

GLOBAL SOIL PARTNERSHIP

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Status of Soil Survey and Soil Information System in Morocco

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Outline

- Overview of the kingdom of Morocco
- Overview of Moroccan agriculture and natural resources
- Overview of soil status in Morocco

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Population growth

- Population growth resulted in increased reliance on continuous cropping and hence in soil nutrient mining and drawdown of active organic matter.
- As population grows and puts more pressure on soils, so it is expected that food insecurity will also grow.

Year	Algeria	Egypt	Morocco
1900	~5	~5	~5
1925	~10	~10	~10
1950	~15	~15	~15
1975	~25	~25	~25
2000	~40	~40	~40
2025	~55	~55	~95

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SOIL DEGRADATION IN NA

Region	Erosion Hydrique (%)	Erosion Eolienne (%)	Deg. Chimique (%)	Deg. Physique (%)
World	~58	~30	~15	~5
North Africa	~30	~52	~12	~10

Food shortage


- The annual rate of increase (change) in yield does not keep pace with the annual rate of increase of the population and explains the ever-increasing shortage of food supply in the region.
- Net wheat imports have jumped from 4.8 millions tons (1970); to 9 Mt (1977) and reached 25 Mt (2000) in North Africa and Meadle East.

Morocco



The Kingdom of Morocco : 710 850 km² area and
 3 500 km of coastline (Atlantic ocean and Mediterranean sea)
 30 Millions people ; 55 % living in urban areas.

Morocco



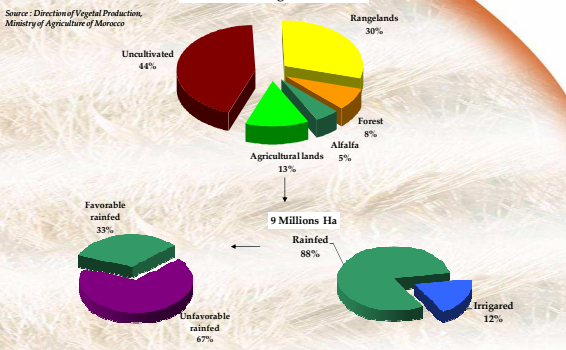
Administration:
 16 Regions
 71 Provinces (26 are Urban)
 1547 Communes (249 are Urban)

Economy:
 Agr.: 40% of labor force
 Ind.: 7,2% of labor force
 Serv.: over 50% of GDP

Moroccan agriculture

Distribution of agricultural land

Source : Direction of Vegetal Productions, Ministry of Agriculture of Morocco



9 Millions Ha

- Uncultivated 44%
- Rangelands 30%
- Forest 8%
- Agricultural lands 13%
- Alfalfa 5%
- Favorable rainfed 33%
- Unfavorable rainfed 67%
- Irrigated 12%

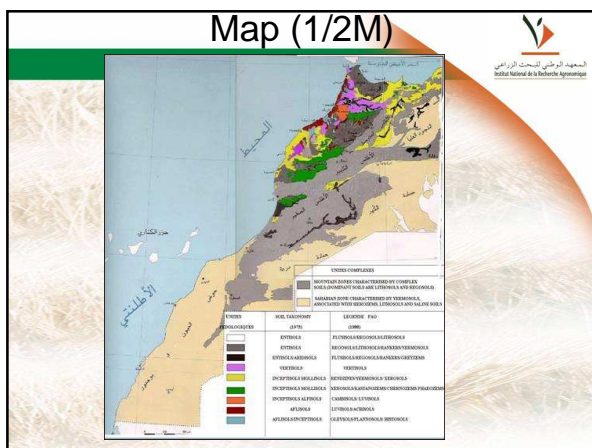
Status of Soil survey

- Before the political independence of Morocco in 1956, foreign pedologists performed most of the soil observations and mapping for both scientific purposes and management needs.
- The National Office of Irrigation (ONI) did the first real soil surveys for the selection of potentially irrigable land. Large regions, such as Sebou, Oum Er-Rbia, and Moulouya watersheds were first surveyed at the reconnaissance scale (1:500,000 to 1:100,000).

- The total area covered by soil survey is estimated to 20 Millions ha. It is mostly concentrated in the North and central western part the country, north of the Atlas Mountains. Therefore, at present, only about 28 % of national soil resources are mapped and characterised at different scales. The French soil classification system (CPCS of 1967) is almost the unique legend used. A schematic general soil map of Morocco was prepared at the scale of 1:2,000,000.

