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Priority Actions Programme (PAP)

Athens, November 23-25, 1992

PROGRESS REPORT ON THE PILOT PROJECT OF EROSION MAPPING AND MEASUREMENT IN THE MEDITERRANEAN COASTAL ZONES FOR THE PERIOD 1989 - 1992

UNEP
Athens, 1992

Progress Report on the Pilot Project of Erosion Mapping and Measurement in the Mediterranean Coastal Zones for the Period 1989 - 1992

I BACKGROUND INFORMATION

The Regional Activity Centre of the Priority Actions Programme (PAP/RAC), operatinG within the UNEP's Mediterranean Action Plan (MAP), has been implementing since 1984 the priority action entitled "Promotion of Soil Protection as an Essential Component of the Environmental Protection in Mediterranean Coastal Zones". The action has enjoyed the participation of 15 Mediterranean countries, FAO and ACSAD (The Arab Centre for the Studies of Arid Zones and Dry Land, Damascus). PAP/RAC organized a number of meetings to discuss and study the national reports on soil erosion in the Mediterranean coastal areas, as well as a number of case studies. As a result, it was concluded that the rainfall-induced soil erosion was one of the most serious forms of soil degradation affecting the Mediterranean coastal zones and threatening the entire coastal environment. Thousands of years of human cultivation, and particularly removal of forest cover, modification and degradation of the vegetation due to centuries of grazing by domestic animals, all caused a total destruction of a very large portion of the soils of the region, while the remaining parts suffered reduction of their capacity to produce food and support life.

The process of degradation and destruction still continues at a rapid rate, enormously accelerated by the widespread use of mechanical agricultural devices since the end of the Second World War.

All Mediterranean countries share the common interest of preventing further degradation of the life processes in the Mediterranean Sea itself and of halting the progressive loss of their basic natural resources. But so far, it has rarely been possible to implement an integrated approach to the problem, to obtain a quantitative view of the problems and their causes, or to identify priority areas, processes and requirements. A common understanding is still lacking of the relationships between physical, social and economic factors affecting soil erosion. This is partly due to a lack of institutional links and programmes, as well as to a lack of technical methods of classifying and mapping of various degradation processes, methods which would be topic-specific, sufficiently accurate, and potentially applicable in all Mediterranean countries.

The first step towards a better understanding of the processes and their underlying causes must be the transfer of information and methods, and the development of joint programmes. Mediterranean countries differ markedly in terms of the expertise and economic

resources which their national priorities permit them to devote to environmental, and in this case specifically, soil erosion issues. A cooperative programme would, therefore, allow for the most economical exchange of knowledge and expertise within the region.

With regard to the above, a cooperative project entitled "Inventory and Network of Erosion Measurement in the Mediterranean for an Environmentally Sound Land Management" was drafted in 1986-87 by PAP and FAO.

In the 5th Ordinary Conference of the Contracting Parties to the Barcelona Convention held in Athens in 1987, Spain offered to host this cooperative project, which was accepted unanimously. ICONA (Instituto Nacional para la Conservacion de la Naturaleza, Madrid) was appointed to act as the host institution of the project.

Accordingly, in the period 1987-1989, PAP, the Spanish authorities, ICONA and FAO performed a number of preparatory activities and defined the programme of the project entitled "Cooperative Project of Soil Erosion Mapping and Measurement in the Mediterranean Coastal Zones". The project was divided in two parts:

- Pilot Project on Erosion Mapping and Measurement, to be implemented in few selected coastal zones of the Mediterranean (1990-1992); and

- Main Project, to be implemented in all interested Mediterranean countries (1994-1996).

II OBJECTIVES OF THE PILOT PROJECT

The basic aim of the pilot project is to elaborate a common methodology of erosion mapping and measurement in Mediterranean coastal zones, which would lead to the preparation of an erosion map of the entire Mediterranean coastal region, as planned for the Main Project. That erosion map will have to be both quantitative and qualitative, which will make it one of a kind.

The objectives of the pilot project were the following:

- to define and quantify rainfall-induced erosion processes in the function of the most relevant erosion factors;

- to set up a network of stations for monitoring and measurement of erosion processes all over the Mediterranean coastal region;

- to standardize the procedure of rainfall-induced erosion measurement and monitoring, and the collection of relevant data, as well as to enable their exchange, comparison and use in the entire research area;

- to produce a common methodology of erosion mapping and measurement in the Mediterranean coastal zones;

Finally, the erosion map will be the final goal of the pilot project, to be prepared according to the common methodology, but only in selected pilot watersheds in the participating countries.

