Global soil monitoring: feasible options for early implementation

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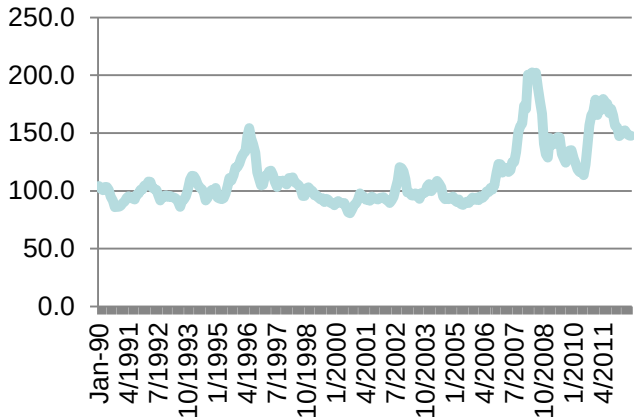
Summary

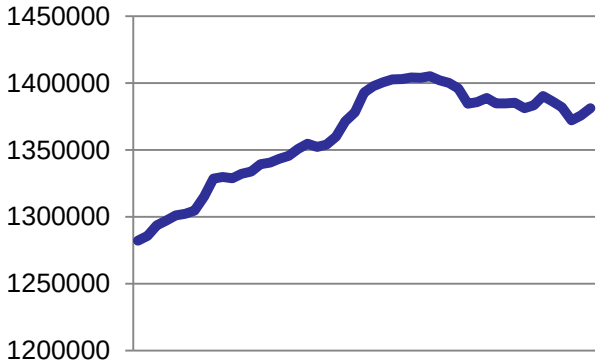
- Why is soil monitoring a global priority?
- What needs to be monitored?
- Technical options and their readiness
- Institutional requirements

Why is global governance of soil resources required urgently?

Cereals Price Index (FAO)



Global area of arable and permanent crops - 1961 to 2009 (10^3 hectares) (FAOSTAT)

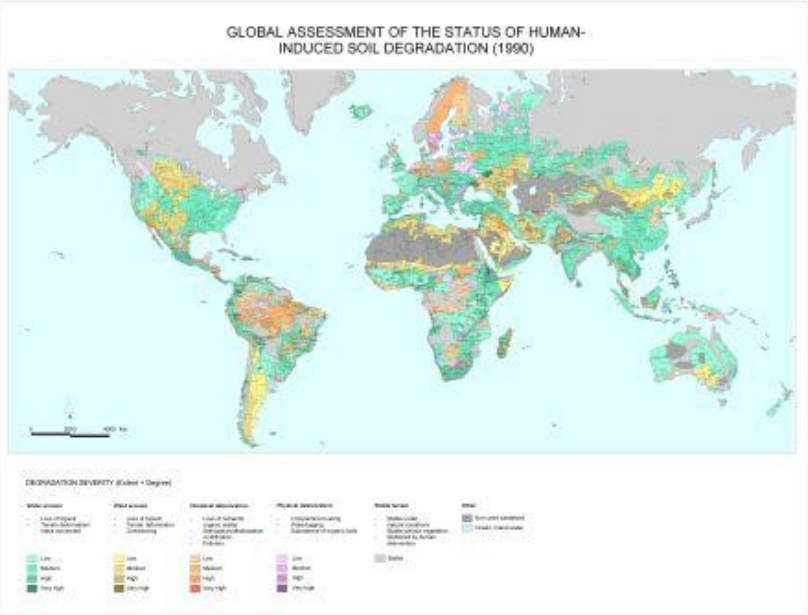


- Soil underpins the productive capacity of land.
- Demand for food (and biofuels) is rising and so are food prices.
- Global markets mean that losses of productive soil anywhere reduces food security for all.
- Therefore there is a requirement for global governance of soil resources.

Why is soil monitoring a priority?

- Unless degradation of soil resources is monitored, politicians will not be convinced that there are unacceptable risks to food security and invest in soil protection.
- Actions will not be targeted correctly without information on where soil resources are at most risk.

What is available already?



GLASOD (Global assessment of human-induced soil degradation) is the only existing global soil status report and dates from 1990

There is no reliable, comprehensive and up-to-date information on the state of and trends in global soil resources

Definition of monitoring requirements

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Key question:

"What is the status and what are the trends in the state of soil resources?"

