Lake Area"

15.50h discussion

16.10h coffee-break / photographing

16.45h Prof. Dr. Yoav Waisel, Botany Dept., Tel Aviv University: "Past, Present and Future - the Israeli Interest in Joint Scientific Projects"

17.10h discussion

17.40h final discussion and roundtable talk on the third session, future joint projekcts, items and research groups

18.30h concluding remarks

19.30h *reception by the Rector of the University of Bielefeld, Prof. Dr. Skowronek*

Wednesday, 30. November 1994

9.30 - 13.00h"open door", visits at the university of Bielefeld, Faculty of Biology and other institutions and/or: short excursion to the forest sites (forest die-back) adjacent to "Peter auf'm Berge", west of Bielefeld, Teutoburger Wald

13.00h break for lunch and closing of the workshop

Afternoon: (optional) "open door", visits at the university of Bielefeld, Faculty of Biology and other institutions; city

International Workshop

"Sustainable land-use in the arid Near East"

Abstracts

Prof. Dr. Kamal Batanouny
Faculty of Science, Dept. of Ecology, Director, Centre of environmental Research and Studies, Cairo University, Giza
"The Impact of War Activities on the Arid Land Ecosystem in Kuwait, Iraq and Saudi Arabia"

Prof. Dr. Dan Cohen
Director, Arid Ecosystem Research Center (AERC), The Hebrew University of Jerusalem, Dept. of Evolution, Systematics and Ecology
"Measuring, Modeling and Predicting Ecological and Hydrological Processes in Arid Ecosystems, using High-Resolution Remote-Sensing Ecological and Hydrological Measurements and High-Resolotion Radar".
- An Outline of an Interdisciplinary Research Proposal -

Dr. Marwan Hassan
University of British Columbia, Dept. of Geomorphology, Vancouver
"Dispersion of Fluvial Sediment and Contaminants in Arid Streams".

Prof. Dr. Hanoch Lavee
Dept. of Geography, Bar-Ilan University, Ramat Gan
"Soil-Vegetation-Erosion Relations along a Climate Gradient in Arid and Semi-Arid Regions in the Near East."

Dr. Avi Perevolotsky,
Dept. of Agronomy and Natural Recources, Agricultural Research Organization, The Volcani Center, Bet Dagan
"Natural Conservation, Reclamation and Livestock Grazing in semi-Arid Ecosystems in Israel: Antagonism or Coupling?"

Prof. Dr. Irina Springuel,
Faculty of Science in Aswan, Asiut University
"Joint Scientific, Multidisciplinary Research Program in Upper Egypt, Aswan High Dam Lake Area"

Ahmad Hammad
Applied Research Institute of Jerusalem, Betlehem
"Land Use in Palestine"

Dr. Raouf A. Moustafa
Botany Department, Faculty of Science, Suez Canal University, Ismalia
"Grazing and plant communities in South Sinai, Egypt"

International Workshop

"Sustainable land-use in the arid Near East"

Prof. Dr. Kamal Batanouny
Faculty of Science, Dept. of Ecology, Director, Centre of environmental Research and Studies, Cairo University, Giza

"The Impact of War Activities on the Arid Land Ecosystem in Kuwait, Iraq and Saudi Arabia"

The outbreak of hostilities in the area occupied by the three countries had great effects on the environment of these counties, with oil-well burning having the greatest impact. The activities that acted directly on the various components of the environment in the region include:

(I) Off-road vehicle traffic;
(II) Camping and defensive construction;
(III) Desert Combat;
(IV) Rocket shelling
(V) Military manoevers
(VI) Fallout of soot
(VII) Oil Spills
(VIII) Destruction of factories, power plants and other constructions.

The impacts of these war activities on fauna, flora, soil productivity, frequency of sandstorms, sand movement, soil salinization, biodiversity, food chain and other componants of the ecosystem will be discussed.

The effects on grazing land and agricultural areas, water bodies and the soil in the three countries will be shown with coloured slides, either on ground or from helicopter in the three countries. The impact of the results of war activities on the arid land ecosystem in the neighbouring countries of the Middle East would be discussed by the participants of the Workshop.

International Workshop

"Sustainable land-use in the arid Near East"

Prof. Dr. Dan Cohen
Director, Arid Ecosystem Research Center (AERC), The Hebrew University of Jerusalem and Minerva Foundation
Dept. of Evolution, Systematics and Ecology

"Measuring, Modeling and Predicting Ecological and Hydrological Processes in Arid Ecosystems, using High-Resolution Remote-Sensing Ecological and Hydrological Measurements and High-Resolution Radar".
- An Outline of an Interdisciplinary Research Proposal -

The survival, growth and reproduction of plants, and the overall primary production in arid ecosystems, are determined mainly by the temporal and spatial distribution of soil moisture. In highly arid ecosystem plant growth occurs mainly in patchy sites, where water is concentrated by local runoff. Modeling the distribution of runoff and plant growth require therefore an integration of rainfall and runoff over a wide range of temporal and spatial scales.

I am convinced that research, modeling, and predictions in ecosystems, can be applied to the large areas in which they are needed, only by using and analysing large amounts of detailed spatial and temporal information that can be collected for large areas by remote sensing.
Differential Radiometry at the red wave length and the Near Infrared wavelength represents the amount of light absorbed by green leaves, and is a measure of their biomass. Such methods have been used effectively for measuring the regional and seasonal changes in green plant cover over large areas.

We need remote sensing measurements of changes in the green plant biomass, at a minimum spatial resolution of 1m, with apossibility of 10 cm or less, which is the spatial scale of the hydrological and ecological processes in arid ecosystems, where soil moisture is provided by localised
runoff.

Application of Weather Radars to Rainfall Measurements: The proposed research will use radar measurements to generate a high-resolution spatial and temporal map of rainfall distribution over large areas.

Rainfall measurements over large areas are practical only with weather radars. Recently, a method was developed at the Hebrew University to determine rainfall intensity at a much higher accuracy over all scales. This opens possibilities for applications that require accurate knowledge of the rain intensities over large areas in high temporal (5 min) and spatial (1 km) resolution. It is proposed to estabish a regional radar network to monitor rainfall distribution over large areas, test rigorously the performance against a network of recording rain gauges, and use the detailed rainfall informations as input to a hydrological model of the distribution of soil moisture change and runoff.

ESTABLISHING A GEOGRAPHICAL INFORMATION SYSTEM (GIS)

A geographical information system (GIS) is a relatively new technology that integrates spatially referenced data obtained from different sources of information (e.g. maps, aerial photographs ect.) into a common data-base. It also provides a variety of tools and applications for analysing the relationship among the various data sets.

Establishing such data-base is a necessary condition for analysing the relationships among the variety of measured a-biotic and biotic variables. Integration of the data with a GIS will improve our ability to identify gaps in our knowledge of the area, and to formulate needs for future projekts.

As a first step, I propose to establish a GIS for the AERC research stations, that will combine available information from ecological and hydrological research, vegetation maps, soil and topographic maps and the wind and rainfall distributions.
High resolution radiometric air photograhy will provide measurements of the changes in the vegetation and the distribution and movements of the mobile sand during the season, and after particular storms. Such measurements over a large area can be carried out effectively only by airbone surveys. The information from the aerial photography will be processed, analysed, and interpreted with the help of the hydrological and ecological models developed in the GIS system.

We propose to ask for funding for a pilot research program for 3 to 5 years, to develope, test, and establish the methodology of combining rain radar measurements, satellite remote sensing, high resolution aerial photography, with GIS information processing, for identifying, measurig and analysing patterns and processes in the arid ecosystems represented by our research stations in Sde-Boker and Nizzana. Ground measurements that are essential for calibrating and testing the aerial measurements and the GIS interpretations, will be carried out in this stations.

We expect to be able to develope this methodology sufficiently well by the end of the preliminary research period, so that we could use it to describe, measure, and predict the important patterns and processes in a wide range of arid ecosystems in Israel.

At the same time, we shall make efforts to develope joint projects for research of arid ecosystems in other interested countries in the Near East, and in other parts of the world. This requires that representative ground will have to be established and maintained in each arid ecosystem.

International Workshop

"Sustainable land-use in the arid Near East"

Dr. Marwan Hassan
University of British Columbia, Dept. of Geomorphology, Vancouver

"Dispersion of Fluvial Sediment and Contaminants in Arid Streams".

Contaminants such as herbicides, pesticides and radioisotopes can be attached to fluvial sediments and move as bedload during floods. Bedload particles are dispersed rather slowly and potentially hazardous contaminants that are attached may therefore remain in a river system for an extended period of time. During sediment transporting events bedload particles change their longitudinal and vertical position with respect to the channel bed. Particles that are buried during one event are commonly reexposed during a subsequent event. Residence time largely depends on a particle's location within the active layer and the hydrological regime of the fluvial system. In arid and semi-arid environments, where many streams are ephemeral, residence times are in general longer than in temperate or tropical environments. Deeply buried particles have a relatively low chance of entrainment and have longer residence times relative to more mobile material close to the bed surface. The movement of sediment is a stochastic process and the dispersion of bedload contaminants will therefore behave in a similar way.

This paper examines the dispersion of bedload particles in gravel-bed rivers using tagged particles. Emphasis is placed on the finer fractions of the bedload which are those sizes most likely to carry the highest concentrations of contaminants. Field data show that the longitudinal transport of particles is largely independent of their size, and strongly skewed with respect to distance. The distribution of distance of movement follows the Einstein-Hubbell-Sayre compound Poisson model or simple Gamma model for small displacements. The vertical movement is one of bi-directional exchange, in which particles buried during a given event are, in a statistical sense, replaced by other particles exposed from inside the active layer during the same event. A one dimensional model based on both field and theoretical considerations which predicts variations in the frequency of burial depths will be presented. Discussion will focus on the implications of these results for modeling the dispersion of contaminants in fluvial sediments in desert environments. The stochastic model of fluvial sediment transport being developed is also of value in estimating reservoir sedimentation rates.

KEY WORDS: RIVERS - EROSION - WATER RESOURCES - RESERVOIRS-CONTAMINANTS

Bielefelder Ökol. Beitr. 9 (1995) p. 14

International Workshop

"Sustainable land-use in the arid Near East"

Prof. Dr. Hanoch Lavee
Dept. of Geography, Bar-Ilan University, Ramat Gan

"Soil-Vegetation-Erosion Relations along a Climate Gradient in Arid and Semi-Arid Regions in the Near East."

The relationships between climate, soil and vegetation properties which influence erosion and desertification processes are investigated at seven sites along a climatological gradient running from the Judean Mountains (average annual rainfall 620 mm; average annual temperature 17°C) in the west to the Dead Sea (average annual rainfall 80 mm; average annual temperature 23°C) in the east.
At three of the sites - representative of Mediterranean, semi-arid and arid climates - radiometric measurments were taken and reference experimental plots have been established, each containing three runoff plots with overland flow and sediment collectors, raingages, temperature probes and gypsum blocks for soil moisture measurments. These instruments were all attached to a data logger.
At all sites, vegetation cover, species and diversity were measured in the field and soil samples were taken at three month intervals for laboratory analyses of mechanical, chemical and biological properties and aggregation processes. Using radiometric measurments and Landsat TM images, models relating multispectral reflectance combinations to environmental parameters have been developed. Spatial variations of stone cover were detected and a vegetation cover map was produced.
Analyses of soil properties such as liquid limit, organic matter content, electrical conductivity and aggregate distribution, all indicate spatial and seasonal variations; the soil stability along the climatic gradient decreases from west to east and also changes during the year. The total number of plant species and vegetation cover percentage both decrease from west to east, and the species diversity is highest in the semi-arid area.

An interesting feature that was found for several vegetation and soil properties is the existance of a threshold in the semi-arid region at 300-350 mm of annual rainfall zone.

The response of the water behaviour (runoff, infiltration, evaporation and soil moisture) to rainfall varies along the climatic gradient. In the Mediterranean area the reaction is low magnitude and continuous; the system seems to be controlled by the soil properties. As aridity increases the rainfall characteristics control the system, the reaction becomes more discontinuous and of higher intensity; the buffer capacity of the system decreases and so does its stability.

International Workshop

"Sustainable land-use in the arid Near East"

Dr. Avi Perevolotsky,
Dept. of Agronomy and Natural Recources, Agricultural Research Organization,
The olcani Center

"Natural Conservation, Reclamation and Livestock Grazing in semi-Arid Ecosystems in Israel: Antagonism or Coupling?"

This paper examines the relatioships between conservation or reclamation and livestock grazing. Traditionaly, livestock were considered as a threat to the success of both these ecological activities. We introduce the notion of Grazing Determined Systems (GDS) and claim that in the Old World, especially in the Near East, grazing is at present an indispensible part of the so-called natural ecosystem and therefore:

1. Conservation in Old World GDS should relate, at least on some spatial scale, to the grazed formation, as essential objective. It is, after all, the 'most natural' situation left. However, preserving this state implies keeping the prevailing grazing regime or an ecological equivalent.
2. At the present state, grazing and even heavy temporal grazing, as has been practiced traditionally, doest not seem to induce significant degradation in GDS. These systems seem to be adaptive to such land use.
3. Claims of overgrazing and resource degradation, under the above conditions, are *a priori* suspicious, and should be substantiated professionally rather than manipulated politically.
4. Environmental factors such as soil moisture and nutrient availability seem to be more significant in determining vegetative community features (species composition, primary production) than grazing impact.
5. Detailed long-term studies on ecological processes following grazing exclusion should be conducted in order to determine the outcome of a no-grazing conservation policy. Decisions should be based on these findings and not on the belief that "nature will take care of itself" (once the livestock are removed).
6. Development and conservation in GDS should take into consideration the role of grazing in molding the existing natural system and provide management solutions for the outcome of livestock exclusion.

Bielefelder Ökol. Beitr. 9 (1995) p. 16

International Workshop

"Sustainable land-use in the arid Near East"

Prof. Dr. Irina Springuel,
Faculty of Science in Aswan, Asiut University

"Joint Scientific, Multidisciplinary Research Program in Upper Egypt, Aswan High Dam Lake Area"

Abstract

The total land area of Egypt is 99.545.000 hectares, of which 96. 943.000 hectares are desert land. Only 3.15% of the land surface is cultivated, mostly in the Nile valley and Delta, and much of this is already cultivated at the near maximum level of intensity. The Aswan High Dam Lake shoreline offers an alternative to the current Nile Delta reclamation program.

A multi-disciplinary team from the Unit of Environmental Studies and Development, Aswan Branch of Assiut University is engaged on a multidisciplinary research program for sustainable management and conservation of natural resources of a marginal zone of the lake and surrounding desert. Wadi Allaqi, is the largest wadi of the southern part of Eastern Desert of Egypt which drains to the Lake was selected as the region for <u>in situ</u> research. The whole Wadi Allaqi basin is a conservation area by the Egyptian Prime Minister's declaration and a Biosphere Reserve within the UNESCO Man and Biosphere program.

The ongoing research program in Wadi Allaqi in cooperation with scientists from different countries has revealed considerable economic potential, i.e. The availability of good quality lake water, occurrence of ground water, enrichment of soil fertility, rich vegetation producing a large biomass, rich fauna diversity and human population comprising four main groups: (nomadic tribespeople in surrounding desert, fishermen on the Lake, farmers on the shores, laborers for minings in the desert).

The use and management of these resources to meet the criteria of sustainable development is a very complicated process due to high instability and vulnerability of the ecosystem i.e. The large and unpredictable fluctuation of water level in the lake has discouraged any sustainable agricultural development. Close to the shore of the lake the soil moisture content is high but periods of land exposure in different years could be insufficient for crops to mature for harvesting. On the other hand, the long exposure periods leads to quick decline of soil moisture and hence to crop failure.

Proposed collaboration for sustainable development, land use and conservation of natural resources could fulfill the following subjects:

- Rangeland and livestock management. Expected benefits would be: 1.- recovery of vegetation cover over a vast region, thus reducing erosion, air and water pollution, 2.- more balanced and sustainable livestock industry, 3 - better social and economic conditions for those using this vast area.
- Economic forestry (cultivation of economically important indigenous desert plants such as <u>Acacia</u> and <u>Balanites</u>) which would complement the pastoral system. This would consider all environmental degradation problems that could be ameliorated by afforestation in arid lands.
- Cultivation of medicinal plants and novel uses of plants as alternative to crop production.
- Germplasm for Arid Lands , establishing of living collection of economically important plants for arid lands.

International Workshop

"Sustainable land-use in the arid Near East"

Ahmad Hammad
Applied Research Institute of Jerusalem, Betlehem

"Land Use in Palestine"

Abstract

The West Bank will comprise the majority of the territory making up the Palestinian state. However, this land has suffered in the last 27 years from Jewish settlement, restrictions on Palestinian access to its natural resources, and, as a result, lack of planning by Palestinians in development and land use.

Jewish settlement has not only meant the expropriation of land for housing, but also for roads and agriculture. Furthermore, it has meant the degradation of West Bank water resources through the digging of deep wells to serve settler water needs.

Large tracts of land have also been closed off either for reasons of creating military or security areas, or for the purpose of creating natural reserves, some of which have been justified, but some of which later have been reclassified to allow Jewish settlement. In any case, these, along with permit regulations designed to limit development, have restricted both Palestinian access to the land and power to make decisions about its management and use.

