STIF 1

II

01

Progress Report - ERTS FOLLOW ON PROGRAMME

77-10122
CR-149864

1. Introduction

1.1	Title:	The Application of ERTS Imagery to the FAO/Unesco Soil Map of the World.
1.2	Investigation Number:	2810 M.
1.3	Principle Co-ordinator:	J.A. Howard
1.4	Principle Investigator:	Raoul Dudal
1.5	Co-Investigator:	André J. Pécrot
1.6	Organization:	FAO, Rome, Italy
1.7	Type of Report:	Quarterly Progress Report
1.8	Date:	25.2.1977

2. Techniques

Visual analysis and interpretation of the colour composite prints supplied was the main technique. The images were compared with the soil map of the world and other existing information in order to assess soil degradation in Western Africa, with a more detailed study in Morocco. The digitised analysis of soil, climate and boundary data which had been initiated on an experimental basis in South America has been abandoned because the time for storage of data and financial resources required, proved too great in relation to staff and budget available and the results achieved.

3. Accomplishments

The execution of the project was partly hampered by the nonapproval of a new post of Technical Officer (Soil Resources) to work on the interpretation of the World Soil Map, due to financial stringency. It was also limited because, of the imagery requested, only a partial cover of part of the region, for one season instead of two, was supplied.

2810 M

The interpretation of the world soil map to compile a small scale (1:25 000 000) world map showing the progress of desertification in the semi-arid zone is being completed and the map will be published as a basic document for the forthcoming UN Conference on Desertification. A world assessment of land degradation and degradation hazards was also undertaken as part of a three year FAO/UNEP project and a map at 1: 5 000 000 scale showing areas where soil degradation is active will be produced, starting with Africa north of the equator and the Middle East. A report on the preliminary results of the use of satellite imagery for such assessment was presented to an Expert Consultation on Methodology for Assessing Soil Degradation held in Rome on 18-20 January 1977 and a copy is attached. A report on a more detailed study made on Morocco is under preparation. The general conclusions from these studies is that the LANDSAT imagery provides significant information, and better mapping boundaries, particularly when used in conjunction with other sources of information but that certain problems remain and the whole benefit from the imagery is not yet being obtained. Multitemporal imagery and some ground control would improve results.

A study of available land resources by agro-ecological zones using the world soil map as basic document, was initiated in September 1976 as part of the FAO regular programme. It has so far concentrated on collection and compilation of climate, yield and land use data from the field, but the possible application in this study of the satellite imagery supplied will be investigated next month with the arrival of a suitably qualified associate expert.

4. Significant Results

Some conclusions have been mentioned in the attached report as to the use of the satellite imagery for small scale mapping of land degradation but final conclusions cannot yet be drawn.

5. Publications

The attached report will be included in the report on the expert consultation which is to be published as an FAO document.

It should perhaps be noted that several other publications have been prepared in the region using imagery not supplied under this contract.

The world desertification map together with a short explanatory note will be printed in the near future for distribution to the participants in the UN Conference on Desertification (August 1977).

6. Problems

The main problems have been:

1. Non-assignment of expected staff to work on the project, due to budget stringency.
2. Only partial delivery of the requested imagery; had it been realized that the NASA budget for imagery was limited to $ 6 000 the order would have been made for a smaller region but covered in two seasons, to serve as a test case. Only the western part of Africa north of the equator is covered and there are extensive gaps in the coverage.
3. From the technical side there are difficulties when using only simple techniques in correlating patterns on the images with the various forms of degradation. This requires further investigation particularly on relations of such patterns with other environmental factors such as climate, vegetation, soils, geology.

7. Data Quality and Delivery

The quality is good and resolution is adequate for this study. The limitation in supply of images has restricted the area which can be examined.

8. Recommendations

Nil.

9. Conclusions

The LANDSAT data is valuable in the study of land degradation and evaluation of land resources. Budgetary limitations at present limit the possibility of its use worldwide or even for the whole of the priority region selected for this contract.