Exemple of Soil Maps

Maps (1/500.000)



Moroccan natural resources

Soil

National irrigated agriculture program launched in 1967 → 1/20.000 and 1/10.000 soil maps covering 2.5 millions Ha

National rainfed areas development program launched at 80s → 1/50.000 and 1/100.000 soil maps covering 6.12 millions Ha

Moroccan dominant soils:

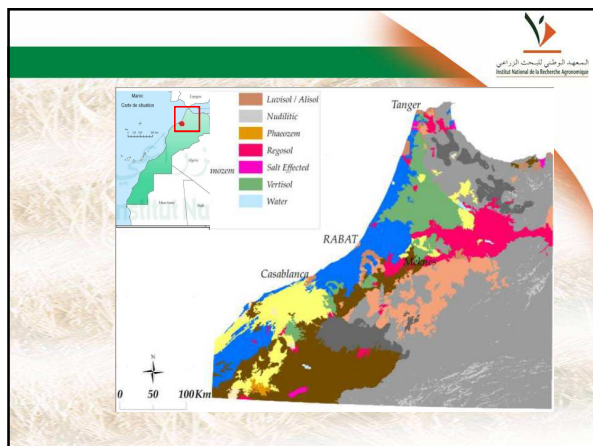
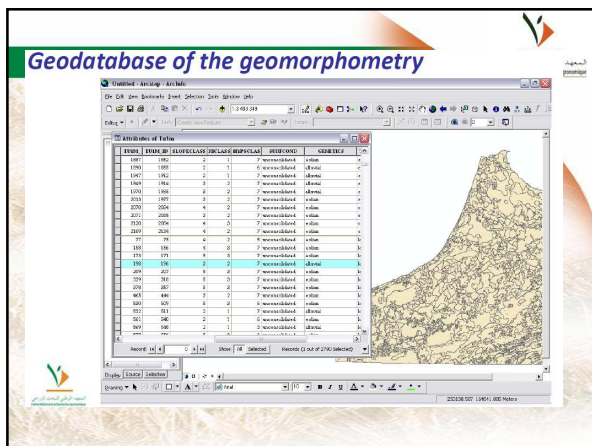
1 – North and North-West: Luvisols, Vertisols, Kastanozems, Chernozems, Phaeozems, Cambisols

2 – South and South-East: Lithosols, Regosols, Rendzinas, Xerosols, Yermosols, Fluvisols

- Unfortunately, according to national statistics, soil maps at various scales cover around 30 % of national territory, the classical approach was used in most cases
- New cost and time effective soil mapping approaches are needed
- Soter project was a good opportunity to test a new (non conventional) large and medium scale mapping approach

-Soter main objectives

- Morphometric landforms description;
- Soil parent material characterization and pattern recognition by remote sensing;
- Standardization of methods and measures of soil attributes to convert legacy data and various national databases to a common standard.



-Soter main outputs for Morocco case study

- Geodatabases for morphometric characteristics and parent material at large and medium scale;
- Correlation of available soil attributes from local soil classification (CPCS) to WRB;
- Soil FAO-WRB units of target areas at large and medium scales;
- Conception of a methodology of soil mapping using legacy data, expert-based knowledge and geomatics for further Digital Soil Mapping in the unstudied areas of the country.

WRB-National classification correlation

- Step 1. Determination of possible correlations of national soil types with WRB RSGs
- Step 2. Define all required data & information for the possible WRB RSGs in table format
- Step 3. Select the relevant ones for the climatic, geographical region.
- Step 4. Define the missing data (and/or diff. methodology)
- Step 5. Define the possible supplement data & information (pedotransfer functions, expert/correlator judgment, or additional field visit)
- Step 6. Define diagnostics or directly WRB reference groups
- Step 7. Same exercise for qualifiers

→ local WRB experts (correlator?) needed



Major soils in Morocco

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LEGENDE		WRB
1	Sols minéraux bruts	Leptosols
2	Sols peu évolués	Regosols
3	Sols calcimagnésiques	Calcisols
4	Sols isohumiques	Kastanozems
5	Vertisols et sols assimilés	Vertisols
6	Sols fersiallitiques	Etc....
7	Sols hydromorphes	
8	Sols halomorphes	
9	Sols brunifiés	


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- Although Soil Taxonomy, FAO and WRB classifications are partially known by most pedologists (courses of soil classification), the French soil classification is the only system used for official soil survey in Morocco. Only scientific studies use FAO or Soil Taxonomy conversions for publication requirements.