Even beyond the occupation, however, current Palestinian land use is not, in the long term, sustainable. For instance, built up Palestinian areas are located on and expanding into valuable agricultural land. Likewise, without significant rethinking of the traditional livestock management patterns, the Eastern Slopes region of the West Bank is in severe danger of further degradation and loss of biodiversity.

Through the use of modern technologies such as Geographic Information Systems and satellite imagery, significant opportunities exist for joint programs to recognize the trends in current land use and correct them for a more sustainable future.

International Workshop

"Sustainable land-use in the arid Near East"

Dr. Raouf A. Moustafa
Botany Department, Faculty of Science, Suez Canal Univerisity, Ismailia

"Grazing and plant communities in South Sinai, Egypt"

F'oristically, the Sinai peninsula is represented by four main p togeographical chorotypes Saharo-Arabian, Irano-Turanian, Sudanian, and Mediterranean. The southern Sinai is characterized by unique vegetation due to its geomorphological formations and climatic variations along altitudinal gradients (850-2641 m). The impact of man and his domestic animals is considerable in this area and threaten the plant life in different forms and many places. In general, human mismanagement is causing the deterioration of natural resources including vegetation.
Our motivation for studying the grazing problems is due to four reasons: (1) Disappearance of pasturer plant communities, rare species, and endemic species; (2) Dominating many wadis and ridge habitats by pure communities of ungrazed plants such as *Artemisia judica*, and *Fagonia mollis*; (3) Deterioration the nature of soil surface; and (4) Reducing the total plant cover percentage. The study included quantitative vegetation analysis of forty seven stands which are representing the main habitats in the study area. each stand, cover percent, and environmental factors (elevation s ope, exposure, nature of soil surface, and soil texture) have been measured. The grazing degree has been measured in each stand based on grazing index which include the number of visits by animals during different seasons, the number of animals and their kinds and the rate of cutting and uprooting by bedouins.
The data analyses were done by floristic classification using TWINSPAN then followed by interpretation the vegetation data in relation to the environmental factors measured using ordination analysis (CANOCO). The classification analysis grouped the vegetation data into seven main communities as follows: *Artemisia inculta- Tanacetum santolinoides*, *Phlomis aurea- Teucrium pilosum*, *Teucrium pilosum-Tanacetum santolinoides*, *Artemisia inculta- Zilla spinosa*, *Peganum harmala*, *Fagonia mollis-Alkanna orientalis*, and *Fagonia mollis - Zilla spinosa*. The demonstration by CANOCO showed that the distribution of the species and the stands are highly correlated to the following factors: boulders and stones, cobbles and gravels, grazing index, palatable/unpalatable value, moisture, evation and soil texture properties (fine sand and coarse sand fractions).

Bielefelder Ökol. Beitr. 9 (1995) p.19-21

Obstacles to Land Use and Forestation in the West Bank

Sumaya Ferhat-Naser
Birzeit University
Box 14, Birzeit
West-Bank

Large areas of the West Bank are bare and face severe ecological problems. These problems are strongly related to the status of the region being under military occupation for almost one third of a century. The land has been deserted by its people due to the following factors:

- Thousands of Palestinians have been deprived the right of living in their homeland and have therefore been prevented from cultivating their soil or reclaiming their land .
- The failure of agriculture in the West Bank to secure a living, the absence of comprehensive planning and governmental support, and restrictions imposed by military policy , have shifted human resources from agriculture in the West Bank to agriculture, services and construction works in Israel.
- This shifting in employment reduced the human resources involved in agriculture to one third of the ratio thirty years ago.
- Land confiscation and closure and uprooting of thousands of trees reduced the land available for the Palestinian people to become only about 30% of the West Bank land included the inhabited area.

The prevailing political situation with no national government led to the stagnation of the planning and development of agriculture and national resources. The native natural landscape has changed negatively. Large areas of lands, which have been cultivated o. could be cultivated, were confiscated and radically transferred into urban areas by Israeli settlement-building activities. The planning policy has been devoted to achieving Israeli political interests, contradicting the vital interests of the Palestinian people. This fact and with the absence of law and order, has brought about the failure to protect and renew cultivated plants. In addition, overgrazing in semi-humid areas and intensive cultivation in certain areas, coupled with inappropriate land use, accelerated the problem. Consequently, this has eroded agricultural production potential, leading to a dependence upon imported agricultural and wood products. This in turn has limited the agricultural source of income and thus has increased unemployment and the migration of manpower to foreign developmental work, particularly because earnings in Israel are double these in the West Bank, while the cost of living in Israel and the West Bank is the same. Moreover, the negligence of terraces, the desertion of agricultural work and the degradation of vegetation cover tremendously increased soil erosion, which is promoted by semi-arid climatic conditions. The result is a decrease in water retention capacity. The danger of desertification is a real concern. The decrease in forest and grazing areas may lead to insufficient fodder supply and uncontrolled grazing.

The West Bank comprises very few natural reservations, which have been established in the twenties and fifties as part of governmental plan for forestation. Over the last thirty years, the caring for nature was totally absent, as the political events exploited the thinking and orientation of life under occupation. There was no room for environmental considerations when the cause of survival was in doubt. A real problem does exist since consciousness for environmental problems was and is totally absent in the minds of people and in the policy of the responsible military authority of occupation. No attempts have been made to detect and define the problems in order to set up possible solutions. Political regulations prevented any environmental development. It is imperative to reveal the link between a developmental approach and environmental considerations and to conceive of the facts that environmental protection is part of the politics which dictate quality of life and the possibility of survival. The right of the Palestinians to legislate, to plan and to execute, constitute the basic conditions to enable them tackle the accumulating environmental problems.

The awareness to afforestation is not only absent but is usually fought or resisted because people do not recognize the role of forests and the importance of native vegetation in maintaining the balance of nature and in reviving biodiversity and natural resources. The orientation is usually towards planting useful plants, which alone are worth to occupy the soil. This assumption is based on the material earning of harvested useful products since available land for cultivation is limited and securing a living has priority. In addition, people consider natural vegetation as a natural reservoir for grazing and for the supply of wood for fire.

It is imperative to establish as top priority the ecological stability of the region in any political and developmental considerations. This stability can be attained through improved training in forestry, while at the same time establishing a comprehensive environmental education and consciousness raising campaigns making them obligatory in schools and popular organizations and at sites of activities .Natural reservations must occupy their appropriate portion and site in the landscape . Improved vegetation cover would make forests and pasture areas available, and could improve soil- and water retention capacity, which in turn promotes agricultural productivity. The incentives for work in agriculture would then be raised and, thus, alternative sources of income created. Land reclamation would become a goal opening the possibility for land preparation, terraces building and road construction. Controlled grazing would mean cultivation of fodder plants and this in turn would introduce additional land reclamation improving animal resources.

Any attempts to create natural reservations must be an enforced plan by the government in order to achieve success. Improving training opportunities in forestry at universities contributes to the institutional strengthening of the self-help capacity of local communities and uses the students as multipliers. The intention must also be to encourage women to participate in afforestation activities, aiming at manifesting the integral role of women in socio-economic development. An arboretum or natural reservation provides educational and research resources and improves awareness for environmental protection and ecological considerations. In the long run, the chance of making a contribution towards rehabilitating degraded water catchment areas through forestry measures is prepared. The conceptual approach towards afforestation must be based on the use of authochtonic tree species and plants indigenous to Palestine, and to the re-introduce of species which had dominated the landscape for long periods but are now disappearing from the region. The integration of these species into socially accepted forms of land use can contribute towards a long term ecological rehabilitation of karstic sites, as well as towards preserving species varieties . The promotion of indigenous species minimizes expensive and environmentally destructive plant protection measures. More over, the cultural association between human beings and their native landscape is a powerful bond that should not only be recognized, but strongly re-enforced.

Bielefelder Ökol. Beitr. 9 (1995) p. 23-29

SOME THOUGHTS ON OVER-GRAZING AND DESERTIFICATION - A LESSON FROM THE NEGEV DESERT IN ISRAEL

by

Avi Perevolotsky

Dept. of Agronomy and Natural Resources,
Agricultural Research Organization,
The Volcani Center,
P.O. Box 6, Bet Dagan 50250, ISRAEL

Introduction

Livestock grazing is viewed as a gross intervention that threatens the structure and function of natural ecosystems. It is argued that such activity may cause soil compacting and deformation, result in vegetation removal and modification, increase runoff and soil erosion, export minerals from the system, and contribute to climatic changes on both micro- and macro-levels. It is not surprising, therefore, to find in a recent text on environmental issues that "plowing and pastoralism are responsible for many of our most serious environmental problems..." (Goudie, 1990).

The negative consequences to the environment associated with livestock raising have been emphasized, and perhaps over-emphasized, in the last decade, especially in the context of the New World (western USA, Australia). However, the fact that in the Old World pastoralism has been part of traditional economy and a prevailing human activity over extensive areas during thousands of years, and as such plays a significant ecological role, is ignored. Th

The following discussion focuses on prevailing misconceptions of the ecological relationships between livestock grazing and natural vegetative communities that have led to presumably wrong management decisions. Consequently, the role of grazing in the sustainable management of natural ecosystems in the Old World has been ignored or denied. This discussion draws primarily on observations and studies conducted in the northern semi-arid Negev desert of Israel.

Grazing-Determined Systems (GDS)

In the 1970s it was common in ecology to define ecosystems on the basis of their principal driving force: a water-controlled ecosystem in arid climates (Noy-Meir, 1973) or a fire-determined ecosystem in Mediterranean climates (Naveh, 1974). Later it was realized that the complexity of most ecosystems requires a multivariate approach (Naveh, 1984). Nevertheless, I find it useful to define the semi-arid ecosystems of the Old World as a grazing-determined system. The practice of a pastoral economy in these ecosystems over thousands of years has, most certainly, modified them so profoundly that livestock grazing has become one of their principal ecological driving forces. Livestock grazing is obviously not exclusive in its impact on semi-arid ecosystems: variable and unpredictable precipitation regimes and a limited amount of nutrients in the soil are also major factors in determining features of the dry ecosystems (Noy-Meir, 1985). Similarly, the structure and function of arid and semi-arid savanna ecosystem are determined by a combined effect of soil moisture, soil nutrients, fire and herbivory (Walker, 1987).

Most ecosystems in the Levant have evolved over a long period (~7,000 years) of virtually continuous impact of grazing by domesticated livestock, and its associated man-made disturbances (Noy-Meir and Seligman, 1979; Zohary, 1983). In the Sinai and Negev regions, socio-economic symbiotic-dimorphic relationships between desert pastoralism and semi-arid dry agriculture have created a stable subsistence model over thousands years of archaeological history (Finkelstein and Perevolotsky, 1990). Such grazing took place during long periods and over an extensive area. Consequently, many of the present ecological features: community structure, soil cover, nutrient status and cycling, to name only a few, have evolved under the impact of grazing livestock.

Nothing in this argument is intended to deny the fact that grazing has had a significant effect on the ecosystem, or that if grazing had been excluded, another significant change would have occurred in the structure or function of the vegetative community. The literature is full of examples of substantial changes in the vegetation of rangelands following the exclusion or control of grazing (McNaughton, 1979; Vickery, 1981; Floret, 1981; Noy-Meir, 1990; Ayyad et al., 1990; Huntly, 1991; Skarpe, 1991).

The point to be stressed here, although difficult to be quantified, is that grazing-determined systems had undergone substantial changes, in various aspects, after the period of livestock domestication 8,000-7,000 years ago and, especially, during the development of the pastoral mode of subsistence. Zohary (1983:290-291) expressed the effect of the newly domesticated livestock on natural ecosystems in a rather vivid, though weakly supported, manner: "thousands of species have disappeared from the scene before they could become known to science.... Enormous areas of grazed lands lost their palatable plants and became altogether deprived of their grazing potentials. These are now vegetated by plant communities dominated by antipastoral, stubborn and highly aggressive plants."

Ecologically speaking, the impact of the pastoral economy on the dry ecosystem can be considered as an example of the 'state and transition model' (Westoby et al., 1989). Under the premise of this model rangeland vegetation may appear in a variety of discrete 'states' while various 'transitions' may drive it from one state to another. Transitions may be triggered by either natural or anthropogenic causes. In this sense, domestication and the initiation of pastoral activity may have caused a drastic transition from a previous 'undisturbed' or less disturbed natural ecological state to a disturbed state with "an alternative [less natural] stable vegetation state". It is most likely that the ecosystem-level changes imposed by the continuous disturbance (pastoral activity) drove the system over a threshold with little probability for turning back, as proposed by the 'state and threshold model' developed to deal with ecological disturbances (Holling, 1973) and adopted by range scientists (Friedel, 1991; Laycock, 1991) to describe grazing impact on rangeland vegetation. In other words, a drastic (and, most certainly, irreversible) change in the ecosystem accompanied the appearance of pastoral societies in much of the semi-arid and arid Old World. Similar argumentation is used by Laycock, Friedel and Westoby and his colleagues in order to explain significant changes in vegetation formation, composition and productivity as a result of human impact (grazing, fire prevention) in the New World, where relatively heavy grazing by domesticated livestock was introduced 400 years ago to ecosystems exposed previously only to light wildlife herbivory.

In the northern Negev, small-ruminant pastoralism has been practiced as a dominant and organized mode of subsistence starting in the Pre-Pottery Neolithic B Period (almost 8000 years ago - Avner et al., 1994; Finkelstein and Perevolotsky, 1990) and continuing, with minor modifications, until a few decades ago. Obviously, we are not able to reconstruct the actual human impact of any historical or archaeological period, however, it seems that the continuity of the impact within the context of a harsh environment should have significantly affected the vegetation community. Moreover, till the domestication of the camel, at the end of the 2nd millennium BC, pastoralism in the Levant was only semi-nomadic or enclosed nomadic, meaning that only a limited movement of humans and livestock was practiced (Rowton, 1974; Khazanov, 1984). Consequently, the pastoralist practice took place, over mellenia, on a rather limited space. So, even if the actual grazing pressure was not very high (in modern terms), its persistence was high and its overall impact - very significant.

As far as grazing impact is concerned, the drastic changes imposed on Bedouin pastoralism in the second half of the 20th century through the incorporation into a the modern, capitalistic Israeli society, made little difference on the livestock impact on the environment. It is true that the Bedouin long-term migration was replaced by heavy grain supplementation during the winter and Bedouin were excluded from some traditional grazing territories that became military training areas or intensively cultivated. But, on the other hand, water is available now almost everywhere, stubble and other sources of fodder are readily available in the close proximity, access to veterinary care is easy and the market is usually good (Ginguld, 1994). As a result, grazing pressure on remaining rangeland is still quite high.

The ecological scenario following the domestication of livestock and the development of pastoralism can be summarized as follows:

a. Natural pre-pastoral vegetation climax and primary successional processes have long disappeared, over extensive regions and beyond any possibility of reconstruction.
b. A vegetative community, well adapted to grazing, became dominant in the grazing-determined systems.
c. Despite heavy use, the system is stable and resilient (sustainable!), though it may be less productive than the original one.

In traditional African pastoral groups, the livestock populations appeared to be in a non-equilibrium but persistent state (Ellis and Swift, 1988), while the pastures they use seemed to be stable at a low equilibrium level *sensu* Noy-Meir (1975). The livestock productivity in this system is, however, below maximal values.

The above contention does not, in any way, imply an approval for future abuse of the semi-arid ecosystems. Heavy grazing pressure may cause undesirable changes, and even irreversible damage to the ecosystem. However, later I will claim that many of the accusations concerning resource degradation in traditional pastoral systems are not substantiated. My claim is that grazing-determined systems are quite adapted or resilient to livestock grazing, due to a long mutualistic evolution, but it does not mean that they can sustain any degree of disturbance (defined hereby *sensu* Grime, 1979 as mechanisms that limit plant biomass by causing its partial or total destruction). The 'red line' separating use and abuse in grazing-determined systems should be determined professionally and since such guidelines are not available, it remains a challenge for the new generation of experts.

Moreover, applying one of the criteria of sustainability - long-term independent persistence - will clearly reveal that both the biological and human components of grazing-determined systems have survived for a long period of time (thousands of years) and through severe environmental fluctuations, obviously indicating high sustainability (or whatever the accepted definition of this ambiguous term will finally be - Brklacich et al., 1991). Whether modern conservation or development programs, under similar environmental conditions, will be as successful and sustainable, is yet to be shown.

Conclusions

Some interesting conclusions that seem partly to contradict the conventional wisdom, can be drawn from the above discussion:

1. Conservation in Old World grazing-determined systems should relate, at least on some spatial scale, to the grazed formation, as essential objective. It is, after all, the 'most natural' situation left. However, preserving this state implies keeping the prevailing grazing regime or an ecological equivalent.
2. At the present state, grazing and even heavy temporal grazing, as has been practiced traditionally, does not seem to induce an on-going degradation in grazing-determined systems. These systems seem to be adaptive to such land use.
3. Claims of overgrazing and resource degradation under the above conditions are *a priori* suspect, and should be substantiated professionally rather than manipulated politically.
4. Environmental factors of grazing-determined systems, such as soil moisture and nutrient availability, seem to be more significant in determining vegetative community features (species composition, primary production) than grazing impact.
5. Detailed long-term studies of ecological processes following grazing exclusion should be conducted to determine the outcome of a no-grazing conservation policy. Decisions should be based on these findings and not on the belief that "nature will take care of itself" (once the livestock are removed).
6. Development and conservation in grazing-determined systems should take into consideration the role of grazing in molding the existing natural system and provide management solutions for the outcome of livestock exclusion.