These achievements will create conditions and provide experience for the preparation of the erosion map of the entire Mediterranean coastal region, which is to be used for prediction of erosion processes and evaluation of erosion sediment going into the Mediterranean Sea. It will also enable planning of measures to prevent or mitigate the erosion, and to protect the Mediterranean Sea.

This is the final goal to be reached through the main project planned for implementation in the period 1994-1996.

III CONTENTS OF THE PILOT PROJECT

The contents of the pilot project could be summarized as follows:

- to create the basis of a common methodological approach to erosion mapping and monitoring in the Mediterranean coastal zones organizing expert meetings and technical sessions with the participation of experts in the field, through national reports and case studies, and using the relevant international experience;

- to select, in the participating countries, representative pilot watersheds;

- to apply, in the selected watersheds, the developed methodology of erosion mapping, monitoring and measurement;

- to test and evaluate, in the selected pilot watersheds, the developed methodology of erosion mapping and monitoring;

- to present the developed methodology and results obtained in the pilot watersheds through national reports and the final report;

- to organize workshops to present the pilot project results;

- to disseminate the outputs to all Mediterranean countries.

The final result of the pilot project will, thus, be the developed methodology of erosion mapping and measurement, tested in the selected watersheds, and applicable in all Mediterranean coastal zones. That methodology, the national reports and the prepared maps will make the basis for the implementation of the main project in the period 1994-1996.

IV HITHERTO RESULTS OF THE PILOT PROJECT

The first methodological basis for erosion mapping and measurement was adopted at the expert meeting held in Malaga in December 1989, which was attended by the representatives of 6 Mediterranean countries (Italy, Spain, syria, Tunisia, Turkey and Yugoslavia), FAO, UNEP and ISRIC (International Soil Reference and Information Centre, Wageningen, The Netherlands). Later on, as a result of several technical meetings and working sessions, the technical advisory group (FAO, ICONA, PAP) defined a common methodological approach to erosion mapping and monitoring to be applied in pilot watersheds selected in the participating countries.

Subsequently, expert missions were sent to the interested countries, composed of the representatives of Spain (ICONA and MOPU), FAO and PAP/RAC. In spring 1990, Turkey, Tunisia and Morocco were visited and the pilot watersheds were selected.

The proposed watersheds in Turkey, Tunisia, Morocco and Spain were accepted in the meeting held in Madrid in September 1990. From that moment the full implementation of the pilot project started, with ICONA as the host-institution, PAP/RAC as technical and financial co-organizer, and Turkey, Tunisia and Spain as participating countries, while Morocco did not join the project.

The field work performed in the selected watersheds could be summarized as follows:

(i) Erosion mapping

A. Erosion mapping methodology

The adopted and applied erosion mapping methodology is a combination of predictive and descriptive approaches. The predictive approach has been widely used, mainly because it can be applied quickly, relatively inexpensively, and with lower requirement for experienced staff.

Complementary to the classical predictive approach, a new, descriptive approach was developed, and through the field work in the selected watersheds, a methodology was developed which integrates both approaches in the mapping process.

This new approach consists of various clearly defined steps to be performed according to the general sequence shown in the Fig.1.

General scheme of erosion mapping procedures

1. Basic erosion status mapping

The mapping procedures for the completion of this first step should be based on large-scale maps (1:20,000 - 1:50,000) according to the best available cartographic coverage of the area. The specific mapping operations would deal with the following topics: slopes, lithology/soils, present land use, vegetation cover, level of soil protection (overlaying land use and vegetation cover maps), and erodibility levels (overlaying slope and lithology/soils maps). The final basic erosion status map will result from overlapping and correlating the soil protection level and erodibility levels maps.

2. Processing and adjustment of intermediate basic erosion status map

The second step in this procedure consists mainly of reducing and adjusting the large-scale (1:20,000 - 1:50,000) predictive maps to a medium-scale cartographic basis (1:100,000 - 1:150,000).

3. Site descriptive erosion process survey and mapping

A systematic analysis and mapping of current erosion processes should be performed through combined photo interpretation and field control, using reduced and readjusted intermediate-scale erosion status maps (obtained in the step 2) as the new cartographic canvas.

The erosion processes mapping should be performed following the codes, symbols and criteria adapted to the scale and formulated as presented in Annex I.

The overall geographical environment can be divided in two broad categories: stable and unstable areas. Details of this division are also given in Annex I.

4. Correlation of the erosion predictive status with the current erosion site description

The correlation procedure implies overlaying and readjustment of the two intermediate-scale maps (reduced intermediate erosion and status map and descriptive erosion processes map, as obtained in steps 2 and 3).

