



SOIL DEGRADATIONS A VITAL AND NEGLECTED ISSUE FOR OUR FUTURE

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« Land Quality and Land Use Information »
in European Union, 26-27/05/2011,
KESZTHELY (Hungary)

ALIMENTATION
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***I. The Soil Challenge for the next future
(2050)***

II. What happens with the soil resource ?

***III. Are we facing our responsibilities in
Europe ?***



I. The Soil Challenge for the next future (2050)

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THE SOIL CHALLENGE for the next FUTURE

The Demand for Food

- ❖ **9 . 10⁹ human beings in 2050**
- ❖ **An important change in food consumption in newly developed countries : more animal products, more plant oils**
- ❖ **Result in a necessary increase of 70 % in food availability**

THE SOIL CHALLENGE for the next FUTURE

The Demand for FUEL

- ❖ Different scenarios according to the target level in CO₂ concentration, efficiency of biofuels production, land use changes policy
- ❖ High variations in potential production estimates (1500 - 400 EJ)
- ❖ 1,4 - 1,5 . 10⁹ ha would be necessary for dedicated crops according to the target level, in CO₂ concentration (Melillo et al. 2009, Fischer 2009)
- ❖ This requires an important change in land use, mainly from grasslands

THE SOIL CHALLENGE for the next FUTURE

- ❖ **Land use change and production techniques must preserve ecosystem functions of soil**
 - ❖ *Water cycle, flood protection, landslides and erosion*
 - ❖ *Carbon cycle, carbon storage, other geochemical cycles (N, P....), chemical water quality*
 - ❖ *Biodiversity and ecosystems conservation*
 - ❖ *Landscape quality*

THE SOIL CHALLENGE for the next FUTURE

Which soil area is available to produce more ?

The present scope

	10 ⁹ ha	%
Continental area	13,0	100
Annual and permanent crops	1,6	12
Grasslands	3,2	26
Forests	3,9	30
Others	4,1	32

THE SOIL CHALLENGE for the next FUTURE

Which soil area is available to produce more ?

- ❖ From $2,6 \cdot 10^9$ ha to $0,45 \cdot 10^9$ ha according to the constraints which are taken into account
- ❖ $1 \cdot 10^9$ ha appears as a reasonable order of magnitude using exclusively grassland to extend cropping
- ❖ Mains sources of uncertainty :
 - ❖ *Quality of data*
 - ❖ *Land ability for crop production : soil properties and climate, accessibility*
 - ❖ *Areas to protect and forest policy*
 - ❖ *Water availability*

THE SOIL CHALLENGE for the next FUTURE

What about climate change impacts ?

- ❖ **Impacts on yields : could be few globally in 2050 but nigher (from -3 to -16 %, function of CO₂ enrichment effect) in 2080, and negative yet according to recent paper**
- ❖ **Impacts on the suitable for cultivation area : slightly positive according to different scenarios at the planetary level (+1 % to +6 %)**
- ❖ **Impacts on extreme climatic events ?**

THE SOIL CHALLENGE for the next FUTURE

Whatever the uncertainties, strong conclusions !

- ❖ **The increases in agriculture production must be obtained mainly by an increase of yields to limit the extension of cultivated area at the expense of forests and natural ecosystems**
- ❖ **This has been possible in the past decades due to the intense use of industrial inputs and extending of irrigated areas**
- ❖ **Increase soil productivity must be done in an ecological and sustainable way**
- ❖ **This means conserve and improve soil qualities in a long-term vision**



II- What happens with the soil resource ?

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WHAT HAPPENS WITH THE SOIL RESOURCE ?

- ❖ **Soil must be considered as a non-renewable resource**
- ❖ **But it is submitted to intense destruction processes :**
 - ❖ *Extending of human infrastructures (cities, industry, mining, communication networks)*
 - ❖ *Water and wind erosions*
 - ❖ *Salination by irrigation (extreme loss in quality)*

WHAT HAPPENS WITH THE SOIL RESOURCE ?

Losses in soil resource are poorly monitored

- ❖ **Infrastructures :** -several millions ha/year in the world
-France 50 000 to 70 000 ha/year
- ❖ **Erosions :** -water $1,1 \cdot 10^9$ ha affected in the world
Europe : 16 % of the lands
-wind : $0,55 \cdot 10^9$ ha affected in the world
- ❖ **Salination :** - $2 \cdot 10^6$ ha newly affected per year ?

Very approximate data about the intensity and speed of the soil loss processes, even in Europe

WHAT HAPPENS WITH THE SOIL RESOURCE ?