References

- Avner, U., Carmi, I. and Segal, D. (1994). Neolithic to Bronze Age settlement of the Negev and Sinai in light of radiocarbon dating: a view from the southern Negev. In: Bar-Yosef, O. and Kra, R.S. (eds.) Radiocarbon: Late Quaternary Chronology and Paleoclimate of the Eastern Mediterranean.
- Ayyad M.A. et al (1990). Effect of protection on the phenology and primary production of some common annuals in the western coastal desert of Egypt. Journal of Arid Environments 18: 295-300
- Ellis, J.E. and Swift, D.M. (1988). Stability of African pastoral ecosystems: alternate paradigms and implications for development. Journal of Range Management 41:450-459.
- Finkelstein, I. and Perevolotsky, A. (1990). Process of sedentarization and nomadization in the history of Sinai and the Negev. Bulletin of the American Schools of Oriental Research 279:67-88.
- Floret, C. (1981). The effects of protection on steppic vegetation in the Mediterranean arid zone of southern Tunisia. Vegetatio 46:117-129.
- Friedel, M.H. (1991). Range condition assessment and the concept of thresholds: A viewpoint. Journal of Range Management 44:422-426.
- Ginguld, M. (1994). Managimg herds and households: management practices and livelihood strategies of sheep-owning Bedouin households

in the Negev region of Israel. M.A. thesis. Institute of Social Studies. The Hague. The Netherlands.

- Goudie, A. (1990). The Human Impact on the Natural Environment. Cambridge, Mass.: MIT Press.
- Grime, J.P. (1979). Plant Strategies and Vegetation Processes. Chichester, UK: Wiley.
- Holling, C.S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology and Systematics 4:1-23.
- Huntly N. (1991). Herbivores and the dynamics of communities and ecosystems. Annual Review of Ecology and Systematics 22: 477-503
- Khazanov, A.M. (1984). Nomads and the Outside World. Cambridge: Cambridge University Press.
- Laycock, W.A. (1991). Stable states and thresholds of range condition on North American rangelands: A viewpoint. Journal of Range Management 44:427-433.
- McNaughton S.J. (1979). In: Sinclair A.R.E. and Norton-Griffiths M. (eds.) Serengeti--Dynamics of an Ecosystem. Chicago: University of Chicago Press.
- Naveh, Z. (1974). Effects of fire in the Mediterranean region. In: T.T. Kozlowski and C.E. Ahlgren (eds.) Fire and Ecosystems. New York: Academic Press.
- Naveh, Z. (1984). Mediterranean landscape evolution and degradation as multivariate biofunctions: theoretical and practical implications. Landscape Ecology 9:125-146.
- Noy-Meir, I. (1975). Stability of grazing systems: an application of predator-prey graphs. Journal of Ecology 65:459-481.
- Noy-Meir, I. (1985). Desert ecosystem structure and function. In: M. Evenari, I. Noy-Meir and D.W. Goodall (eds.) Hot Deserts and Arid Shrublands. Amsterdam: Elsevier.
- Noy-Meir, I. (1990). Responses of two semiarid rangeland communities to protection from grazing. Israel Journal of Botany 39:431-442.
- Noy-Meir, I. and Seligman, N.G. (1979). Management of semi-arid ecosystems in Israel. In: B.H. Walker (ed.) Management of semi-Arid Ecosystems. Amsterdam: Elsevier.
- Rowten, M.B. (1974). Enclosed nomadism. Journal of the Economic and Social History of the Orient 17:1-30.
- Skarpe, C. (1991). Impact of grazing in savanna ecosystems. Ambio 20: 351-356
- Walker, B.H. (1987). A general model of savanna structure and function. In: B.H. Walker (ed.) Determinants of Tropical Savannas. Oxford: IRL Press.
- Westoby, M., Walker, B. and Noy-Meir, I. (1989). Opportunistic management for rangelands not at equilibrium. Journal of Range Management 42:266-274.
- Vickery, P.J. (1981). Pasture growth under grazing. In: Morely F.H.W. (ed.) Grazing Animals. Amsterdam: Elsevien
- Zohary, M. (1983). Man and vegetation in the Middle East. In: W. Holzner, M.J.A. Werger and I. Ikusima (eds.) Man's Impact on Vegetation. The Hauge: Dr W. Junk Publishers.

Bielefelder Ökol. Beitr. 9 (1995) p. 31-49

Dispersion of Fluvial Sediment and Contaminants in Gravel-bed Rivers

Marwan A. Hassan

Department of Geography and Topographic Sciences

University of Glasgow

Glasgow, G12 8QQ

UK

Introduction

Contaminants such as herbicides, pesticides and radioisotopes can be attached to fluvial sediments and move as bedload during floods. Bedload particles are dispersed rather slowly and potentially hazardous contaminants that are attached may therefore remain in a river system for an extended period of time. During sediment transporting events, bedload particles change their longitudinal and vertical position with respect to the channel bed (Schick et al., 1987). Particles that are buried during one event are commonly re-exposed during a subsequent one (Hassan, 1993). Residence time largely depends on a particle's location within the active layer and the hydrological regime of the fluvial system. In arid and semi-arid environments, where many streams are ephemeral, residence times are in general longer than in temperate or tropical environments. Deeply buried particles have a relatively low chance of entrainment and have longer residence times than the more mobile material close to the bed surface. Macklin and Klimek (1992) estimated that the residence time of toxic heavy metals in alluvial sediment to be in the order of 10^2-10^3 years. Remobilization of stored sediment and contaminants may have serious effects on river biota (Karbe, 1988) and the quality of surface and ground water (Forstner, 1989). The movement of sediment is a stochastic process and the dispersion of bedload contaminants will therefore behave in a similar way.

Desert floods are infrequent and short lived. Yet, over these short periods, large volumes and sizes of sediment are transported. During sediment transporting events, some of the particles exposed at the bed surface become buried and, inversely, some of the buried particles become exposed. In other words, the active scouring layer serves as a dynamic storage body whose components change both their vertical and horizontal positions over time. Bed morphology, texture and structure are determined by the sediment dynamics and its interaction with flow characteristics. This paper examines the dispersion of bedload particles in gravel-bed rivers using tagged particles (Hassan et al., 1984). The results can be applied to estimate the dispersion pattern of bedload and bedload-attached contaminates in gravel bed rivers.

The Data

Data presented in this paper were obtained in various studies (see Hassan and Church, 1992; Table 1). Figure 1 presents the location of the study rivers. The rivers cover a wide range of channel texture, from gravel-bed and well-armoured perennial rivers (Harris Creek) to ephemeral sand-bed desert rivers (Arroyo Los de Firjoles). In addition, the rivers cover a wide range of channel morphology and bed texture. In terms of hydrological regime, the rivers range from flash floods in the desert to gradually varied snow melt floods.

Sediment Mixing

In all study cases the tagged particles were located at the bed surface and started from a fully exposed position. Following the first event, some of these were found to have been buried while others remained exposed on the surface. The next event would bury some of the surface particles and re-expose a portion of the buried ones. For example, of 282 tagged particles, 34% were buried and 66% remained exposed on the surface after the first event (Figure 2). The second event was relatively large and 63% of the particles were found buried. In summary, figure 2 illustrates the vertical mixing of sediment in river beds and its influence on the sediment transport.

Burial Depth and Particle size

The relation between burial depth and particle size was examined for several events. Three typical examples are shown in Figure 3. The figure shows no straightforward relation; some particles were deeply buried while others of the same size remained exposed on the bed surface. In general, the data suggest that, in individual events, mobile particles are apt to be buried at any depth beneath some envelope that demonstrates the maximum likely depth as an inverse function of particle size. In an ensemble of particles this distinction disappears over many events.

Figure 4 presents the size distribution of the exposed and buried particles after individual events. In all cases the size distribution of the buried particles was finer than that of the exposed ones. Statistical analyses (Kolmogorov-Smirnov test was used; Davis, 1973) indicates that the size distributions of buried and exposed particles are statistically different.

Burial Depth Distribution

The burial depth distribution of tagged particles was examined. Figure 5 presents the burial depth distribution of moved particles only. In addition, an exponential model was applied to the field data (for more details see Hassan and Church, 1994). In most of the cases the exponential model provides a satisfactory description of particle burial depth. The above analyses is limited to the moved particles only. However, stationary particles can change their vertical position as a result of net scour or net fill (Hassan, 1990, 1993a). Figure 6 presents the distribution of burial depth of all particles during individual flow events and the overall distribution after a full season in Carnation Creek. The individual events yielded a pattern similar to that obtained for the moved particles only. However, a skew-peaked with tendency toward uniformity was obtained for the full season data of Carnation Creek. This implies that after a few events the overall seasonal results tends toward a uniform distribution and that the exponential model is no longer applicable. A numerical model has been developed to simulate the burial depth distribution (see Hassan and Church, 1994).

Distance of Movement and Particle Size

The relation between distance of movement and particle size has been examined for many flow events; three typical examples are presented in figure 7. The distance of movement varied significantly between events, without any apparent relation with particle size. These results concur with Einstein's (1937) flume experiments and the field studies of Leopold et al. (1966) and others. However, there is an envelope over the widely graded sediment off Harris Creek, indicating that large particles travel shorter distances (Figure 7). Generally, the figure shows that particles can move any distance beneath the envelope.

Distribution of Distance of Movement

The distribution of particle displacements was examined for flood events for several rivers. Figure 8 shows the observed and fitted distributions for moved particles and all particles (including those which did not move). The Enistein-Hubbell-Sayre (Einstein, 1937; Hubbell and Sayre, 1964; Sayre and Hubbell, 1965) and Gamma models were tested against the field data. Four of the five cases (figure 8) indicate that both models provide a satisfactory description of particle displacement. The successful cases derive from simple rainstorm events of small to moderate magnitude and short distances of movement, whereas the unsuccessful ones are associated with long, complex snowmelt flows and major multi-peak rainstorm events during which particles travel long distances. Carnation Creek exhibits a secondary mode of displacement implying the existence of traps for mobile particles after short to moderate distance of movement. These trap locations are the channel bars, and constitute a major accumulation of mobile channel bed sediment.

Influence of Cannel Morphology on Sediment Transport

Figure 9 in presents an example of the spatial distribution of the tagged particles in Nahal Og. Similar results were obtained from other studies (e.g., Hassan, 1993b).

Following the first event, which was a major one, about 75% of the recovered particles were found deposited in bars, with the remaining 25% in the thalweg. Almost half of the particles were found on one major bar located between stations 50 and 140. A second group (15%) of particles was found in the bar between stations 0 and 40.

The second event was relatively small and only minor changes in the distribution of the tagged particles were detected. The side bar near stations 0-60 was partially destroyed (compare points B; figures 9a and 9b). Part of the eroded material was deposited at station C. During the event, most of the activity was concentrated in the main channel where about 63% of the particles were transported. In comparison, only 20% of the tagged particles were moved from bars.

Summary

The paper examines the dispersion of bedload particles in gravel and sand bed rivers using tagged particles. Field data show that the longitudinal transport of particles is largely independent of their size, and strongly skewed with respect to distance. The distribution of distance of movement follows the Enstein-Hubbell-Sayre compound Poisson model or simple Gamma model for small displacements. The vertical movement is one of bi-directional exchange, in which particles buried during a given event are, in a statistical sense, replaced by other particles exposed from inside the active layer during the same event. A one-dimensional model based on both field and theoretical considerations which predicts variations in the frequency of burial depths was developed. These results can be employed for modeling the dispersion of contaminants in fluvial sediment in both arid and humid environments. The stochastic model of fluvial sediment transport being developed is also of value in estimating reservoir sedimentation rates.

References

Einstein, H.A. (1937) 'Bedload transport as a probability problem', Ph.D. thesis, in Sedimentation, Shen, H.W. (ed.), 1972, Colorado State Univ., App. C.

Davis, J.C. (1973) 'Statistics and Data Analysis in Geology', John Wiley, New York.

Forstner, U. (1989) 'Heavy metals', in Global Water Quality, Meybeck, M. et al. (eds.), Oxford.

Hassan, M.A. (1990) 'Scour, fill, and burial depth of coarse material in gravel bed streams', Earth Surf. Processes and Landforms, 15, 341-356.

Hassan, M.A. (1993a) 'Bed material and bedload movement in two ephemeral streams', in Alluvial Sedimentation, Marzo, M. et al. (eds.), pp. 37-49.

Hassan, M.A. (1993b) 'Structural controls of the mobility of coarse material in gravel channels', Isr. Jour. of Earth Sci., 41, 105-122.

Hassan, M.A. and Church, M. (1992) 'The movement of individual grains on the streambed', in Dynamics of Gravel-bed Rivers, Billi, P. et al. (eds.), pp. 159-175.

Hassan, M.A. and Church, M. (1994) 'Vertical mixing of coarse particles in gravel bed rivers: a kinematic model', Water Resour. Res., 30, 1173-1185.

Hassan, M.A., Church, M. and Schick, A.P. (1991) 'Distance of movement of coarse particles in gravel bed streams', Water Resour. Res., 27, 503-511.

Hassan, M.A., Schick, A.P. and Laronne, J.B. (1991) 'The recovery of flood-dispersed coarse sediment particles, a three-dimensional magnetic tracing method, Catena Suppl., 5, 153-162.

Hubbell, D.W. and Sayre, W.W. (1964) 'Sand transport studies with radioactive tracers', Proc. Am. Soc. Civ. Engrs., J. Hydraulics. Div., 90, 39-68.

Karbe, L. (1988) 'Interactions with biota', in Metals and Metalloids in the Hydrosphere: Impact Through Mining and Industry, and Prevention Technology, Strigel, S. (ed.), pp. 165-186.

Leopold, L.B., Emmett, W.W. and Myrick, R.M. (1966) 'Channel and hillslope processes in semi-arid area, New Mexico'. U.S. Geol. Surv. Prof. Paper 352-G, 193-253.

Macklin, M.G. and Klimek, K. (1992) 'Dispersal, storage and transformation of metal-contaminated alluvium in the upper Vistula basin, southwest Poland', Applied Geography, 12, 7-30.

Schick, A.P., Hassan, M.A. and Lekach, J. (1987) 'A vertical exchange model for coarse bedload movement: numerical consideration', Catena Suppl., 10, 73-83.

Sayre, W.W. and Hubbell, D.W. (1965) 'Transport and dispersion of labeled bed material: North Loup River, Nebraska', U.S. Geol. Surv. Prof. Paper 433-C, 48pp.