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Major soil constraints affecting sustainable agricultural production and development


- Soil erosion** is the most important soil degradation process in Morocco. The total annual soil loss is evaluated to **100 millions tons**.
- Soil depth** (limits soil depth). This is a major constraint limiting the agricultural arable land in Morocco. A survey per-formed in different regions of the country showed that about **2 millions** ha could be re-claimed by subsoiling and stones removal.



Soil quality changes in irrigated perimeters


Many studies conducted in the irrigated perimeters have shown that irrigation leads generally to soil and water quality deterioration. The major degradations are:

- **Salinisation**, surface **sealing**, rising of **saline groundwater**, reduction of **soil drainage**, soil **compaction**. At present, the surface area of saline soils is estimated to about 0,5 Mha.
- **Loss of organic matter**. A mean soil organic matter is low than 2 %



Soil inventory database

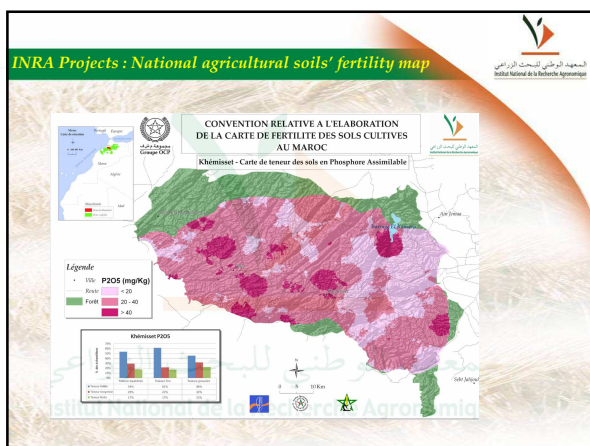
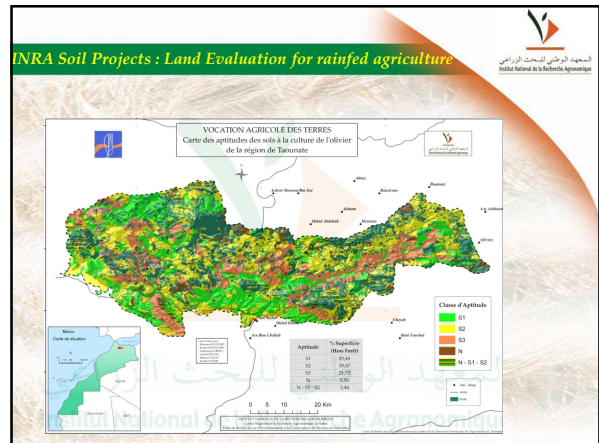
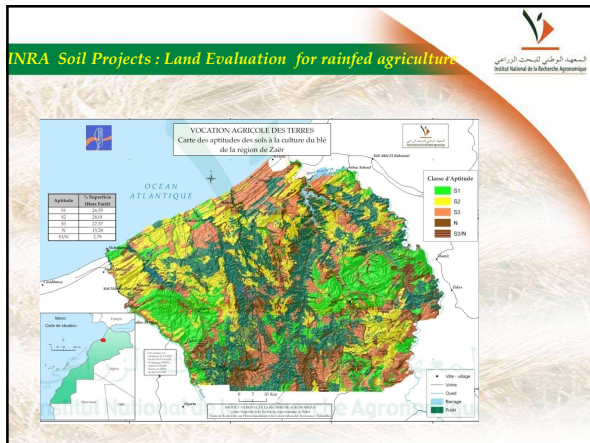
- Although the importance of soil information was recognised from a long time, the availability of data on soils was always difficult to get and to use. A special effort therefore was made by the Ministry of Agriculture/INRA to establish a database for all the soil information available.



- In order to establish a general soil map of Morocco, it is necessary to normalise the legend. Pedologists are invited to use the normalised descriptions, symbols, and interpretation norms. Unified colours are also proposed for the pedologic map and the constraints map. This soil database needs to be updated now to introduce the new studies realised during the last years (2 Mha).



- **The Moroccan soil information system needs to be improved by:**
- Updating the existent soil database;
- Establishment of new specialised national and regional GIS laboratories to improve the storing capacity and interpretation of soil information;
- Training of pedologists and technicians for soil database establishment and use;
- A national program of soil inventory and mapping is needed to complete soil survey in Morocco and to coordinate the activity between specialised scientific institutions, research centers, and the administration.



Thank you

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