5. Preparation of the final potential and actual erosion map

This final procedure implies a reduction and readjustment of the map from intermediate scales to the final adopted scale of 1:200,000.

The areas affected by active erosion should be delineated by sub-boundaries inside the erosion status unit boundaries.

B. Watersheds selected for erosion mapping

Spain: Adra river, F = 720 km^2

Tunisia: Khirat and Ermal rivers, F = 1,000 km^2

Turkey: Esen Caj river, F = 2,800 km^2

C. Erosion maps produced

All pilot watersheds selected in the participating countries were mapped following the above explained general scheme of erosion mapping procedure. As example, the Figures 2, 3 and 4 show parts of the pilot watersheds in Turkey, Tunisia and Spain mapped according to the adopted common methodology.

D. National reports on erosion mapping

National reports regarding this part of the project were prepared for Spain, Tunisia and Turkey, and will be presented in a workshop planned to be held in Malaga on November 16-18, 1992.

(ii) Erosion measurement

A. Guidelines for rainfall-induced erosion monitoring and measurement

A methodology of rainfall-induced soil erosion measurement and monitoring in the Mediterranean coastal zones, combining catchment and field plots studies under natural and simulated conditions, was proposed and adopted in the Malaga meeting held on February 26-27, 1991. This part of the pilot project is essential for the quantification of the erosion map as shown in the Figure 1.

The concept of the methodology, defined as integrated measurement in nested catchment, combines measurement and monitoring of rainfall-induced erosion in the representative catchment (pilot catchment) and sub-catchments of various sizes. Inside the pilot watershed, several sub-catchments of various sizes make the link between the erosion on site (field plots) and downstream sediment yield in the pilot catchment, expressed through sediment delivery ratio (SDR).

B. Watersheds selected for erosion measurement

The following watersheds and sub-watersheds were selected in the participating countries:

Spain:

- Pilot watershed: Adra F = 720 km^2
- Sub-watersheds: several, ranging from 10 to 150 km^2

Tunisia:

- Pilot watershed: El Khirat F = 140 km^2
- Sub-watersheds: El Melah tr. F = 9 km^2
  Ladhiab F = 2.6 km^2

Turkey:

- Pilot watershed: Cajbogazi F = 220 km^2
- Sub-watersheds: Nif F = 77 km^2
  Cenger F = 10 km^2

C. Results of erosion measurement

Design, calibration and construction of weirs and flumes for water discharge measurement, and other required preparatory hydrological works are in course.

Equipment for rainfall and water discharge monitoring (data logger), sediment sampling and other necessary instruments have been purchased and will be installed according to the schedule.

Installation of the measurement equipment, written instructions for the field technicians, and a training course on the measurement procedure will be completed before October 1, 1992, when the measurement should start.

V FORTHCOMING ACTIVITIES

The forthcoming activities within the pilot project are:

- start of erosion measurement, planned for October 1992;
- a regional workshop on erosion mapping, scheduled for November 1992;
- preparation of the final report on the sub-project of erosion measurement, to be finished in November 1993;

- a regional workshop on erosion measurement, planned for December 1993, intended as the conclusion of the pilot project "Erosion Mapping and Measurement in the Mediterranean Coastal Zones.

- simultaneously, already in 1993, measures will be taken for the formulation of the programme of the main project, and for the creation of conditions for its implementation.

ANNEX I

Stable and Unstable Areas

I Stable, non erosion-affected areas

01: Stable, non used wasteland (rock outcrops, cliffs, stony or sandy areas)

02: Stable, unmanaged areas with agricultural potential

03: Stable, managed areas

04: Stabilized areas (naturally or artificially)

05: Areas in process of stabilization (natural or artificial)

Assessment of erosion risk for all stable or stabilized environments to be expressed by complementary digit (0 to 3) to the original stable unit's code:

0: No erosion risk (highest grade of stability)

1: Low to moderate risk

2: High risk

3: Areas in hazardous state (highest grade of risk)

II Unstable areas

Splash and rill erosion-affected areas

A1: Localized splash erosion (< 30%)

A2: Dominant splash erosion (30-60%)

A3: Generalized splash erosion (> 60%)

D1: Localized rill erosion

D2: Dominant rill erosion

D3: Generalized rill erosion

Sheet erosion

L1: Localized

L2: Dominant

L3: Generalized with soil profile removal

Lx: Non-recoverable areas due to total soil removal

Gully erosion

C1: Individual gullies

C2: Dendritic localized gully networks

C3: Dominant dendritic gully networks

C4: Generalized dendritic gully networks

Cx: Non-recoverable areas due to generalized bad lands

Wind erosion

W1: Localized loss of top-soil/overblowing/deflation

W2: Dominant

W3: Generalized

Wx: Non-recoverable areas due to total sand or sediment burying or top-soil removal