Figures see following pages

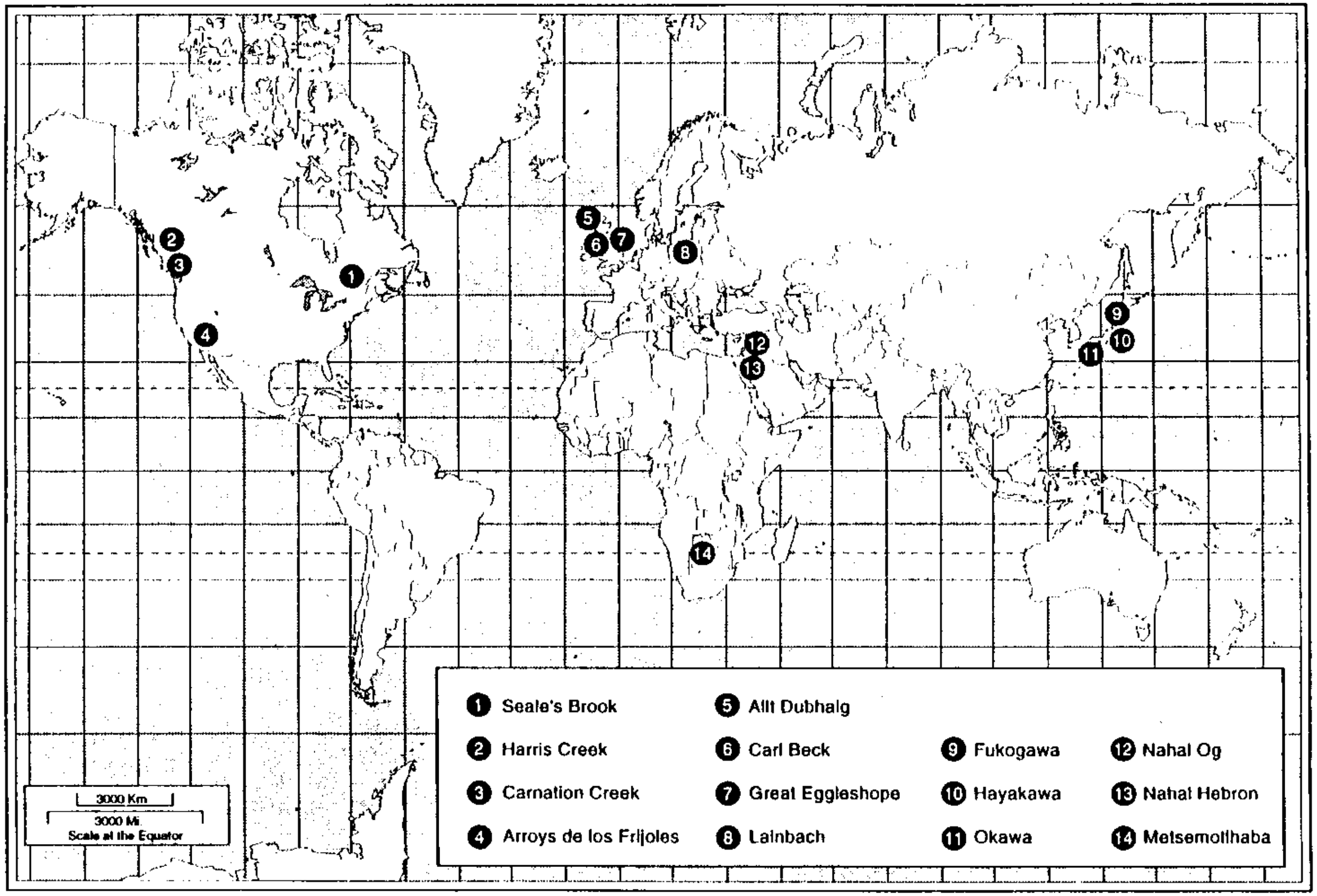


Figure 1: Location map of the study rivers

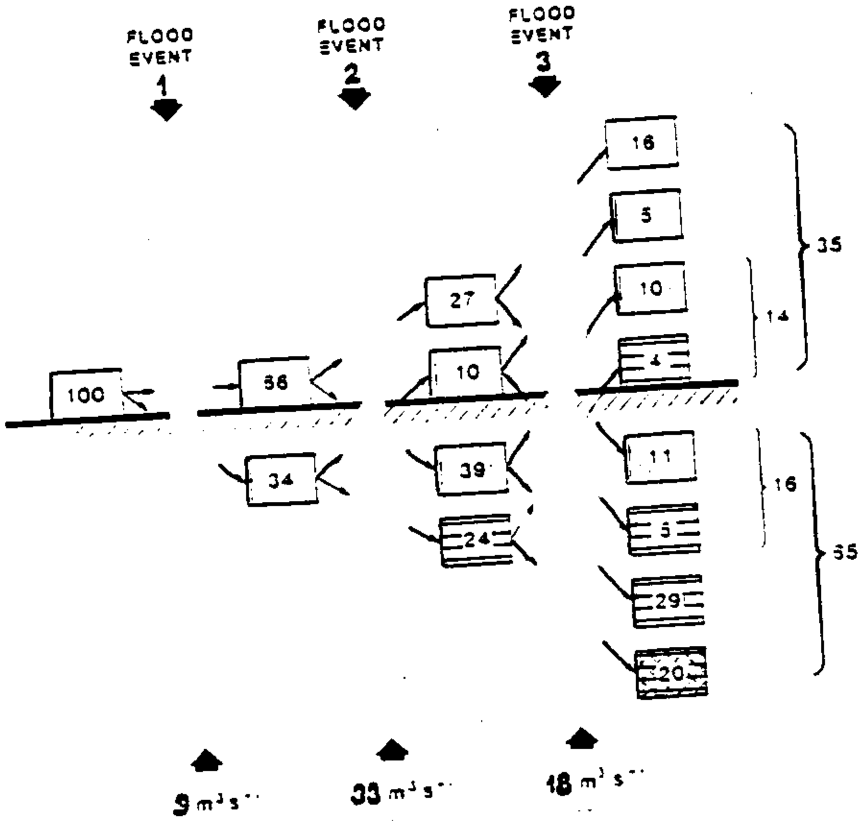


Figure 2: Vertical exchange of tagged particles within the scour layer as a result of flow events in Nahal Hebron (After Schick et al., 1987)

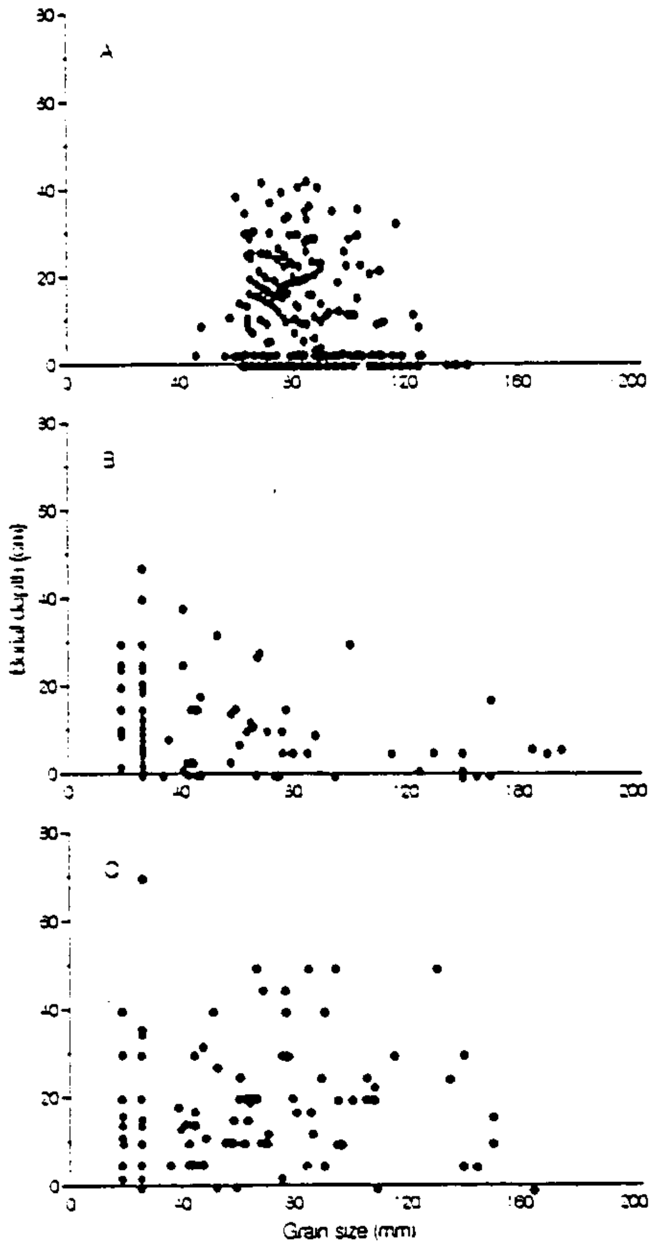


Figure 3: Burial depth versus particle size in (A) Nahal Hebron (B) Carnation Creek -- first event (C) Carnation Creek--second event (After Hassan and Church, 1994).

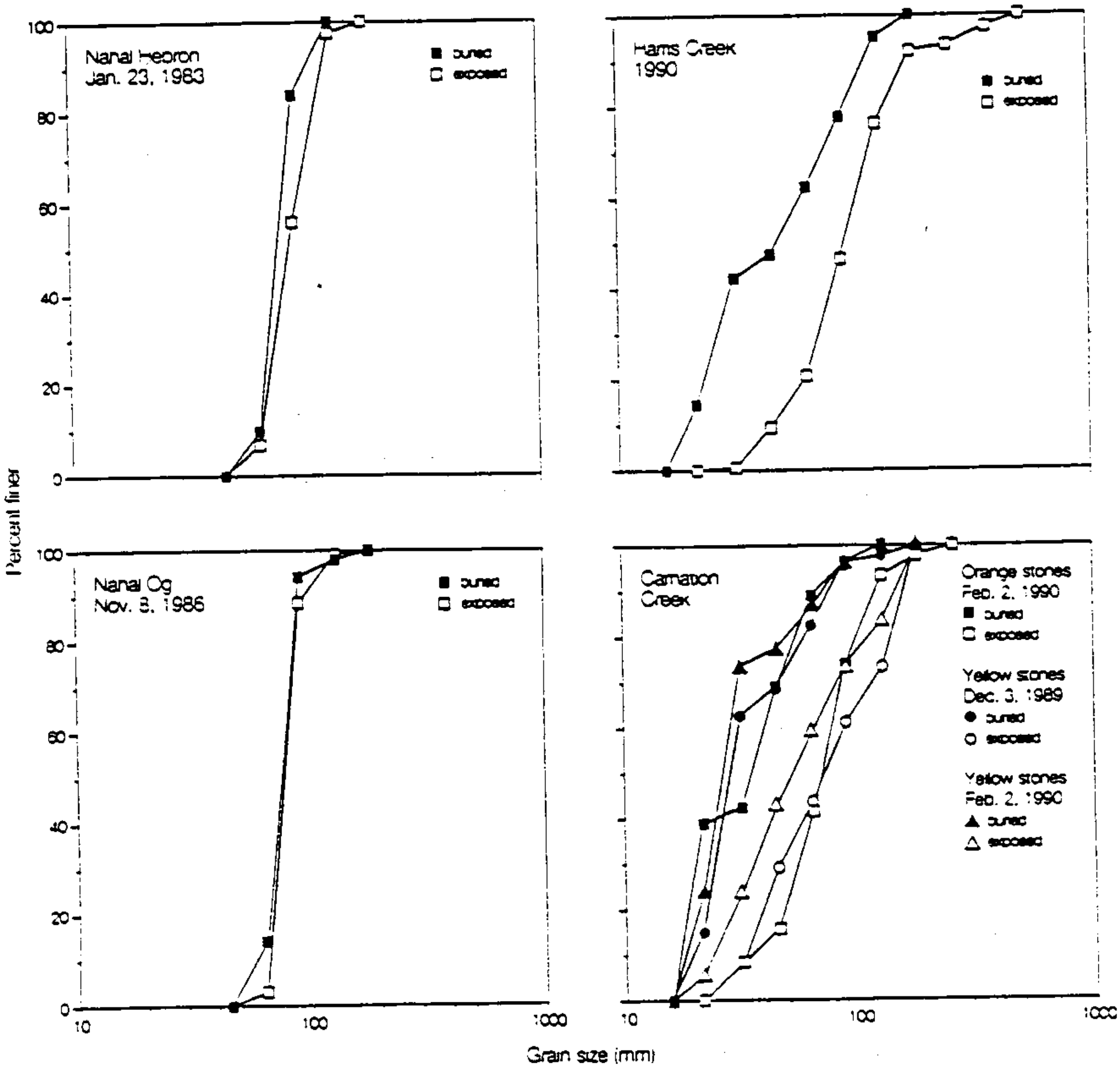


Figure 4: Particle size distribution of tagged particles (After Hassan and Church, 1994).

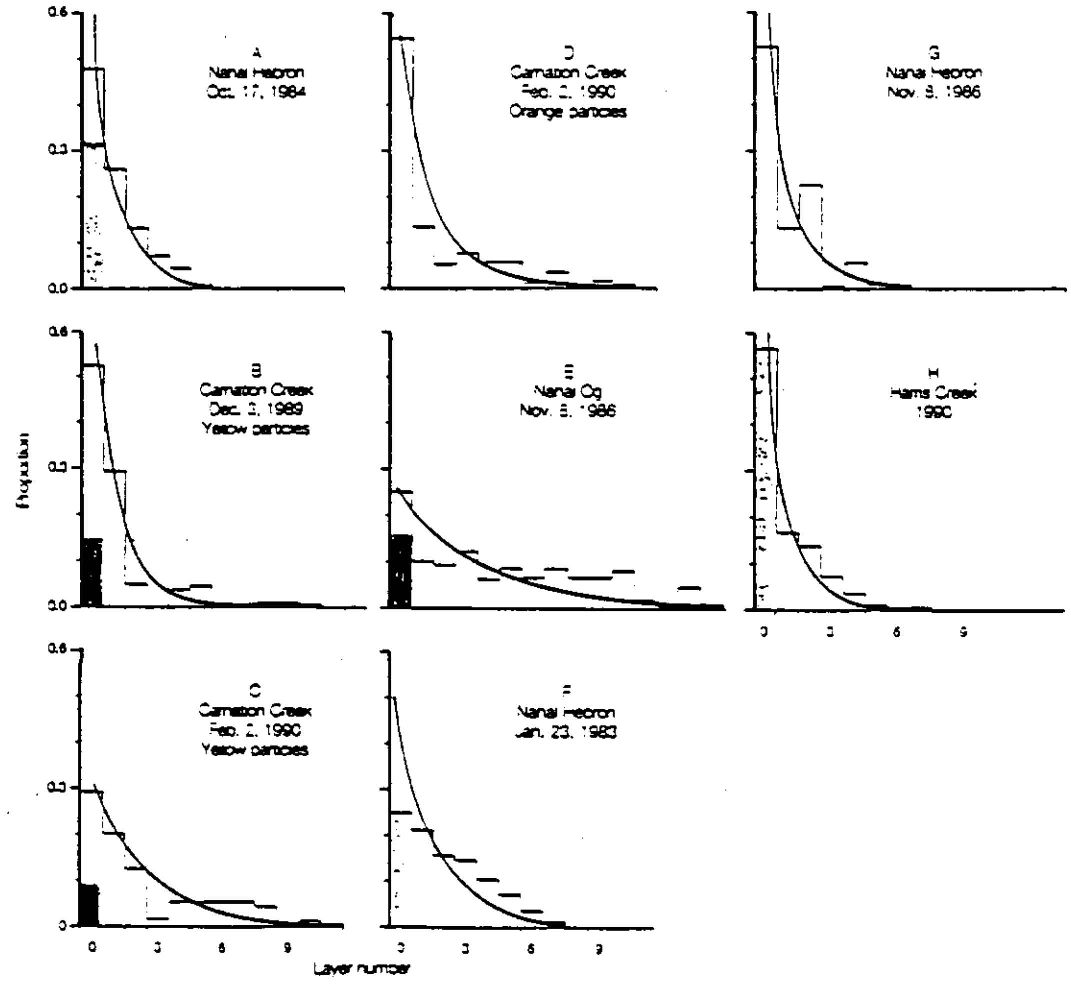


Figure 5: Burial depth distribution of moved particles (After Hassan and Church, 1994).

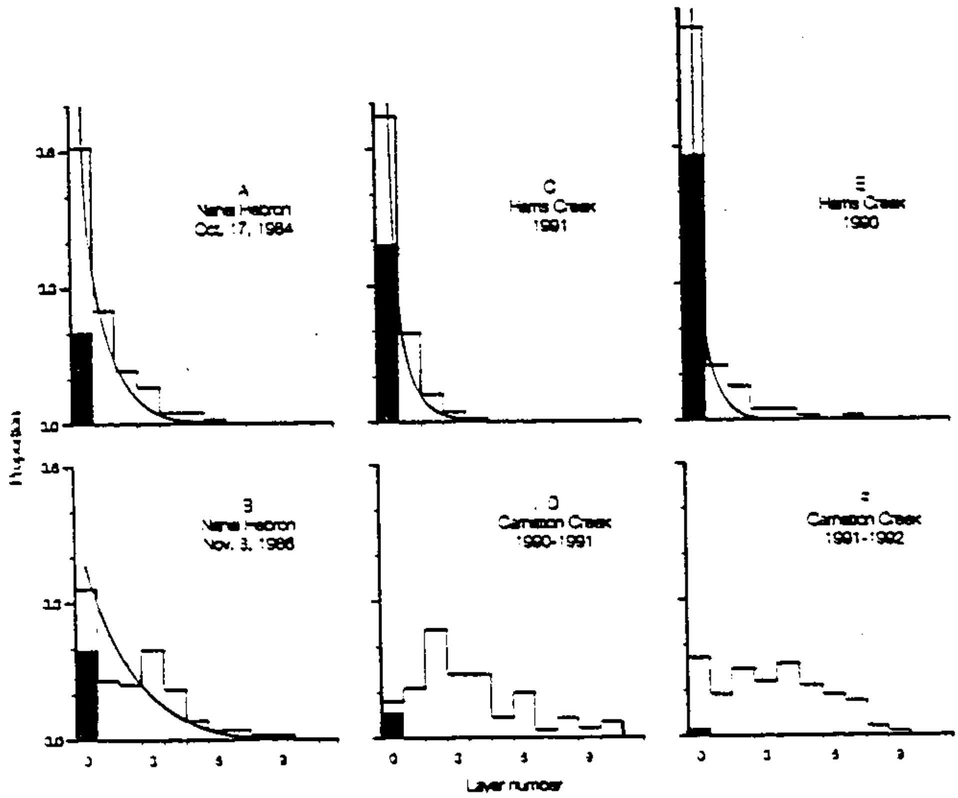


Figure 6: Burial depth distribution of all particles(After Hassan and Church, 1994).