- **Information is required on both the quantity of soil resources and their condition**

Reporting categories:
Global, continental, regional and countries

Reporting frequency:
Ideally, better than 10 years to match policy-making cycles

Quantity indicators

Issue	Availability
1. Agricultural land area	FAOSTAT
2. Agricultural area lost to infrastructure and built environment growth	Remote-sensed land cover data[1]

Areas of fertile soil are often most at pressure from urban growth

[1] For example see http://www.eea.europa.eu/articles/urban-soil-sealing-in-europe

Condition indicators

Type	Type of indicator	Example	Maturity
Health[1]	Measures (biological) system performance	Nitrification rate	Immature
Quality[2]	Measures that describe capacity to support specified services (e.g. agriculture)	Available phosphate	Mature
Degradation	Change linked to degradation processes	Rate of soil erosion by water	Mature[3]

[1]Kibblewhite et al (2008); [2]Karlen et al (1997); [3]Huber et al (2008)

Illustrative measures of degradation

Threat	Measure of harm	Units for risk estimation
Erosion (water and wind)	Loss of soil mass per unit area	t ha^{-1} y^{-1}
Decline in soil organic matter	Change in concentration (w/w) of soil organic carbon For peats and organic soils: change in carbon stocks	(g/ kg) y^{-1} t ha^{-1} y^{-1}
Compaction	Change in packing density	Mg. m^{-3} y^{-1}

What design options are there for a global soil monitoring network?

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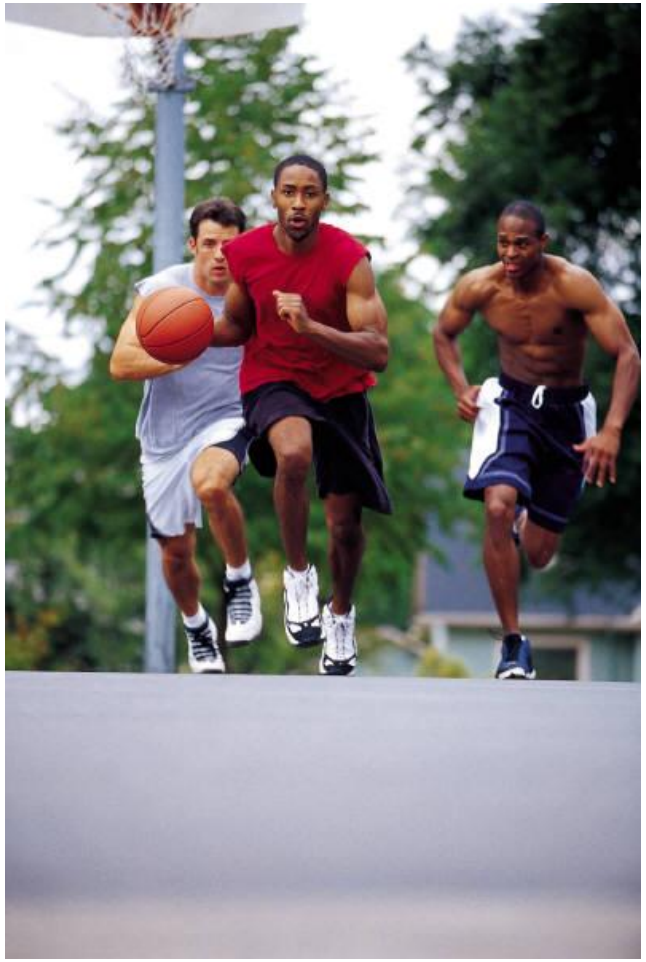
Option	Selection criteria	Commentary
Benchmark sites	Typical sites that may not necessarily be representative	High value for scientific studies but less so for policy development
Systematic (model)	e.g. regular grid	Design requires prior knowledge of variability; Imposes logistical requirements that may not be realistic
Random (design)	e.g. stratified random sampling with bio-geographical regions as strata	Offers resilience to logistical constraints;

Moving to concerted action



What is well-developed?

- Definition of indicators
- Many procedures and protocols for sampling, testing and reporting

Development priorities

- International operational coordination
- Agreement on sampling network
- National scientific capacities

Conclusions

- A global soil monitoring system is a strategic priority yet there is no well-founded scientific assessment of soil resources at the global level
- Scientific development of a soil monitoring system is advanced but urgent action is needed on developing:
  - International agreement on system design
  - Institutional capacity for global coordination
  - International and national investment