Losses in soil qualities

- ❖ **Chemical contamination by mineral and organic molecules**
- ❖ **Decrease in organic matter content**
- ❖ **Physical degradation, compaction and structure degradation**
- ❖ **Losses in biodiversity and bio-activity**

WHAT HAPPENS WITH THE SOIL RESOURCE ?

Losses in soil qualities

- ❖ **The state of the resource is poorly quantified**
- ❖ **The speed of changes is less known**
- ❖ **The consequences for soil productive an ecological functions less quantified yet**

WHAT HAPPENS WITH THE SOIL RESOURCE ?



- ❖ **It is reasonable to admit that the equivalent loss of soil is at least close to $10 \cdot 10^6$ ha/year**
- ❖ **If that trend is maintained up to 2050 we shall consume an important part of supplementary areas dedicated to food and fuel productions**
- ❖ **The soil challenge will hardly affect the food, energy and ecological issues**



III. Are we facing our responsibilities in Europe ?

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ARE WE FACING OUR RESPONSABILITIES ?

- ❖ **At the planetary level no soil policy**
- ❖ **Europe is highly concerned :**
 - ❖ **It is and will be an important agricultural producer, next to neighbours facing increased food deficit (mediterranean region particularly)**
 - ❖ **It has the necessary skill (science, technology, farmers) to get high productivity and environmental sustainability**
 - ❖ **It has defined a soil strategy which is not implemented**

ARE WE FACING OUR RESPONSABILITIES ?

Do we know our soils ?

- ❖ **Broadly we could answer yes ...**
- ❖ **But there are still important heterogeneities between countries and regions**
- ❖ **We need to complete the soil information system at 1:250 000 scale**
- ❖ **Availability of detailed soil surveys (1:50 000 scale or larger) is far to be complete**
- ❖ **Soil information systems are limiting adequate decision making**

ARE WE FACING OUR RESPONSABILITIES ?

Do we properly monitor our soils-state?

- ❖ **Most countries have established monitoring programmes**
- ❖ **Heterogeneity between countries and regions (type of data, use of soil forest or/and agriculture, sampling...) and availability of data are limiting the possible use of the results**
- ❖ **The necessary permanency of monitoring programmes is far to be guaranteed**
- ❖ **Can we really hope to be able to estimate soil changes in the next decades ?**

ARE WE FACING OUR RESPONSABILITIES ?

An example : Monitoring system in France

- ❖ **Soil Quality Monitoring Network :**
 - ❖ 1 site every 16 x 16 km square (2200 sites)
 - ❖ Pedology and agronomy sound data, mineral and some organic contaminants
 - ❖ Two layers 0-30 and 30-50 cm
 - ❖ Expected return time : 10 years
- ❖ **Data will be published in Novembre 2011**
- ❖ **The bank of data and bank of samples are an important support for research (ex : soil bacteria abundance and diversity)**
- ❖ **The Cost is high (0,6 millions € per year)**

ARE WE FACING OUR RESPONSABILITIES ?

An example : Monitoring system in France

- ❖ **The soil analysis data bank**
 - ❖ **Collects data from private labs selling analyses to farmers since 1995**
 - ❖ **High quantity of data (# 5 . 10⁶)**
 - ❖ **Parameters are mostly related to chemical fertility, sampling is uncontrolled, location is approximately known**
 - ❖ **Cost is much less (0,1 million € per year)**

ARE WE FACING OUR RESPONSABILITIES ?

Some critical points about our experience

- ❖ **Such a soil quality monitoring network can provide an accurate photography of soil resource state for the national and european level of decision making**
- ❖ **But in many cases it will be difficult to quantify soil changes precisely and certainly before a long time ... far from political time !**
- ❖ **Modelling improvement requires the availability and improvement of other data bases (mainly land use changes)**
- ❖ **A major difficulty is that soil state data cannot be referred to official standard values**

ARE WE FACING OUR RESPONSABILITIES ?

How to do more and better ?

- ❖ **How to maintain production ability of soils is quite well known in Europe. Permanent adaptation to technology, crop systems, and climate changes is required**
- ❖ **Less is known about mantaining or improving some soil ecological services**
- ❖ **This allows to promote a long terme soil protection policy**
- ❖ **With the condition of beeing able to define targets, evaluate progresses and adapt soil management to local conditions**

CONCLUSIONS

- ❖ **More emphasis must be given to soil information systems development in Europe**
- ❖ **Monitoring soil quality systems are necessary supports of any soil protection policy**
- ❖ **Research must be sustained to increase the performance of such systems and reduce their costs**
- ❖ **But the progresses depend on a political impulse : recognize through soil management objectives that soil protection is a key issue for sustainable development at the global and continental levels.**



**THANK YOU FOR YOUR
ATTENTION**