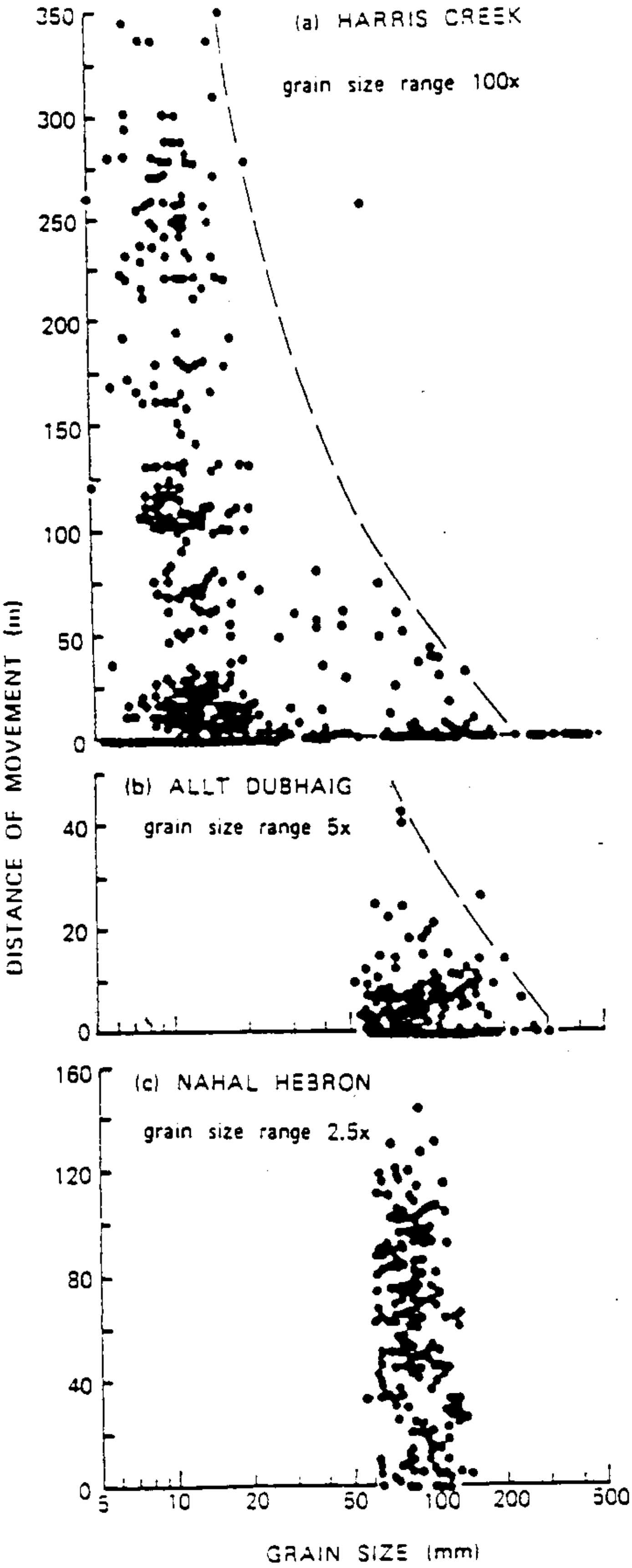


Figure 7: Distance of movement versus particle size in (a) Harris Creek (b) Allt Dubhaig (c) Nahal Hebron (After Hassan and Church. 1992).

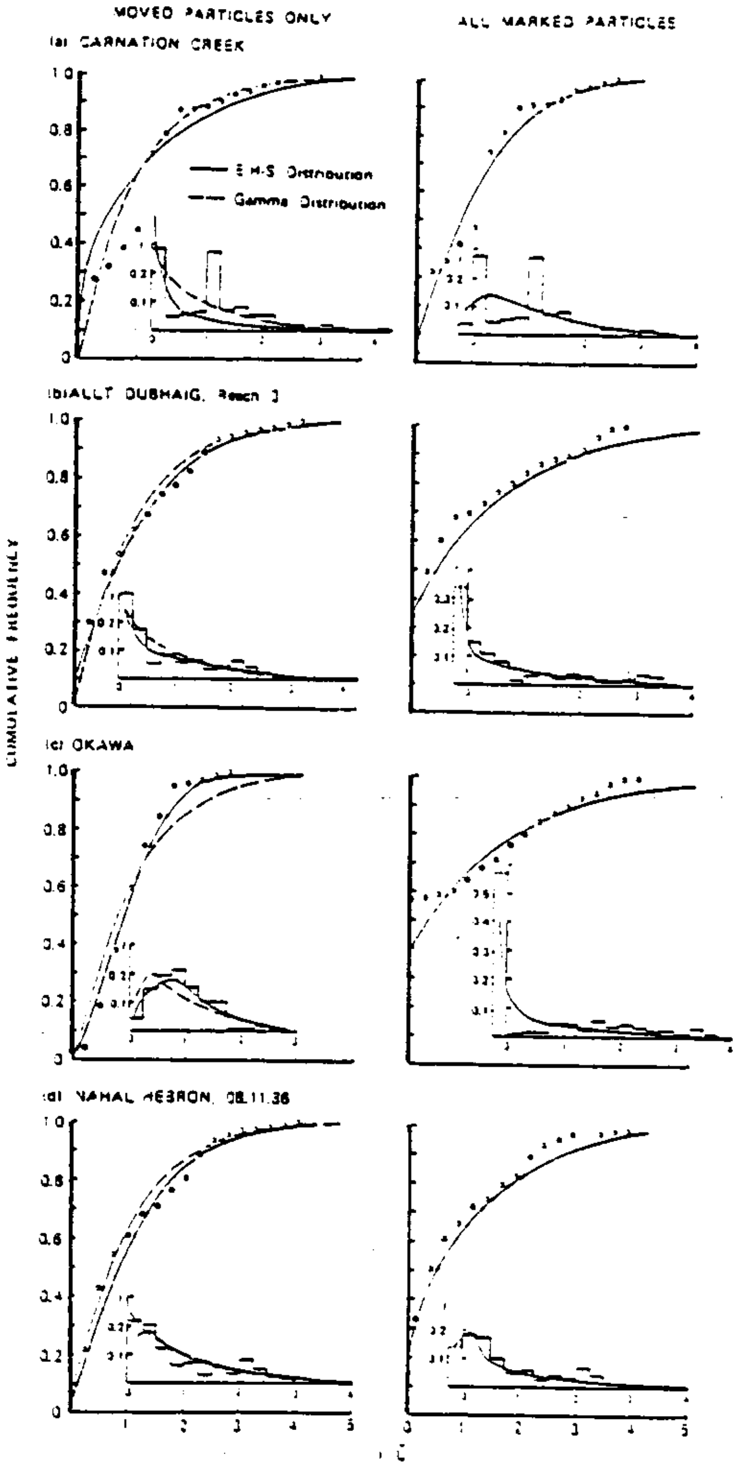


Figure 8: Particle displacement of moved and all particles (After Hassan and Church, 1992).

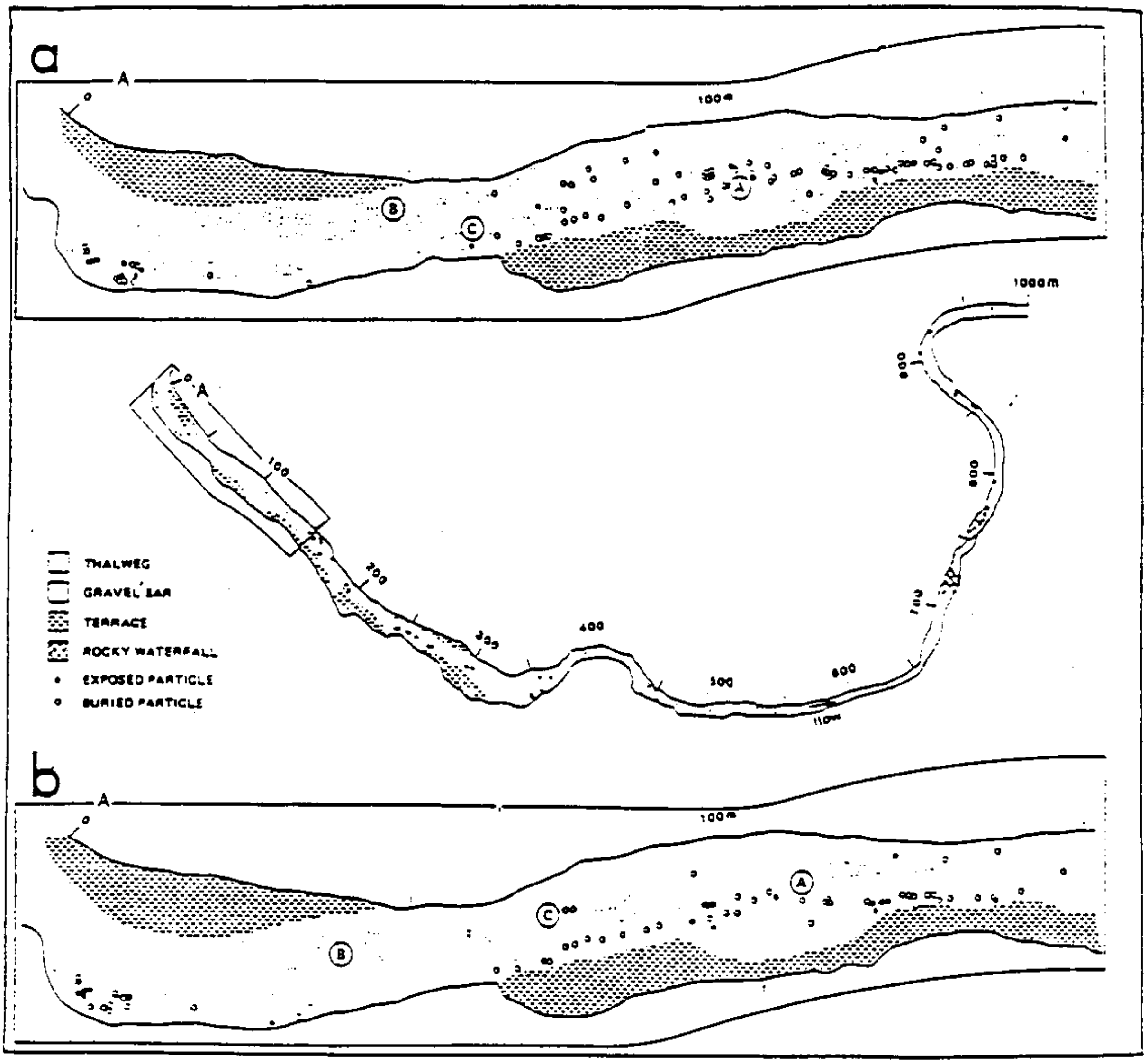


Figure 9: Nahal Og -- Distribution of tagged particles recovered (a) after the first event, and (b) after the second event (After Hassan, 1993b).

Bielefelder Ökol. Beitr. 9 (1995) p. 51-62

Joint Scientific Multidisciplinary Research Program in Upper Egypt, Aswan High Dam Lake Area.

Irina Springuel and Ahmed Belal

Unit of Environmental Studies and Development
Aswan Branch of Assiut University, Egypt

Introduction

The total land area of Egypt is 99,545,000 hectares, of which 96,943,000 hectares are desert land. Only 3.15% of the land surface of Egypt is cultivated, mostly in the Nile valley and Delta, and much of this is already cultivated at near maximum levels of intensity. The Lake Nasser shorelands offer an addition to the current Nile delta land reclamation program. This lake is about 500 km long of which 200 km are in Sudan, with a maximum storage capacity of 168 billion cubic meters and a maximum surface area of 6000 sq. km. The water of the Lake has covered the whole Nubian Nile valley and deeply penetrated into the desert through the tributary wadis. Depending on the quantity of water stored in the reservoir, its shoreline bounds 5 300 to 7 800 km of desert land.

There is, however, a location difficulty, in that areas are at considerable distances from the main population centers in the north of Egypt. The absence of good transportation inhibits exploration of the area; only recently was the road on the western side of the Lake completed and the road on the eastern side is still under construction. A further difficulty lies in employing appropriate agricultural technologies particularly in establishing a suitable irrigation system. But the key problem is that the location of the Lake shore is constantly changing in response to the balance between Lake inflows and outflows. There is always the danger that the land in which capital investment was made on any major scale would be either flooded, or left at a considerable distance from sources of usable water.

At present, there appear to be four main interest groups involved:

The State, represented by Aswan High Dam Lake Development Authority (AHDLDA) and, to some extent the Ministry of Agriculture and Governorate of Aswan, have clear interests.

Private capital , is a second interest group. However, there is the problem that private capital sees the Lake Nasser shorelands as representing a high degree of investment risk.

Third is the Bedouin group already living close to the shores of the Lake. The social barrier between Bedouins and water was removed when Nubians were resettled in New Nubia in the Kom Ombo plain north of Aswan. In response, many nomadic groups began to alter their patterns of seasonal movement in order to take advantage of improved grazing opportunities and year-round access to water (Fahim 1979, Briggs et al. 1993), as well as to grow crops on a limited scale

(Pulford et al. 1992). Their former migration patterns were disrupted, and they began to congregate in more permanent settlements near the Lake shore (White 1988 , Briggs 1991, Belal 1993), threatening to disturb the human/resource equilibrium. This is specially serious where the population lives in a marginal environment.

Fourth, the Nubians who were living in this area before inundation by the Lake have a great interest in being resettled in their mother land. As a matter of fact their actual mother land is several meters below the water surface and the new shores serve only as a nostalgic reminiscence of what their former lands looked like.

There is little doubt that the economic opportunities produced by inundation around the Lake Nasser shorelands have increased considerably over the last 15 years. However, several factors have combined to limit the success of reclamation efforts. These include:

1) lack of knowledge of the environmental factors affecting the marginal zone, particularly the duration and extension of the flood, soil types, and ecological conditions including plant and animal population dynamics;

2) lack of a sustainable and manageable production technology adapted to the peculiarities of the desert environment;

3) weak post-implementation assistance including extension, training and input supplies.

Thus, lands which were not fully reclaimed/developed were cultivated, and an inappropriate deltaic land technology was applied to the desert soil.

Although several studies have been carried out in the Aswan region as a result of the building of the High Dam, there are still wide gaps in our knowledge about how harsh desert conditions affect life and economic activity in this hyper-arid environment. The creation of the High Dam (Nasser) Lake has brought about unusual conditions of permanent water availability at its shores, yet this favorable situation remains relatively underexploited (Supreme Council Report, 1989), wasting a great potential resource.

Several integrated development schemes can be envisaged for these shores, In addition to the Lake shores are the mouths of wadis into which the Lake waters penetrate and recede according to the rise and fall of water level in the Lake. This is controlled by incoming flood water on the one hand, and by the draw-down for the needs of the rest of Egypt, on the other.

The Allaqi Project

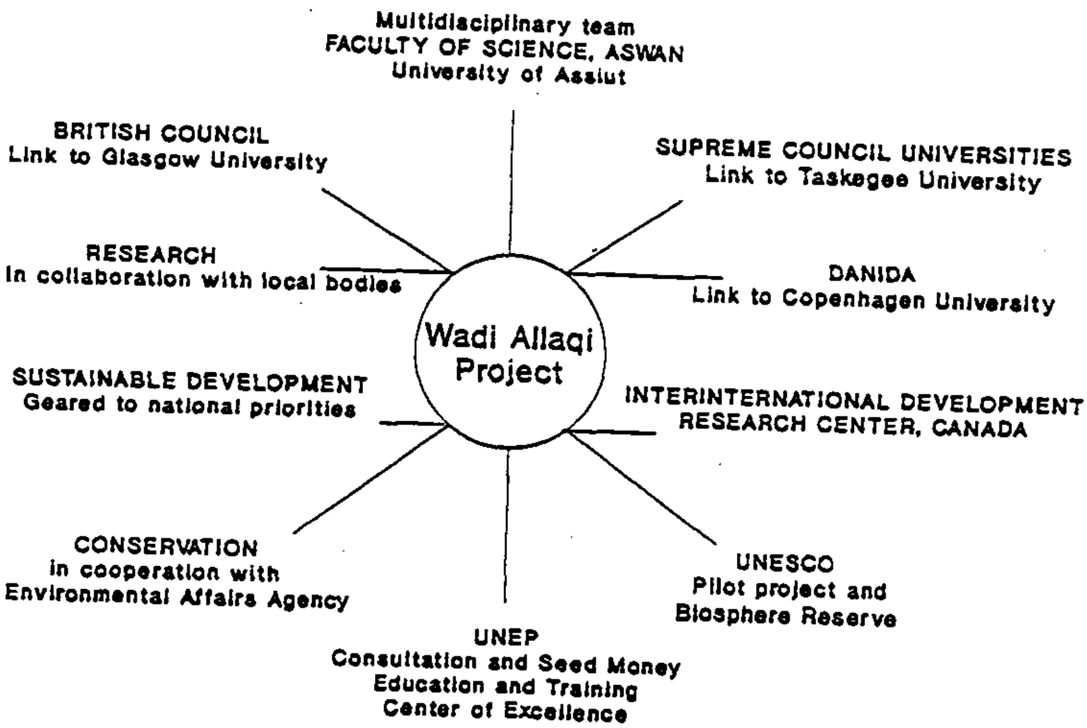
Sustainable development of the area around the Lake is a long- term continuous process which needs specialists of different skills in the natural and social sciences to assess the nature and suitability of the natural resource base for sustainable economic development. The Universities in Egypt, as well as in other developing countries, are involved in some way or another in the development of new appropriate techniques (Kishk, 1994).