Mass movement

M1: Local terracing

M2: Localized land-slides/mudflows

M3: Dominant

M4: Generalized

Mx: Non-recoverable areas due to total slope slides

Water or sediment excess

S1: Areas periodically flooded and/or sediment buried

S2: Areas permanently flooded and/or sediment buried

Multiple processes

P1, P2, P3, etc. (to be determined by local conditions)

Erosion expansion trend (rate)

Assessment of erosion trend/rate for all unstable, erosion-affected areas to be expressed by a complementary digit (0 - 3) to the original unstable unit's code:

0: Trend to stabilization, recession or limitation of spatial expansion

1: Trend to local expansion or intensification

2: Trend to widespread expansion or intensification

3: Trend to increase generalized degradation towards an irreversible situation

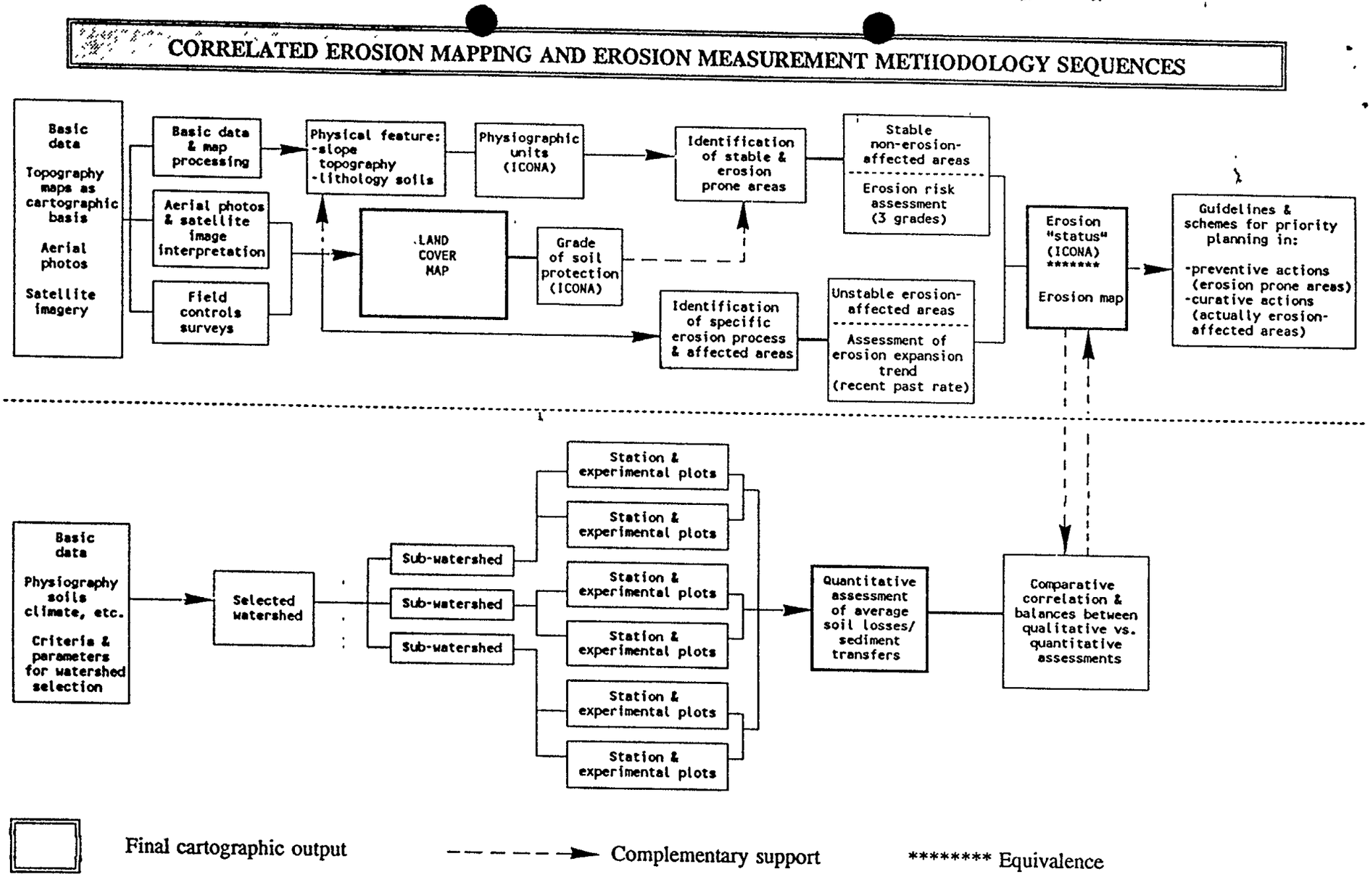
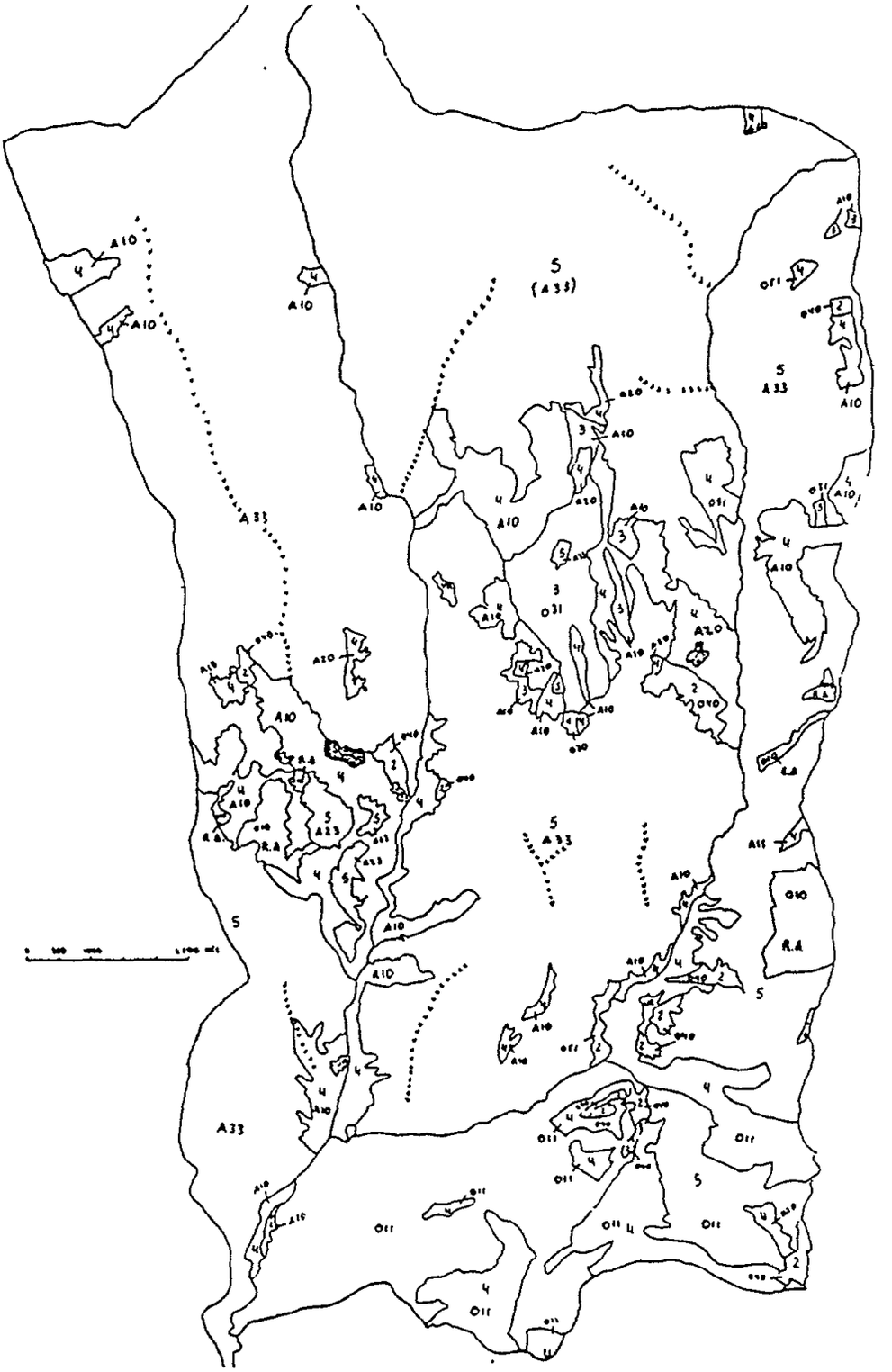


Figure 1. *Diagram of methodology used for mapping soil erosion in the Mediterranean basin*

Figure 2.



