One of the municipalities, near the Poznań city border. (www.geoportal.gov.pl)

Ex-post and ex-ante soil sealing maps (Poland)

Mapy procesu zasklepiania gleb (Polish)

DESCRIPTION

Ex-post and ex-ante soil sealing maps

The technology utilizes soil agricultural maps and provides information on quality of sealed soils.
It involves cellular automata software to build the model of land use change and produce the forecasts for various soil protection scenarios.
Spatial development of the functional areas. These are mostly areas of soil protection for food production purposes. The delineation is based on land productivity information (present on soil-agricultural maps), distribution of high nature value areas, need for establishment of "green rings" around the bigger cities.

The maps will be sent to the municipal authorities, with a scientific comment on the problem. The technology enables determining the scale of the soil sealing threat in the province, also what is the soil quality class of the area of interest. In the municipalities with the greatest soil sealing problem and with perspective to expand in the future, there is a need for new legal regulations to force soil protection in local spatial plans. The regional spatial planning office should become a coordinator for the local spatial planning offices, to raise the knowledge about how to use soil digital maps in spatial planning, especially in the case of protecting the soil against soil sealing process. For the municipalities, large scale maps are produced, which contain results of soil sealing forecasting model.

Land use maps of at least 10-meter resolution are produced for two historical periods through classification of the satellite images and using available local land use information. The information on land use change is superimposed on maps characterizing soil quality in order to detect to what extend the urbanization took place on valuable soils. The new sealed area, reflecting the built up sprawl of at least last 15 years, consists with expansion of the following land use classes: continuous residential area, commercial/industrial area and transport facilities. The soils under these new land use types fully lost their environmental functions. In the soil sealing forecasts the Cellular Automata-based Metronamica model is used. The software was developed and provided by the Research Institute from Knowledge Systems (RIKS) from Maastricht, The Netherlands. The software utilizes cellular automata model to spatially distribute areas of particular land use classes with assumption that the neighborhood of a cell (surrounding cells) influences the transition of this cell into other land use class in the next time step. The method utilizes land use maps and soil quality maps.

LOCATION

Location: Poznań, Poland/Great Poland province, Poland

No. of Technology sites analysed:

Geo-reference of selected sites
- 16.9, 52.399

Spread of the Technology: evenly spread over an area (199.0 km²)

In a permanently protected area?:

Date of implementation: less than 10 years ago (recently)

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☑ during experiments/ research
- ☑ through projects/ external interventions

CLASSIFICATION OF THE TECHNOLOGY

Main purpose
- ☐ improve production
- ☐ reduce, prevent, restore land degradation
- ☐ conserve ecosystem
- ☐ protect a watershed/ downstream areas – in combination with other Technologies
- ☐ preserve/ improve biodiversity

Land use

Cropland
- Annual cropping

Number of growing seasons per year: 1

- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [x] create beneficial social impact
- [x] Create and spread knowledge

Grazing land

Water supply
- [ ] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation
- [x] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

physical soil deterioration - Pu: loss of bio-productive function due to other activities

SLM group
- ecosystem-based disaster risk reduction
- Creating and sharing knowledge

SLM measures

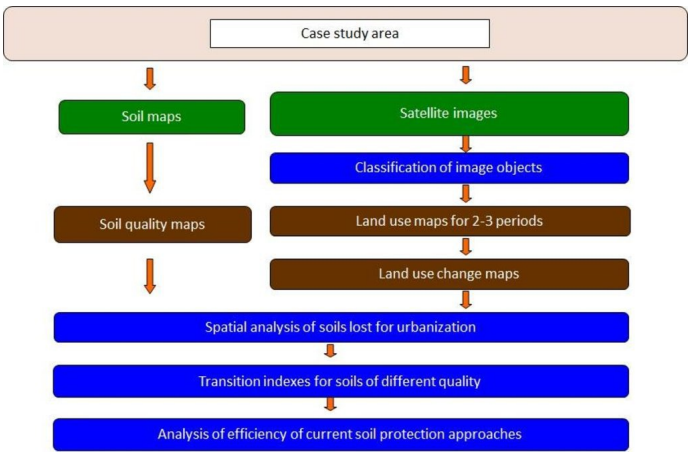
management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications
This is a schema for soil sealing maps developement.

Technical knowledge required for land users: moderate (Developers)
Technical knowledge required for Administration: high
Technical knowledge required for Researchers: high

Main technical functions: improvement of surface structure (crusting, sealing), increase of infiltration, spatial arrangement and diversification of land use
Secondary technical functions: improvement of water quality, buffering / filtering water
Change of land use type: Limited conversion of agricultural land into urban purposes.
Change of land use practices / intensity level: Steering new constructions to soils with less functions. Limited sealing of high quality soils.



ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs
- Costs are calculated:
- Currency used for cost calculation: **n.a.**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs
n.a.

Establishment activities
n.a.

Maintenance activities
n.a.

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Thermal climate class: temperate

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [x] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Ja
- [ ] Nee

Occurrence of flooding
- [ ] Ja
- [ ] Nee

Species diversity
- [ ] high
- [ ] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [x] employee (company, government)

Gender
- [ ] women
- [ ] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [x] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [x] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	good
education	poor	good
technical assistance	poor	good
employment (e.g. off-farm)	poor	good
markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts

fodder production

decreased — increased

comparing to baseline scenario

production area (new land under cultivation/ use)	decreased	increased	comparing to baseline scenario
irrigation water availability	decreased	increased	comparing to baseline scenario
irrigation water quality	decreased	increased	comparing to baseline scenario

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved	comparing to baseline scenario
recreational opportunities	reduced	improved	comparing to baseline scenario
SLM/ land degradation knowledge	reduced	improved	

Ecological impacts

surface runoff	increased	decreased
soil loss	increased	decreased
soil crusting/ sealing	increased	reduced
soil compaction	increased	reduced
habitat diversity	decreased	increased

Off-site impacts

water availability (groundwater, springs)	decreased	increased
downstream flooding (undesired)	increased	reduced

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Benefits compared with maintenance costs

CLIMATE CHANGE

-

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- 11-50%
- > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- 0-10%
- 11-50%
- 51-90%
- 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- Ja
- Nee

To which changing conditions?

- climatic change/ extremes
- changing markets
- labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

Strengths: compiler's or other key resource person's view

- Analysis of various scenarios possible
- Decisions in spatial planning based on empirical data in spatial format

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Lack of regulations forcing use of the technology Pressenting examples of implementation in order to encourage to apply at local level strategies
- Potential errors in forecasts Improving the data quality and model effectiveness.

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1716/

Linked SLM data
Approaches: The prevention of soil sealing https://qcat.wocat.net/af/wocat/approaches/view/approaches_2540/

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