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Soil Carbon Assessment

Institute of Agricultural
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Influence of Soil Organic Carbon (SOC) on main soil functions

- soil fertility (plant nutrition)
- soil structure (soil physics)
- stability of aggregates (decreases the risk of soil erosion)
- water capacity
- catchment for pollutants (filter, buffer capacity)
- carbon storage (sink or source for CO_2)
- decomposition of org. matter / pollutants)

Soil C Losses due to Land Use Change

- Standard soil depth 30 cm
  = 2/3 (4/5) of total soil C stocks

- Soil C stocks: 45 % (25-60 %) of total forest C stocks

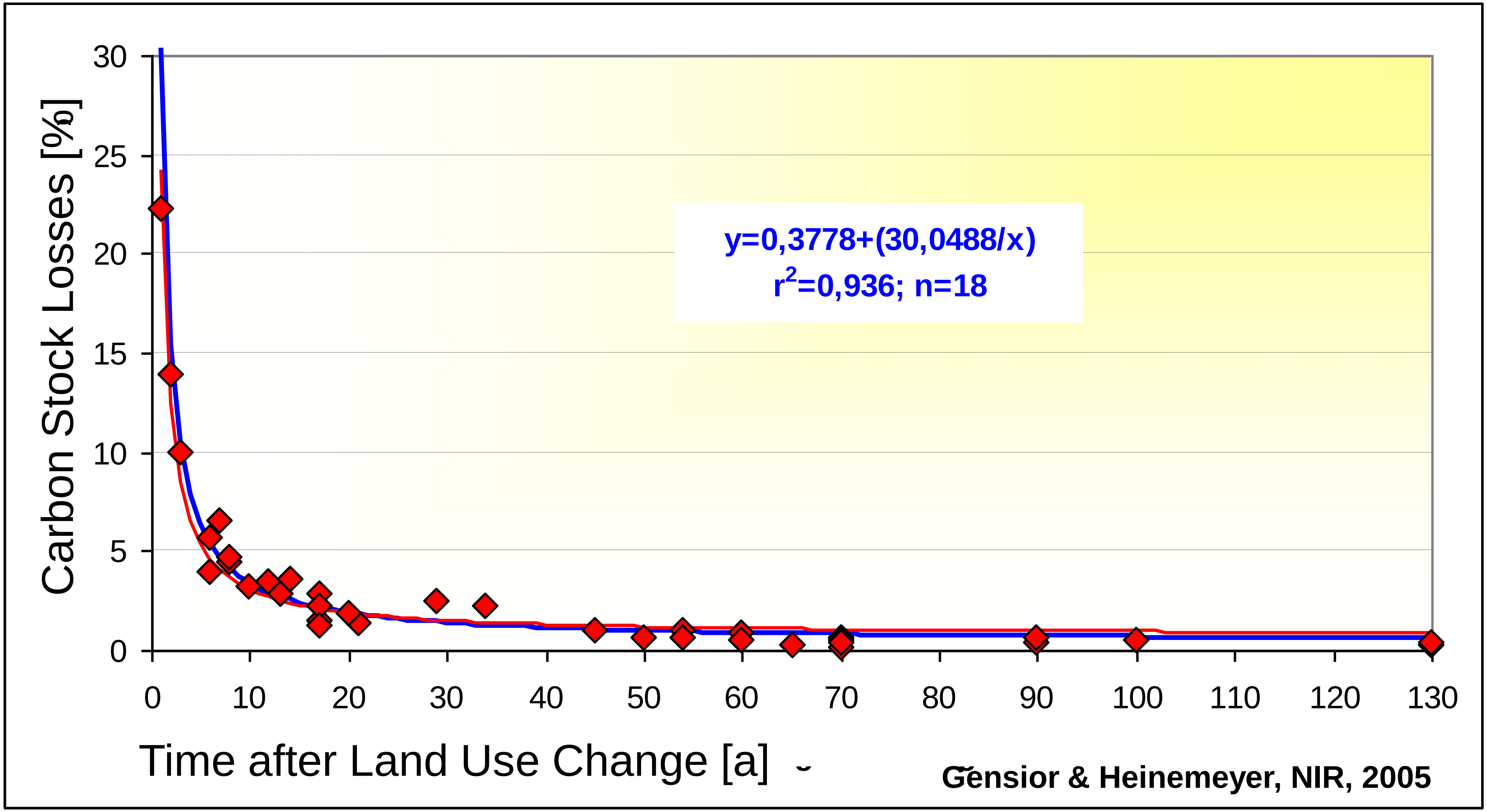
- C losses by deforestation

	average t C/ha
– 100% aboveground biomass	56
– 50%? belowground biomass	7
– 100% dead wood & litter	16
– 40% soil C	29
SUM	108

- Soil C losses account for >25-30% of total forest C loss

Marklund & Schöne, FAO 2006

Relationship between loss from initial soil carbon content and duration of land use change (grassland, perennial crops, fallow or forest to cropland)



Reporting GHG-Emissions from SOC

Best available quality of data must be used

3 quality levels of reporting

- Tier 1:
  - default soil C – content from table in IPCC - guidelines
  - only 5 different soil types worldwide
  - IPCC - tool

Reporting Emissions from Soil Organic Carbon

- Tier 2:
  - country specific emission factors (t C area^{-1}) and activity data (area) needed
  - differentiation of areas according to soil types and land management intensity

    e.g. use of soil map and a simple empirical

    C – turnover model

Reporting Emissions from Soil Organic Carbon

- Tier 3: (obligatory for key categories and Kyoto-reporting)
  - sophisticated stratification of land-use categories and sub-categories (e.g. wall to wall landregister (e.g. German ATKIS-B-DLM)
  - use of country-specific measurement-based approaches (e.g. SOC-monitoring: grid or stratified)
  - use of detailed and country-specific C-turnover models