The Faculty of Science in Aswan, a branch of Assiut University, has demonstrated its commitment to sustainable development. The downstream part of Wadi Allaqi was selected for implementation of a pilot project (Wadi Allaqi Project).

The Allaqi Project began in 1988 as a multi-disciplinary project involving different Departments of the Faculty of Science, in collaboration with the University of Glasgow in the United Kingdom and the Tuskegee University in USA.

Research was funded since 1988 by the United Nations Environmental Program (UNEP), and this substantial support included resources for seminars, workshops and training. Researchers from the University of Glasgow provided valuable scientific input, and the British Council provided considerable assistance for research visits and training activities both in Glasgow and Aswan. The Faculty of Science in Aswan is recognized by UNEP as one of six Centers of Excellence in Africa for Environmental Education and Training. Tuskegee University, Alabama, USA, participates in the Allaqi Project through the Supreme Council of Universities.

Other important connections are shown in the following scheme:



Aims of the project include:

The first phase is to assess the present and potential natural resource base as basis for future development planning in the area. Specifically the objectives are:

1) to contribute to scientific knowledge and understanding of the environment around Lake Nasser,
2) to determine the suitability of Wadi Allaqi for sustainable agricultural and other economic development and for human settlement by:
   - assessing the flora, fauna, soil, water ,mineral and energy resources
   - establishing an experimental farm and pilot demonstration area
   - making a cost-benefit analysis of the development of the area, and preparing preliminary models for the development of both Wadi Allaqi and Aswan Dam Lake region as a whole .

The second phase is to propose ways in which these resources can be managed to allow the careful development of the region, sympathetic to the needs of the inhabitants, without the over-use of these resources.

In short the project's main achievements till present could be summarized as follows:

1) the creation of a multi-disciplinary international team interested and competent in research related to the severe dry conditions of remote desert areas and in applying their expertise to broader environmental issues;

2) provision of research facilities and infrastructure for local students abroad and for overseas students in Wadi Allaqi;

3) training at advanced research levels of post-graduate students;

4) Research studies:
   - study of factors affecting soil fertility, soil chemistry in general, and nitrogen fixation under specific desert conditions;

   -study of plant ecology, including plant population dynamics, ecology of economically important plants, soil seed banks, etc.;

   - study of hydrogeology and soil water;

   - study of fauna of Wadi Allaqi (soil vertebrates, insects, birds);

   - study of human-resource inter-relationships, and how Bedouin people perceive, use and manage resources;

5) Establish guidelines and principles for conservation and management of resources, flora and fauna, and inventory of possibilities for new and renewable energy.

8) Creating specialized laboratory on the Faculty campus and a field station in Wadi Allaqi.

9) The Special Unit of Environmental Studies and Development within Aswan Branch of Assiut University was designated in 1994 on the basis of Allaqi Project.

The research program in the Wadi Allaqi and Lake Nasser area has considerable implications for similar areas in arid and semi-arid regions where large scale reservoir impoundment schemes have created a new resource base for shore-line development.

Management of natural resources in Wadi Allaqi

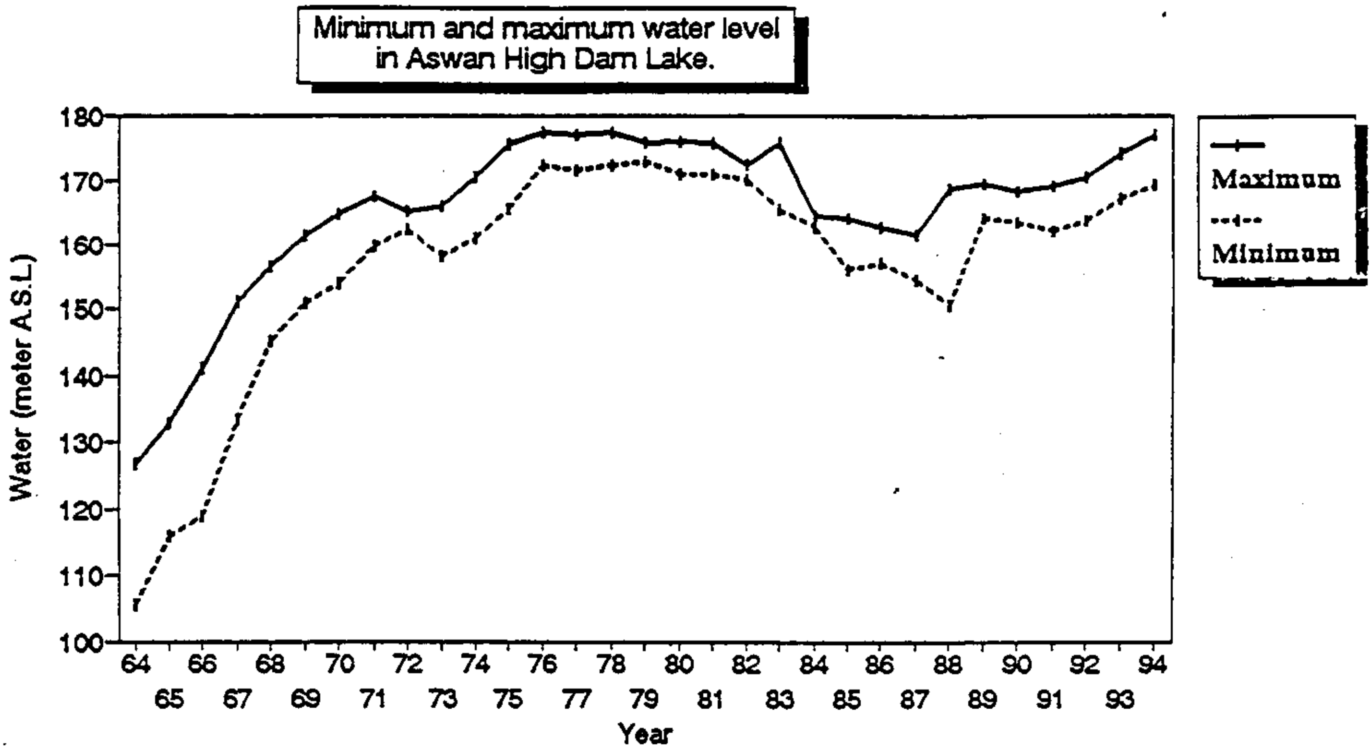
The ecology of the downstream part of Wadi Allaqi has clearly been affected by the creation of Lake Nasser and the consequent inundation of an area which had previously been arid desert.
Monitoring the natural resources and socio-economic system of this area indicates its considerable economic potential, i.e.:

- *The availability of good quality Lake water in this extremely arid environment;*
- *Occurrence of groundwater: Groundwater is found in the basement complex and the wadi deposits. The Nubia Sandstone in the study area is dry or filled with a limited amount of groundwater where it is in contact with the Lake. The potential aquifer in the area is the wadi sediments. Groundwater in the wadi sediments comes from two sources: infiltration of rain and surface runoff originating from the upstream areas, and infiltration following periods by the inundation of Lake in the downstream areas.*
- *Enrichment of the soil fertility: data on the soil study, and the success of small scale cropping have shown the fertility of the soil and its ability to support crop growth in the short term.*
- *Rich vegetation producing a large biomass within the ecotone sites between lake and desert.*
- *Rich fauna diversity, particularly numerous resident and migratory birds*
- *The human population, attracted by available resources, comprising at present, four main groups:*
  1) nomadic tribes people from the surrounding desert settled close to the Lake,
  2) fishermen on the Lake and
  3) farmers cultivating the marginal zone.
  4) miners of mining for granite and marble.

The use of these resources is, however, a complicated process due to the high instability and vulnerability of the ecosystem.

- The large and unpredictable fluctuation of the water level in the Lake has discouraged any substantial agricultural development. The annual variations cause the shoreline to move by a few kilometers, while the long-term fluctuations have resulted in changes of the order of tens of kilometers. These alternating periods of flooding and exposure prevent permanent cultivation of the marginal zone.

Fig 1. Minimum and maximum water levels of Aswan High Dam Lake during the 20 years, since formation of the Lake.



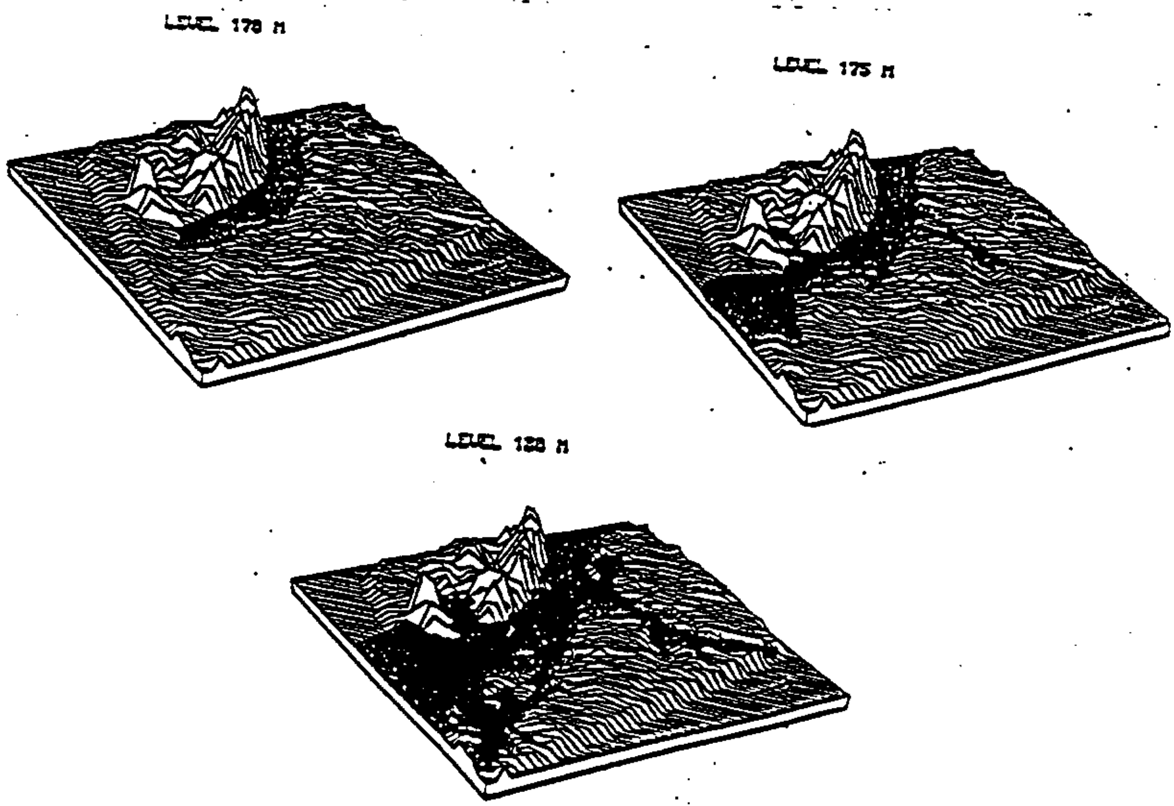
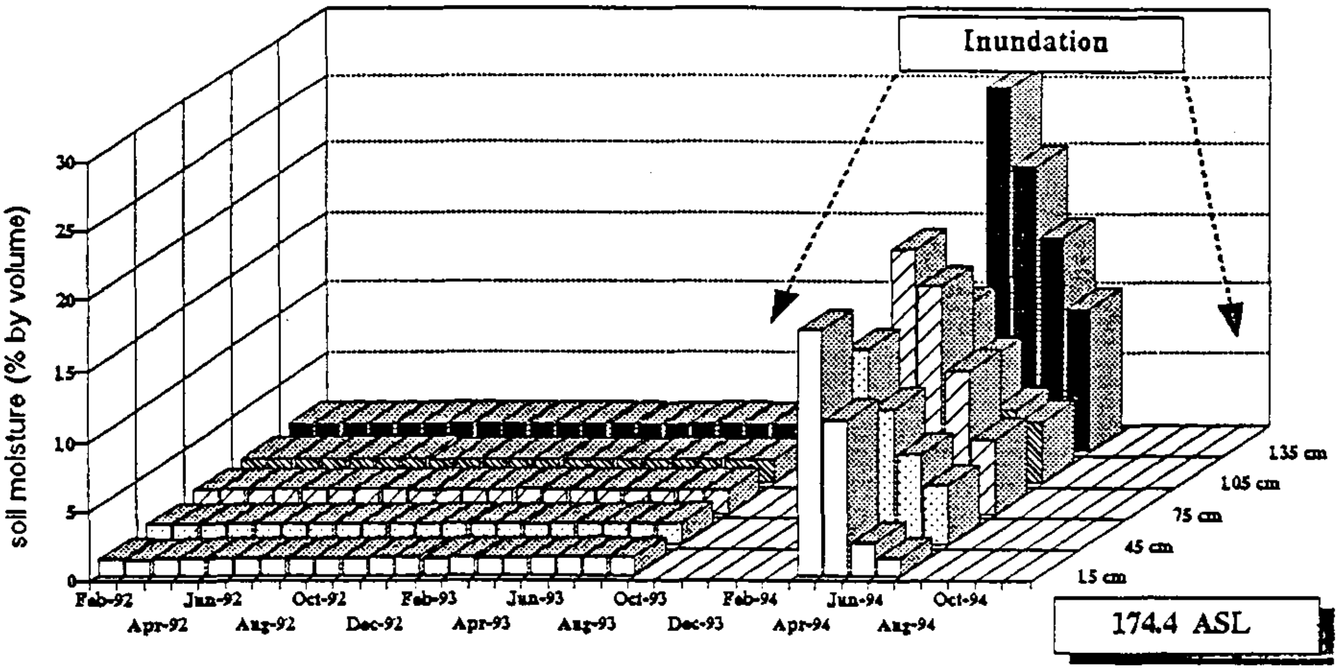


Fig. 2 . Shoreline of the Lake at different water levels of 170 m, 175, and 180 m ASL. (location: join point of

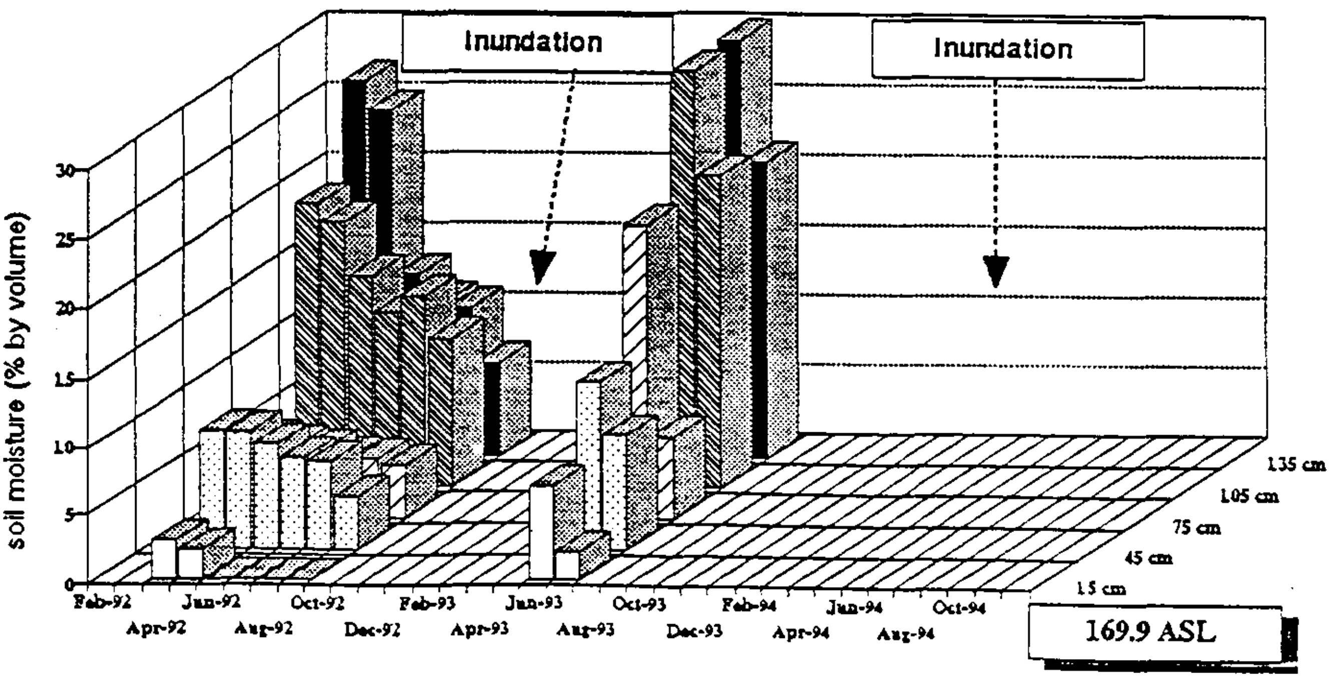
- Studies on the soil moisture provide evidence that close to the Lake the soil moisture content is high but periods of land exposure in different years could be insufficient for crops to mature for harvesting. In addition the long exposure periods lead to quick decline of the soil moisture and hence to crop failure. It means that innovative irrigation systems should be established for farming.