ADRA WATERSHED (Northeast subwatershed)
POTENTIAL AND ACTUAL EROSION
SCALE (See scale bar)
El Ingeniero de Montes
April, 1992

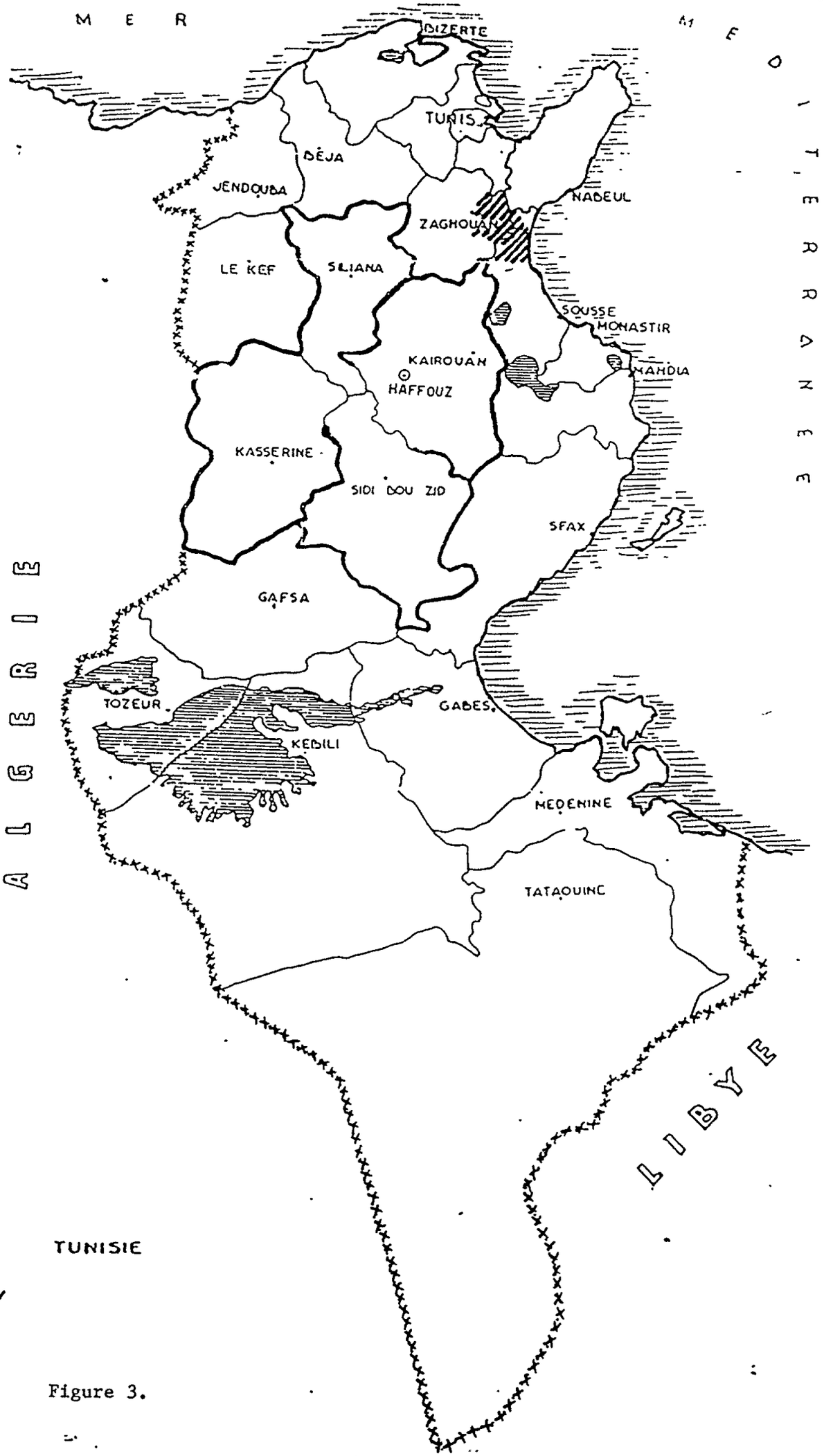

M E R
BIZERTE
TUNIS
DÉJA
JENDOUBA
NABEUL
ZAGHOUAN
LE KEF
SILIANA
SOUSSE
MONASTIR
KAIROUAN
HAFFOUZ
MAHDIA
KASSERINE
SIDI BOU ZID
SFAX
GAFSA
TOZEUR
GABES
KEBILI
MEDENINE
TATAOUINE
ALGERIE
LIBYE
TUNISIE
ECHELLE 1/2000(0)

Figure 3.