January 1977

FAO/UNEP EXPERT CONSULTATION ON
METHODOLOGY FOR ASSESSING SOIL DEGRADATION

Rome, 18-20 January 1977

APPLICATION OF LANDSAT IMAGERY TO THE ASSESSMENT OF SOIL DEGRADATION

by

J. Riquier 1/

1/ Project Coordinator, Soil Resources Development and Conservation Service, Land and Water Development Division, FAO.

APPLICATION OF LANDSAT IMAGERY TO THE ASSESSMENT OF SOIL DEGRADATION

The project "World Assessment of Soil Degradation" recommends the using of satellite imagery and aerial photography for the assessment of degradation. Without negating the usefulness of this approach, I would point out its limitations in the framework of this project.

1. The aerial photography can only be used on a pilot zone or a limited region because the number of photographs which are to be integrated, becomes rapidly far too many. This method is thus completely excluded for establishing the degradation map at 1:5 000 000 scale except perhaps for a test-zone. The methodology has been studied particularly at ITC but the conclusions are that erosion is often very little evident on photographs but has to be deduced from criteria such as: geomorphology, vegetation, land use, topography and so on. We return to the general problem of this meeting which is the assessment of soil erosion from some criteria in the absence of means to assess or measure directly this degradation. Erosion is just one of the degradation processes, but the other processes are yet more difficult to assess by these means.

2. The use of satellite imagery is more useful at our scale, although the number of images for the whole world is already very high and the interpretation work proportional to this number.

In addition there are some limitations linked to Landsat imagery.

a. The weak resolution of Landsat imagery, 80 to 100 meters, which does not permit a gully to be seen for example, or the vegetation of isolated trees in the desert zone.

b. If we are to use the advantage of multispectral imagery, we have to know the signature of the different types of vegetation at different seasons and to have several sets of images during the year. It is costly and time consuming.

c. Automatic processing by computer or density slicer is also usable, but only if ground survey has provided sufficient information to interpret the image. It is also impossible in this phase of the project.

d. The use of a colour additive viewer to recompose multispectral image from the four spectral bands also takes a long time (about 30 minutes) and is not practical because the image is vertical on a screen.

In conclusion, only manual interpretation of Landsat imagery is possible and can be adopted.

Our study on Morocco is a good example. Work has been made by Dr. Pacheco, who unfortunately is not here. He has used a mosaic of imagery enlarged to 1:1 000 000 by photographic process and a set of false colour images provided by the US Department of Agriculture and covering the whole of West Africa.

The main advantage of this approach is that we can easily draw a land inventory map of Morocco; as you can see on the board, it is a list of physiographic and geomorphological regions.

At a later stage, degradation criteria can be listed not only from the visible characteristics of the satellite imagery but also from existing maps of vegetation, topography, soil and land use and then soil degradation is deduced by judgement from these criteria. A comparison of the map and the imagery is useful for interpretation of the imagery.

We have noted certain facts during this interpretation:

i) it is relatively easy to distinguish, on black and white Landsat imagery, a physiographic region with a certain homogeneity of soil degradation criteria;

ii) cultivated areas are more difficult to see in the African region because the geometrical forms of fields are not regular or usual in Africa. However in the savanna zone, vegetation degradation by overpopulation is very visible in false colours and is shown by light spots around the villages;

iii) false colour imagery has been used for the desertification map. The red of this imagery has a high reflectivity in infrared and shows very clearly the humid soil and humid vegetation. The climatic zonation is then very obvious from the yellow of the desert to the red of the humid forest through the green of the savanna;

iv) soil covered by salt in Sebkha is clearly visible but salty soil can be confounded with soil with a high reflectivity, such as: white sand bare soil of alluvial fans.

But except for some sheet erosion occurring in a vast area and shown by degradation of the vegetation, it is impossible to see soil degradation itself. However, Landsat imagery is useful to verify some criteria such as vegetation, geomorphology, topography, drainage network, land use already more or less known by map and assessment of degradation can be made from these criteria in homogeneous region.

It is a framework for other studies on degradation.