Fig. 3, Water stored in Wadi Allaqi soils at different elevations of the Wadi bed.

Site (1)



Site (7)



- Concerning the soil there is no evidence yet available to confirm long term sustainability of the soils for crop production, and in particular the supply of nitrogen and phosphorus. If these two macro-nutrients have to be supplied in large amounts, in order to sustain agricultural production, there would be considerable risk to the ecosystem, especially the Lake. Thus there is a serious danger of nitrate concentration in Lake water rising to a level where eutrophication would be possible, at least in the wadi estuaries.

- Vegetation is rich, however comprising a diversity of species, but of low palatability for grazing and abundant but poor quality fuel wood (Tamarix nilotica).

- The high concentration of birds, especially herbivorous such as the Egyptian goose, causes great damage to the crops in the fields. Presence of poisonous animals, including scorpions and vipers, constitutes a serious threat to human settlements.

Taking into consideration the above mentioned conditions it is clear that management of natural resources of this marginal zone to meet the criteria for sustainable development is a very complicated process. yet, the area is highly coveted by both government planners and private investors to solve, at least partially, the economic problems and to provide work for young people.

This new ecosystem is extremely fragile, and any development will have to be carefully planned to avoid deleterious processes.

Recommendations for sustainable development of area around Lake Nasser:

Before giving the proposals and recommendations for development of the Lake and its surroundings we should always take into consideration that:
" The purpose of building the Aswan High Dam was to form a reservoir so large that excess water from the Nile's greater flood years could be held in storage for several years in the future and released under control when required" (Fahim 1981). Thus the Dam was primarily built for water conservation, all other uses including power generation being of secondary importance.

In this respect the ecotone with its natural life protects the shoreline of the Lake forming a buffer zone between desert and Lake. For example the dense Tamarix growth prevents the invasions of reeds on the lake shores, that could considerably increase the evotranspiration rate. In addition Tamarix bushes protect the Lake from moving sand dunes, especially on its western side. However, this zone could become a main source of water pollution through mismanagement as large-scale agriculture and industry and tourism develop on the marginal zone.

Because of the scarce population and harsh climatic conditions there is no danger of large scale industry developing on the Lake in the near future.
The unpredictable large fluctuations of the water level in the Lake prevent the large-scale agriculture in the marginal zone. However, there is still a danger in the number of large scale agricultural experiments in the marginal zone which have led

to destruction of the protection zone of natural vegetation followed by land degradation and pollution of the Lake water.

An alternative to the above mentioned uses of the area is the conservation of the marginal zone and Lake itself which will fulfill the main purpose of construction of the Lake. Conservation here is not in conflict with development, but is a precondition for sustainable development, which unites the ecological concept of carrying capacity with the socio/economic concepts of growth and development. Following recommendations given by the Allaqi research group Wadi Allaqi was declared a conservation area by Prime Minister's Decree in 1989 and a Biosphere Reserve within UNESCO Man and Biosphere Program in October 1993.

The creation of the conservation area in Wadi Allaqi which is also part of Lake, makes it possible to emphasize sustainable resource use, maintenance of ecological processes and conservation of biotic diversity, particularly the indigenous plants which are of potential economic value (Springuel and Mekki 1994).

Recommendations for uses of natural resources and sustainable development of the marginal zone have been given in a number of publications (Briggs 1991, Belal 1993, Pulford at al 1992, Briggs at al 1993, Springuel 1994). All authors agree that integrated development schemes should not comprise large-scale agriculture or industry. **Better practice would be agroforestry, animal husbandry, tourism, etc., but in a harmonious, environmentally sound and socially acceptable manner, which would benefit the local population.**

It is important to point out that a new ecotone has been formed in an area where traditional pastoral livelihood systems have been conducted since remote history. The local populations are nomads who have sensible ideas about environmental management They understand the need to balance stock numbers with the conditions of the range resource. There is no need to introduce modern concepts when local effective equivalents already exist. Rather, non-local elements, both technological and managerial, might at best be used as supplements to, instead of replacements for, indigenous practices.

The traditional pastoral nomadic structure works successfully in drylands without significant environmental disruption. It is able to do so because pastoral nomadism is roughly in balance with the ecological rhythm of its environment.
(a) The traditional pastoral livelihood system, which is well adapted to pulsating and variable conditions of the marginal zone and surrounding drylands, should be promoted.
(b) Nomads should be informed on incidents of rainfall and hence grazing potentialities as well as to provide information on location of grazing for camel.
(c) Rangeland management should include seeding in places where soil moisture is sufficient for plant growth, cultivating deeply rooted highly palatable indigenous trees and shrubs which could be self-sustaining and constructing fences to prevent overgrazing and develop wildlife habitats.

The development of plantations as an alternative to the exploitation of wild stocks has been proposed for fuel wood, building material and medicinal plants. Measures must be taken for the cultivation of economically important plants in ecologically suitable habitats in order to increase the productivity of the natural vegetation so as to meet human needs.

As an alternative to large-scale cultivation, small scale cultivation can be recommended in the marginal zone by the local nomads who have semi-settled in Wadi Allaqi and on the shores of the Lake. Since the sowing-to-harvest period is rapid, given the prevailing climate, crops can be successfully produced in the short period of time, that is provided by the annual Lake level movements, thereby minimizing the risk of losing the crop either by inundation or by drought. Plots, being relatively small, are easily prepared and their location can be changed on year-to-year basis, relative to Lake water movements. Irrigation water can be provided from wells. The production of water from wells is possible but the yield depends on the relative situations of the well location, i.e., recently inundated by the Lake, inundated some time ago, inundated long ago or never inundated. Even at the most favourable situation, that is a recently inundated location, well output is relatively low and the areas that can be irrigated are small. Future wells should therefore be for domestic use only.

Groundwater exploration and hence the agriculture outside the influence of the Lake is not recommended, since well output will be low, and the high sulphate concentrations could be a threat for consumption.

Proposed collaboration for future interdisciplinary studies projects

Proposed collaboration for sustainable development, land use and conservation of natural resources could fulfilled in the following subjects:

- Rangeland and livestock management

Expected benefits would be: 1. recovery of vegetation cover over a vast region, thus reducing erosion, air and water pollution, 2.- more balanced and sustainable livestock industry, 3 - better social and economic equity for those using these vast area.

- Economic forestry (cultivation of economically important indigenous desert plants as <u>Acacia</u> and <u>Balanites</u>) which would complement the pastoral system. This would consider environmental degradation problems that could be ameliorated by afforestation in arid lands.

For the cultivation of the indigenous trees in the downstream part of the Wadi the study of soil/plant water relationships is required in order to establish appropriate irrigation methodology. Research to adapt new technologies to the local environment is necessary to fully exploit productivity potentials. Work has already begun in Wadi Allaqi where the indigenous trees <u>Balanites aegyptiaca</u> and <u>Acacia</u> trees are cultivated in the experimental plot and water requirements are regularly monitored.

- Cultivation of medicinal plants and novel uses of plants as alternatives to crop production.

- Germplasm for Arid Lands , establish and manage *in-situ* and *ex-situ* conservation of genetic diversity of economically important plants for arid lands. Study of the economic value of indigenous plants in Wadi Allaqi basin reveals that more than 80 percent are used by the nomads in Wadi Allaqi or are of potential use and around 40 percent are plants with multi-purpose uses (Springuel 1994).

Attention should be given to the use of nitrogen fixing plants, and potential of nitrogen micro-fixing organisms (ex. treatment of seeds with the proper bacterium) , as a way of improving soil fertility. An experiment on one nitrogen fixing plant (Lablab purpurens) has already been conducted in Allaqi Project and this plant has been recommended for cultivation in the downstream part of the Wadi.

References:

Belal, A.E., (1993). Sustainable Development in Wadi Allaqi, *Desertification Control Bulletin*; 23: 39-43

Briggs, J.A.(1991). Pastoralism in Wadi Allaqi Region, Egypt: An economy under pressure. In Stone (ed). *Pastoral economics in Africa and long-term responses to drought* : pp 197-205

Briggs, J. A., Dickinson, G., Murphy, K. J., Pulford,I.D, Belal, A.E., Moalla, S., Springuel, I., Ghabbour, S.I. and Mekki,A. (1993). Sustainable development and resource management in marginal environments: natural resources and their use in the Wadi Allaqi region of Egypt. *Applied Geography*, 13: 259-284.

Fahim, H. M. (1979). Regional Sociological Impacts of the Aswan High Dam in R.E. Driver and W.O. Wunderlich (eds), *Environmental Effects of Hydraulic Engineering Works*, Knoxville, Tennesse Valley Authority, pp 479-87.

Fahim, H.M. (1981). *Dams, People and Development. The Aswan High Dam Case.* Pergamon Press.

Kishk, M.A. (1994). Appropriate technologies for sustainable desert development in Egypt. (M.A. Kishk ed .) *Proceeding of the First National Conference on Land Reclamation and Development in Egypt*. November 1992, Minia, Egypt, 443 pp.

Pulford, I.D., Murphy K.J., Dickinson, G., Briggs J.A. and Springuel, I. (1992). Ecological resources for conservation and development in Wadi Allaqi, Egypt, *Botanical Journal of the Linnaean Society*, 108: 131-141.

Springuel, I. (1994). Plant Ecology of Wadi Allaqi and Lake Nasser. 4. Bases for economic utilization and conservation of vegetation in Wadi Allaqi Conservation Area, Egypt. No. 13 (2nd Edition), *Allaqi Project working papers*. Published by Assiut and Glasgow Universities.

Springuel, I. and Mekki, A.M. (1994). Economic Value of Desert Plants: Acacia Trees in the Wadi Allaqi Biosphere Reserve. *Environmental Conservation* Vol.21 No1:41-48.

Supreme Council Report (1989). Ecological studies in Aswan Region, *First Quarterly Report*, Supreme Council of University and Faculty of Science at Aswan, Assiut University.

White, G.F. (1988). The Environmental Effects of the High Dam at Aswan, *Environment*, 30- 7: 5-40.

Bielefelder Ökol. Beitr. 9 (1995) p. 63-66

INTERNATIONAL WORKSHOP ON

"SUSTAINABLE LAND-USE IN THE ARID NEAR-EAST"

THE PALESTINIAN INTEREST IN JOINT SCIENTIFIC PROJECTS

COMBATING LAND DEGRADATION* IN WEST BANK

Dr. Othman Sharkas
Birzeit University
Department of Geography

The main problems due to the difficulty in obtaining funds and there are no basic information and data on Soils, vegetation and human activities in West Bank. Unfortunately no concrete Projects and sub-projects were proposed by different and various disciplines in West Bank.

I would like to suggest the most important projects in West Bank. There are :

1) Combating land degradation in West Bank.

2) Public Education Campaign for land degradation Control in West Bank.

3) Management of Grazing Resources in West Bank or Rehabilitation of severally degraded range lands and forest lands in West Bank.

4) Management of Water Resources in West Bank or Application of water Harvesting in West Bank.

It seems to be these Projects are very important and urgently needed in West Bank, because we are facing increasing pressures on our environment. Soil erosion, loss of Productive top soil and consequent land degradation, as well as availability and quality of fresh water resources threaten food production in many areas in West Bank, while the fluctuation of precipitation and other physical reason may play a role, the Present environment is largely a result of the interactions between man, natural resources and technology in the Socio-economic and cultural development process.

*** In 1992 the United Nations Conference on Environment and development (UNCED) in Rio de Janeiro modified the definition as follows: "Desertification is land degradation in arid, Semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities" (UNEP, 1992)**

The author believe that the land degradation is a human problem and should, therefore, be a focal point for social science, it has, so far, been defined and examined mainly by natural scientists.

Technical Guidelines for monitoring land degradation in West Bank

It is of great importance that Combating land degradation Project should adopt a comprehensive approach to land use. The work Strategy for the management of such a small area (5500km2) of semi avrd and sub-humid land should take the following basic from:

a) Defining Problems and objectives and work procedure.
b) Making an inventory of Physical and human resources.
c) Devising and applying a flexible system for monitoring environmental change.
d) Planning and implementing measures of land-use control and ecological rehabilitation.

DEFINING PROBLEMS AND OBJECTIVES:

The success or failure of combating land degradation measures depends on a proper understanding of the Problem and the clear formulation of appropriate objectives. The urgency of the problem of ecological deterioration is amply by deferent disciplines e.g. : Land degradation includes Soil deterioration & erosion, vegetation degradation, degrees the potential land use etc. and we must new the process of land degradation.

The main objectives are:
To protect the soil against erosion in mountainous areas
To improve the soil by conservation and afforestation
Rehabilitate saline soils in the irrigation lands in Jericho
Rehabilitate the Terraces and to buildup a new terraces in mountainous areas in order to help the farmers in West Bank.
This project will be taken five years with practical work-plan chart

It seems to be the process of land degradation quite important in order to monitor land degradation and environmental degradation of semi arid and sub-hùmid regions in general, It is important to make a qualitative and, as far as possible, a quantitative assessment of all the natural and human conditions preceding land degradation, its different phases and the resulting forms of ecological degradation, and the social and economic problems involved.

INVENTORY OF THE NATURAL AND HUMAN RESOURCES:

In order to monitor land degradation successfully and plan regeneration projects which are both effective and appropriate to the environment, it is important to possess reliable data on area concerned. For planning purposes, this inventory should be summarized and shown in various maps giving the relevant natural and human resources. These maps should the following themes:

land classification by ecological units
Present land use
population, settlement and infrastructure

As the available topographic maps at the scale of 1:10000 or 1:25000 are partly incomplete and old assess human resources properly, field work is necessary in West Bank.

MONITORING PHYSICAL INDICATORS OF LAND DEGRADATION

1) Monitoring climatic indicators.
Collecting and interpreting relevant climatic data is one of first steps towards monitoring the climatic changes.
2) Monitoring botanic indicators:
Monitoring the degradation of the vegetation cover by Braun-Blanquet methods in different land use (forest, Grazing lands, cultivation land).
e.g. Plant cover densities, increase or degrease palatable & unpalatable species as well as invader plants and clearing for cultivation.

3) Monitoring indicators of soil degradation:
Salinity, allcalinizatian, degrease of soil moisture, loss of top-soil, degrease organic matter etc.

MONITORING SOCIAL INDICATORS:

Monitoring anthropogenic land degradation indicators is much more difficult than monitoring physical indicators. The reason lies in the fact that the latter have a more direct effect, while the social consequences are indirect.
We can make the basic maps of land use in West Bank in different scales 1:100,000 or 1:50000 depends on the purpose of the project.

The following phenomena are especially suitable for monitoring land degradation
* lack of food and fodder in traditionally selfficient areas
* population degrease in rural areas .
* inflation of towns in west bank ... etc.
* immigration increased from villages to cities and abroad.

COMBATING LAND DEGRADATION BY EDUCATIONAL MEASURES:

In order to combat land degradation effectively, education should be directed to the problem of arid land management and of the deterioration of natural resources as a result of land misuse, such public education should be conducted at all levels from the primary to the adult.
In addition to classroom teaching, the following possibilities of informal education. It is also the communications important such as radios, TV, News papers (press), Mosques, Churches.

Finally devising pedagogic units on arid and semi arid & sub-Humid enviroment for Palestinians teachers at different levels.

LAND DEGRADATION POSTER:

It seems to be the education is the most powerful weapon against land degradation in both West bank, no effort should be spread to develop educational units and audio-visual means of teaching both children and adults the causes and consequences of land degradation with the aim of changing their attitude towards natural resources and convincing them that such resources should be allowed constantly to renew themselves.

Finally, we need various training programs in order to create awareness of the threat of land degradation and to enhance the capabilities of developing areas in West Bank to deal with it in order to ensure sustainable land-use development.

Work-plan Chart

Location: West Bank
Duration: Five years
Executing agency: Birzeit University and other partner in EEC
Specification of the equipment's: Expendable (from West Bank Universities)
Non-expendable (from the donators)
Objectives: Short-term & long-term objectives
Staff: From Birzeit University, An-najah University & Bethlehem University and staff from the donors Universities or Institutions
Funds: From the donors EEC

An outline of proposals for participation of the Arid Ecosystems Research Centre in regional joint ecosystem/environmental research

by

S. M. Berkowicz* & Dan Cohen**

* Administrator, Arid Ecosystem Research Centre, The Hebrew University of Jerusalem, Jerusalem, Israel 91904

**Director, Arid Ecosystem Research Centre, and Dept. of Evolution, Systematics and Ecology, The Hebrew University of Jerusalem, Jerusalem, Israel 91904

1. Introduction

The Arid Ecosystems Research Centre (AERC) was established in 1987 with the joint assistance of the German Minerva Society, Munich, and the Hebrew University of Jerusalem. In order to increase our knowledge of the structure and function of arid areas and in view of the on-going threat of environmental degradation in such regions, both organizations thought it best to combine their expertise and enable Israeli and German scientists to carry out field research in Israel's Negev desert.

Coordinated studies normally provide the best opportunity to understand arid ecosystems. Due to the interaction between climate, soils, plants, animals, and hydrology, there is a need to make long-term observations of these variables in order to detect subtle linkages and relationships. Accordingly, permanent stations are required to serve as focal points for research activities.