DIRECTION DE SOLS

PROGRAMME D'ACTION PAR
U.N.D.P PLAN D'ACTION MEDIT

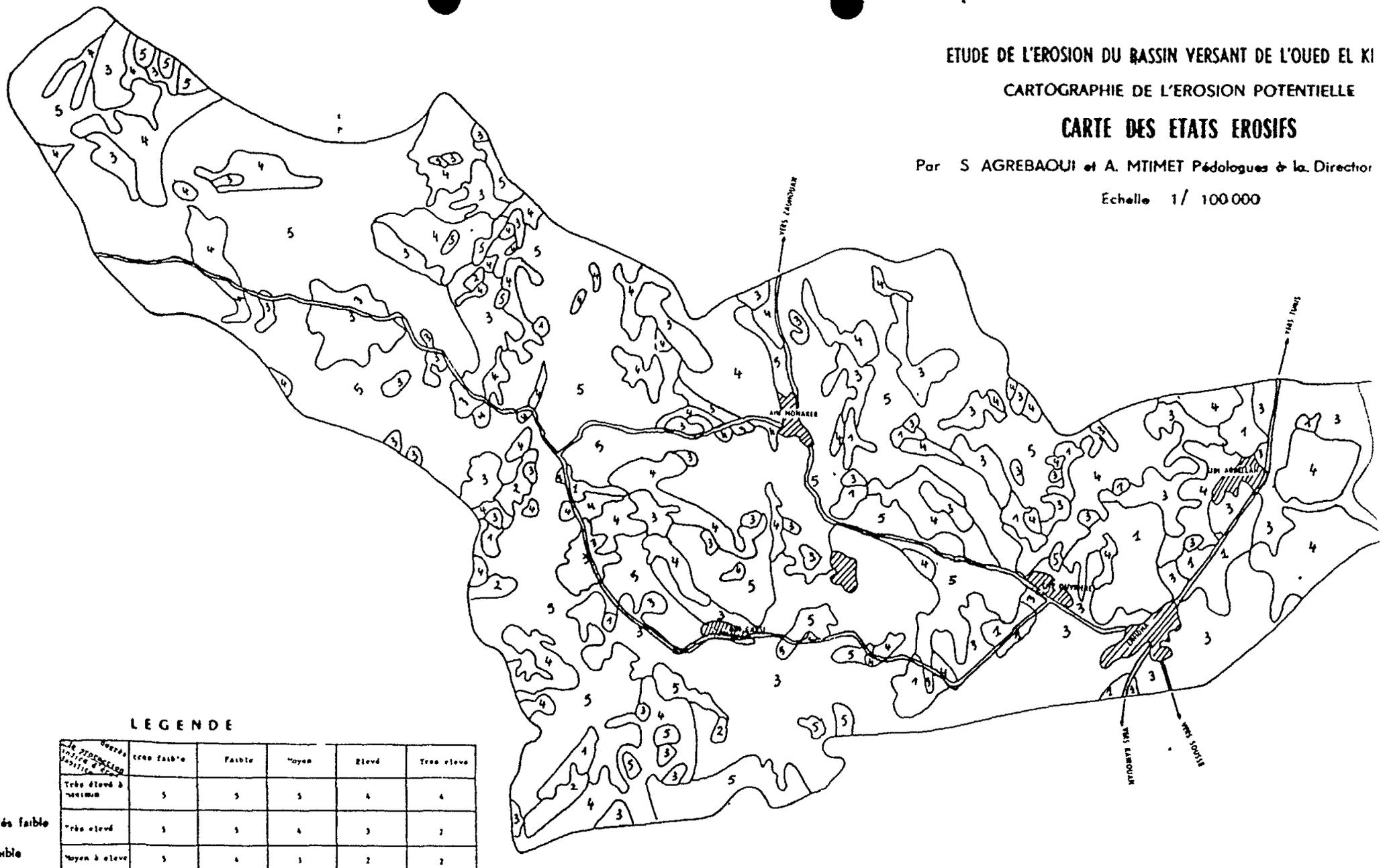
ETUDE DE L'EROSION DU BASSIN VERSANT DE L'OUED EL KI

CARTOGRAPHIE DE L'EROSION POTENTIELLE

CARTE DES ETATS EROSIFS

Par S AGREBAOUI et A. MTIMET Pédologues à la Direction

Echelle 1/ 100 000



LEGENDE

1	Très faible
2	Faible
3	Moyen
4	Grave
5	Très grave

Degrés de protection contre l'érosion hydrique	Très faible	Faible	Moyen	Elevé	Très élevé
Très élevé à maximum	5	5	5	4	4
Très élevé	5	5	4	3	2
Moyen à élevé	5	4	3	2	2
Moyen à faible	4	3	3	1	1
Faible	4	3	2	1	1