  - highly disaggregated management data

German Soils 2005: Area (km^2), C-stocks (Tg) and CO_2-C Emissions (Tg)

2005	Germany	
	Mineral soils	Organic soils
Area (km^2)	338.995	18.098
C- stocks (Tg)	3.159	2.400
CO_2-C Emissions (Tg)	0,26	10,05

Soil Monitoring – Stratified Approach

Needs: soil maps, topographic maps, information on land use and management (e.g. LU-maps, remote sensing, land register etc.), vegetation maps or cover of vegetation etc.

- Intersection and combination of the different information sources to generate a map of country specific, representative land use-, soil- and management units
- Representative soil sampling for each unit
- Quantification of bulk density plus carbon content
- Extrapolation of the results (e.g. with a simple regionalisation model: $emissionfactor_{unit} * area_{unit}$)

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Soil Monitoring – Grid Based Approach

Needs: soil maps, topographic maps, information on land use and management (e.g. LU- maps, remote sensing, land register etc.), vegetation maps or cover of vegetation etc.

- Soil sampling using a regular grid (e. g. 4 x 4 km)
- Quantification of <u>bulk density</u> plus carbon content, optional other parameters
- Extrapolation of the results applying geostatistics, regionalisation models or other methods
- Calculation of carbon stocks

Comparison of both approaches

	Soil Monitoring	
	grid based	stratified
Expertise	+++	++
Costs	+++	+
Effort	+++	+
Results	+++	+
Uncertainties	+	+++

moderate: +
high:+++

Conclusions

- SOC is an important source of greehouse gas emissions, especially for peatlands (hot spots)
- Depending on soil type SOC losses can account for 25 to 100 % of total carbon losses due to Land Use and Land Use Change
- SOC losses from mineral soils mainly occour in the first ten years after LUC
- SOC losses from organic soils due to LULUC (drainage) are permanent
- SOC assessment is essential to climate change reporting and can be done even under restricted ressources

Thank You For Your Kind Attention!

Any questions to the expert?