The Negev desert of Israel is an ideal region to carry out such work. It contains several different desert ecosystems separated by only a few ten's of km. This heterogeneity is complemented by a sharp north-south annual rainfall gradient (from 300 mm to 25 mm, respectively) as well as sharp differences in elevation (1000 m a.s.l. in the Negev Highlands to -400 m at the Dead Sea).

The Arab nations in the region are also characterized by arid to Mediterranean ecosystems. They are equally prone to land use pressures brought about by both limited rainfall and water sources, agricultural requirements, and by overgrazing. The on-going Middle East peace process has now raised the possibility of joint Israeli/Arab research in the field of arid land ecosystems. Certainly such cooperation is needed if we are to better satisfy the scientific input necessary for sustainable development in the Middle East.

In this paper, we summarize the research activities of the AERC and discuss some possibilities for joint scientific cooperation with Egyptian, Jordanian, and Palestinian research organizations. More information on the AERC can be found in Berkowicz et al. (1995) and references to published works are contained therein. For those interested in an overall background to the Negev desert, the book by Evenari et al. (1982) is recommended.

2. AERC research approach

The AERC has a *multidisciplinary* approach to the study of arid and semi-arid regions. In order to integrate both abiotic (climatology, hydrology, pedology, geomorphology) and biotic aspects (ecology, botany, physiology, zoology, microbiology), as well as feedback mechanisms, several experimental sites were established in the Negev desert to serve as long-term research stations. The stations were established in representative sandy, rocky and loess ecosystems in order to develop our overall understanding of the desert environment.

The variables under study include :

Soils - morphology, genesis, ecology, soil moisture, salinity, permeability, soil erosion and deposition
Climate - temperature, rainfall, effective rainfall, rainfall intensity, wind speeds and wind regime
Hydrology - runoff, rainfall-runoff relationships, spatial variability of runoff along slopes, water harvesting
Plant ecology - seed production and dispersal, germination, establishment, survival, growth, flowering, pollination, and competition
Microbiology - surface crusts, organic matter decomposition, and nutrient cycling
Animal ecology and behaviour - foraging strategies, habitat selection and preference
Resources - The availability and predictability of resources (water, nutrients, etc) and spatial heterogeneity of these resources

3. AERC experimental research sites

The AERC experimental stations consists of four sites (Fig. 1, Table 1) :

a) Sede Boqer

The Sede Boqer experimental hilly watershed has an average annual rainfall of about 100 mm. It is characterized by a considerable proportion of bare limestone rock with limited loess soil cover, but with relatively deep soils in the wadis Instrumentation for the measurement of the spatial and temporal variability of rainfall, wind regime, hillslope and channel runoff, and soil erosion are available. Biological aspects that have so far been studied include the spatial and temporal variability in biomass production and the effects of burrowing animals on soil erosion and soil properties. Porcupines, snails, and isopod activity have also been studied here. Runoff concentration techniques have been applied to the hillslopes in order to test the possibilities and potential for tree-planting.

b) Avdat Farm

The Avdat site, originally established in the 1950's (Evenari et al., 1983), is based on the very successful use of water-harvesting of hillslope runoff for agricultural purposes. Average annual rainfall is 88 mm. The farm is now jointly run by the Hebrew University of Jerusalem and the Ben-Gurion University of the Negev. The AERC is interested in research projects investigating the relationships between local rainfall and runoff.

c) Nizzana

This station was established in a sandy area composed of longitudinal dunes having relatively well-preserved natural vegetation. Average annual rainfall is approximately 100 mm. The site is equipped with instruments for the measurement of temperature, wind, rainfall, soil moisture, runoff and sediment removal, and dust fallout. A 15 m mast has been installed with propeller anemometers available at heights of 4, 8, 11 and 15 m. The response of the flora and fauna to precipitation, sand crust and sand movement, and to soil moisture and salinity is an integral part of the research.

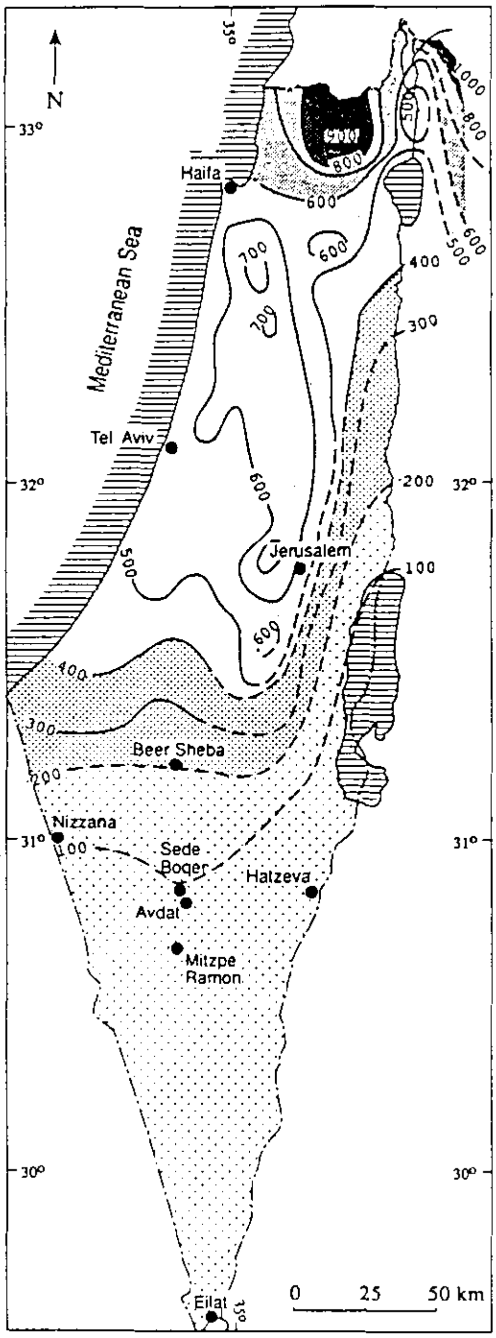


Figure 1 : Average annual precipitation (mm) map as prepared by the Israel Meteorological Service in 1990 ; shading in increments of 200 mm. AERC research stations consist of Nizzana, Sede Boqer, Avdat and Hatzeva.

Station	Location	Elevation (a.s.l.) (m)	Distance (km) from Mediterranean	Annual Ave Rainfall (mm)	Annual Ave Max Temp (°C)	Annual Ave Min Temp (°C)	Geomorphological Setting
Nizzana	34°23'E 30°56'N	190	45	100[a]	26.5[b]	12.5[b]	sand dunes, playas
Sede Boqer	34°47'E 30°51'N	480	70	97[c]	24.7[d]	12.1[d]	Rocky slopes, alluvial valleys
Avdat	34°47'N 30°47'N	610	80	88[c]	24.2[f]	11.8[f]	Rocky slopes, alluvial valleys
Hatzeva	35°13'N 30°48'N	-110	180	50[e]	g	g	Gravels overlying silts and fine-grained material

a - estimated (D. Sharon, Hebrew University, Personal comm.)
b - Nizzana mast, 3m height, 1991-92
c - From 1961 to 1990 (Israel Meteorological Service)
d - Zangvill & Druian (1983)
e - From 1951 to 1980 (Israel Meteorological Service)
f - Evenari et al. (1982)
g - no data

Table 1 : Summary table of AERC experimental stations (from Berkowicz et al, 1995).

d) <u>Hatzeva</u>

This station is located in the southern part of the Dead Sea rift valley in an area having gravely surfaces overlying fine-grained material. Average annual rainfall is 50 mm and as such the area is classified as extreme desert. The station has been used to study annual vegetation along channels of different stream orders and to assess the response of annual vegetation to sparse rain storms.

4. Suggestions for joint regional arid ecosystems research

The combination of population growth and extremely limited regional water resources are now forcing all parties in the Middle East to examine their present use of water and land. In light of the pressures being exerted for agricultural, urban, and industrial requirements, ongoing reassessments of national planning, land and water use policies, and conservation activities are being carried out. Compounding the situation is the question of climate change. In the Middle East, a sustained shift northwards of precipitation isohyets of even a few tens of km can be problematic in terms of water resources.

Accordingly, the AERC believes that there are several possibilities for regional cooperation. Apart from joint projects related to the various topics mentioned in Section 2, the following items are highlighted here :

<u>4.1) workshops</u>
Scientists in the region need to be made aware of each others' research accomplishments, capabilities, and limitations. This can be achieved through workshops which would include visits to research and experimental sites/stations. The workshops would provide the opportunity to prepare an "inventory" of relevant past and current research, and identify research priorities.

<u>4.2) regional research network</u>
Creating a network of study sites to analyse and monitor soil-hydrology-biosphere-atmosphere interactions is necessary for any regional research. In addition to ecosystem dynamics and processes, the data would be available for studies on land degradation and climate change research. The AERC's existing research stations could be usefully linked to others in the region.

4.3) database

It is clear that some form of joint database should be developed between the research groups. A database directory could list all the available information for research sites including background history and description, experimental setup, and period of record and data processing. Climatological data such as precipitation, rainfall intensity, air temperature and humidity can easily be exchanged in addition to basic soil and geological descriptions. Plant information such as species diversity and vegetation cover would be useful.

4.4) land degradation

Anthropogenic activities in arid and semiarid regions have normally brought with it considerable surface disturbances. As the population increases in a limited land area, land use pressures become more intense and often lead to severe land degradation such as overgrazing, clearing of woody vegetation for firewood, cultivation of marginal areas, and use of poor-quality water. Even tourism and recreation have created a need to determine the carrying capacity of such activities. New roads have led to better accessibility.

It is also becoming evident that as areas having a more Mediterranean climate are converted to agricultural, urban, and industrial land uses, rising land prices and settlement policies will likely steer people in the direction of semi-arid and arid regions.

A network of cooperating regional research stations would permit the systematic study of land degradation. One particular area of interest is the Egyptian/Israeli border near Nizzana where both restricted and farming/grazing activities occur.

4.5) remote sensing and geographic information systems (GIS)

Ecological processes of plants in arid ecosystems are determined largely by the temporal and spatial distribution of soil moisture and surface characteristics. In many arid ecosystems, plant growth occurs mainly in patchy sites where water is concentrated by local runoff. Modeling the distribution of runoff and plant growth accordingly requires the integration of rainfall and runoff over a wide range of temporal and spatial scales.

Differential radiometry at the red wavelength (600-680 nm) and the Near Infrared wavelength (730-880 nm) represents the amount of light absorbed by chlorophyll in green leaves, and is a indication of their biomass. Such methods have been used effectively for measuring the regional and seasonal changes in green plant cover over large areas. Existing remote sensing methods of changes in green plant biomass can provide a spatial resolution of 0.2 m.

Research, modeling, and predictions in ecosystems can be applied to large areas only by measuring and analysing large amounts of detailed spatial and temporal information about changes in plant cover and surface characteristics ; such data can be obtained by satellite and aerial remote sensing. GIS can provide the means of integrating data from different sources, such as maps and aerial photographs, into a common database as well the ability to analyze relationships between data sets.

Joint regional cooperation is needed for the efficient gathering, timely collection, and analyses of remotely-sensed data for the region. Although satellite data may be costly, local aerial photography is relatively inexpensive, and in some cases the data is already available.

5. Concluding comments

This short paper has briefly outlined the research activities of the AERC as well as pointed to several areas where joint and coordinated regional research could be fruitful. In light of the on-going peace process, the study of desert ecosystems is perhaps one of the few "non-controversial" subjects where all parties can benefit through cooperation. We would be glad to receive inquiries from interested individuals and organizations in the Middle East.

References

BERKOWICZ,S.M., BLUME,H.-P. & YAIR,A. (1995). The Arid Ecosystems Research Centre of the Hebrew University of Jerusalem. In : Arid Ecosystems Research. Advances in GeoEcology, Vol 28, 1-12.

EVENARI,M., SHANAN,L. & TADMOR,N. (1983). The Negev : The Challenge of a Desert. Oxford University Press : Princeton, N.J.

--- Scientific Topics ---
List of key-words for possible preproposals for future joint ecological and environmental research in the arid Near-East.

person responsible for collecting data and preparation of short preproposal underlined.

1 - Combating Land Degradation

e.g. Education
Nature Conservation (species, vegetation, habitats)
Control of pollution or overuse
....
Othman Sharkas, Christ. Wissel, Avi Perevolotsky, NN

2 - Information Exchange and data-bases

e.g. Nature Conservation
Forest Resources
Professional training
Research Groups and Projects
....
Linda Whittaker, Sumaya Ferhat-Naser, Maik Veste, NN

3 - Grazing

e.g. Regulation of grazing (desertification)
High yield plants (supplements)
Nitrogen limitations (C/N-ratio)
....
Raouf Moustafa, Avi Perevolotsky, Maik Veste, Christ. Wissel, NN

4 - Livestock for Meat and Milk

e.g. Livestock management
Livestock improvement
....
Irina Springuel, Uri Shani, NN

5 - Biodiversity

e.g. α-, ß-diversity
Hot spots of endemism
Minimizing human interference
Improvement of the local germplasm (positive/negative selection)
....
Kamal Batanouny, Dan Cohen, Siegmar Breckle, NN

6 - Soils and Water

e.g. Water Capture (dam construction)
Ground water recharge
Catchment area / area for production
Soil dynamics (natural, anthropogenic)
....
Peter Felix-Hennigsen, Simon Berkowicz, Marwan Hassan, Hannoch Lavee, Ahmad Hammad, Awni Taimeh, NN

7 - Water and Irrigation

e.g. Efficient use (optimization of use)
Low cost fertigation systems
Prevention of salinization
excessive irrigation
application in model agriculture systems
....
Uri Shani, Yoav Waisel, Irina Springuel, Reinhard Bornkamm, NN

8 - Eco-Tourism

e.g. Nature Reserves
National Parks
Hiking effects
Environmental impact balance
....
Irina Springuel, Raouf Moustafa, Kamal Batanouny, Linda Olsvig-Whittaker, NN

9 - Remote Sensing, GIS

e.g. Aerial photographs
Scanning
Multispectral images
Radar use digitized maps
....
Dan Cohen, Christ. Wissel, Amram Eshel, NN

10 - Modelling

e.g. Specific ecosystem processes
Databases
Simulation models
Anthropogenic effects
....
Christ. Wissel, Dan Cohen, Maik Veste, NN

Acknowledgements and Additional Remarks

This workshop was unique in many ways. The idea to organize it came in late summer 1994. The Ministry of Research and Technology of the Federal Republic of Germany (BMFT, now BMBF) was willing to finance this effort. So the participation list had to be established more or less at once. It happened that we were then asked from some of the intended participants: "*Should it be Nov. 1994 or 1995? Did you not make a typing error?"* Well, so the decision to organize the meeting was a matter of minutes, instead of weeks, to formulate the programme a matter of hours instead of months, and the organization was a matter of weeks, instead of years.

We intended to invite Palestinian and Israeli scientists from many different kind of natural and applied sciences, and in addition to have some scientists from Egypt and from Jordan. We were not totally successful, since some people didn't get their visa in time or got stuck in Amman, but we were able to replace somebody even the last two days before the workshop started.

The subject "Sustainable Land-use in the arid Near East", however, is a challenging subject not only in the Middle East, but in many other areas of the globe, since about 60% of the land-surface can be termed arid in the hydrological sense. It needs special care in using water for irrigation systems, management in grazing procedures, in agriculture and forestry. From the beginning it was obvious that only some examples of the many problems could be talked about in this meeting. It was also obvious that these examples will be brought in by the people who had been willing and able to join this last-minute invitation.

We have to thank many people and institutions who helped to make this workshop successful. First, the BMBF, who financed the expenses, then, the University of Bielefeld, especially the ZiF (center for Interdisciplinary Research) to host the workshop. Frau Irmingard Meier as well as some students from the Department of Ecology were very helpful in solving the suddenly arising problems. The students Ute Sartorius and Anke Stratmann did much of the preparing work, letters, faxes, and telephone calls in the first phase, though they were afraid not to get paid in time. Maik Veste was everywhere, he had made some contacts in Israel and in Germany and other parts of the world, and thus was a big help. The "Mövenpick"-Hotel in Bielefeld should be mentioned, too; they were very friendly and patient with all the extra wishes of the foreigners.

There were several goals to achieve: We were sure that only discussing some scientific topics from the different view-points would enhance communication for better understanding each other in the future, though or because of some really severe discussions. But we hoped that in addition it would be possible to formulate some scientific fields and kew-words, where future joint efforts could bring together working groups for interdisciplinary research projects.

Some months after the workshop it is clear that both these goals had been achieved. The participants are still in contact with each other, mainly by the modern means of fast communication (*Fax and e-mail* – without these, all the rapid organization would not have been possible). There is now communication between the nature conservation authorities from Jerusalem and the West Bank, there is communication between Egyptian scientists and those from Israel, there are preliminary research proposals on the way, where e.g. the water use efficiency on various scales (single leaves, whole plants, entire fields, natural ecosystems) will be studied - water, which is the main issue in an arid area, with all the other problems adhering to that: salinity, plant nutrition, soil compaction, over-grazing and segetalization, forest-fire etc.

This meeting was successful. We have to thank all participants for their good cooperation.

S W Breckle