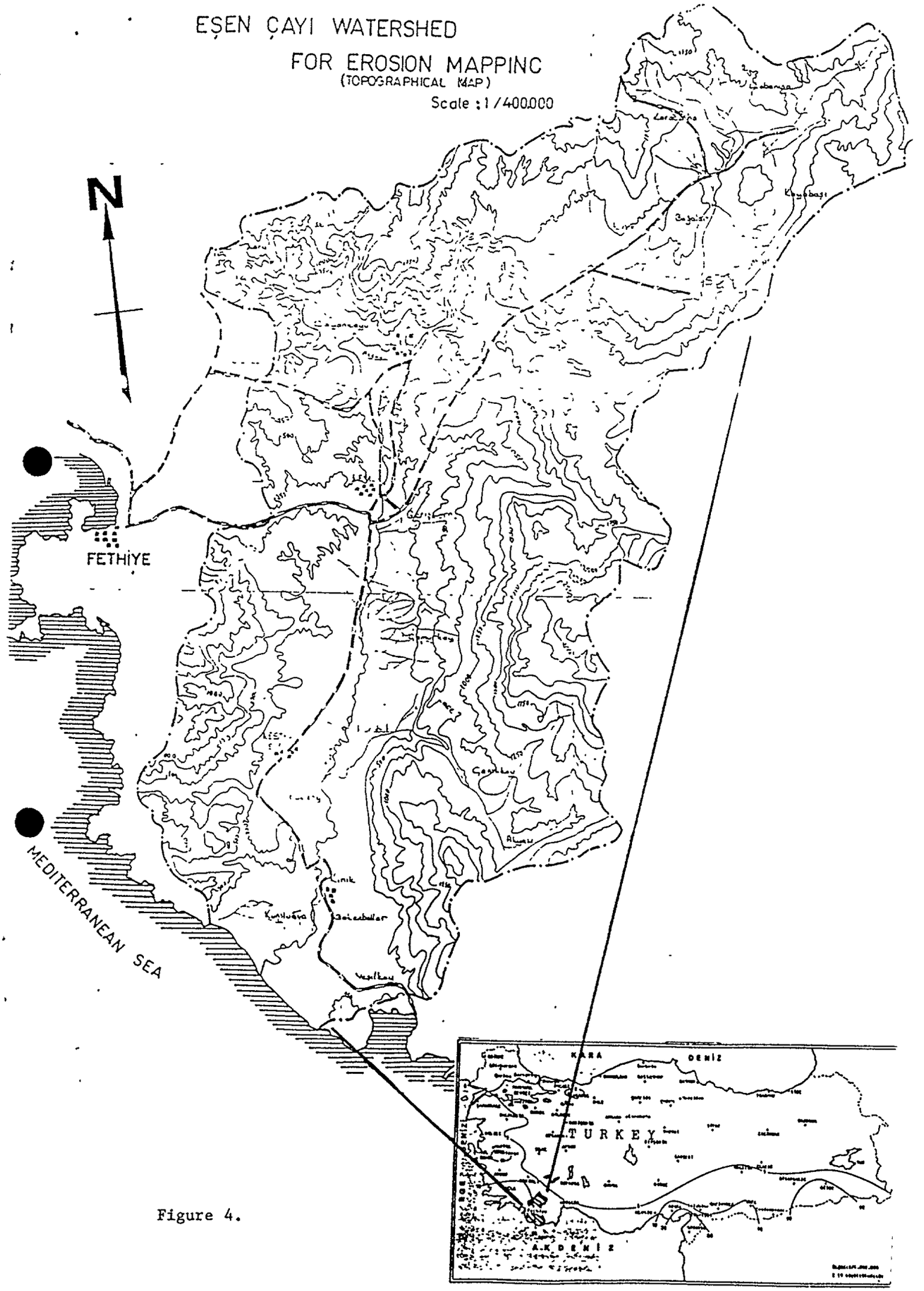

EŞEN ÇAYI WATERSHED
FOR EROSION MAPPINC
(TOPOGRAPHICAL MAP)
Scale : 1 / 400.000
N
FETHİYE
MEDITERRANEAN SEA
KARA DENİZ
TURKEY
AKDENİZ

Figure 4.

CARTE DE L'EROSION DES SOLS DU BASSIN-VERSANT D'EŞEN EN TURQUIE

ESEN CAYI HAVZASI TOPRAK EROZYONU HARITASI