Soil evaluation for planning procedures: providing a basis for soil protection in Alpine regions

Clemens Geitner & Markus Tusch

Abstract

The project "SEPP" (Soil Evaluation for Planning Procedures) is focused on the evaluation of soil and its natural functions as a basis for preventive soil protection in the Alpine space. It aims at providing ecologically relevant information on soils for regional planning. Tasks in the project include compilation, combination and evaluation of all existing soil data, GIS-based elaboration of concept soil maps from secondary data for areas where soil data is missing, the development of an automatised soil evaluation system, comprehensive tests of the system in the district of Kufstein, and suggestions for the practical implementation of evaluation results in regional planning.

Keywords: Alpine space, regional planning, soil evaluation, strategic environmental assessment

1 Introduction

The present paper introduces general concepts of the ongoing project SEPP (Soil Evaluation for Planning Procedures) funded by the Translational-Research-Programme (TRP) of the Austrian Science Fund (FWF) and carried out at the Institute of Geography, University of Innsbruck. The 3-years' project started in summer 2007. It aims at more effectively embedding soil conservation measures in planning practice and thereby at contributing to sustainable development in the Alpine space. Linking soil science and spatial planning requires a transdisciplinary approach to the subject. Consequently, a lively discourse concerning contents and methodology shall be held between all involved disciplines right from the start of the project. As the research objectives are located at the intersection of natural sciences and social sciences an integrative approach is useful. The occupation with a specific interrelation of man and environment makes the project a good example for the so-called "Third Pillar" of modern geography (e.g. Müller-Mahn & Wardenga 2005).

The public barely recognises the central role of soils in the ecosystem. This is also true for the Alpine space (Tusch et al. 2005) where soils are subject to very unique conditions and need special protection (Geitner 2007). The pronounced mountain topography implies that well developed soils are limited to very few locations in the Alpine space. Soil formation and regeneration are slower than in plain areas and are continuously disturbed by morphodynamic processes. Land use changes have more profound adverse effects on alpine soils than elsewhere. Hence soil conservation should be a major issue for spatial planning in the Alps (CIPRA 1998; Landeshaupt-stadt München 2006).

2 Motivation and aims

2.1 General

Starting point of this project as well as of various preliminary studies was the detected lack of adequate information about soils and soil quality. However, such information is important for the implementation of soil conservation measures in spatial planning as required by various legal regulations. Hence providing processed information on soils and to interpret evaluation results in close cooperation with planners and decision makers is a main aim of the project. Contents and quality of this information depend on the requirements for particular planning procedures and on the level of detail of input data.

2.2 Soil protection in spatial planning and preliminary work

Soil protection exceeding mere quantitative aspects – i.e. limitation of land consumption and sealing – has generally played a minor role in planning procedures so far. Soil was, if at all, only mentioned in Environmental Impact Assessment reports for major projects without spending much effort on taking a closer look at soil quality, except for contamination.

On municipal and regional level concepts and planning instruments for concerted soil conservation activities were already elaborated and applied in some German and Swiss cities and regions while other Alpine countries still lag behind (cp. Mosimann 1999, BUWAL 2001, Umweltbehörde Hamburg 2003, SenStadt Berlin 2006, Regionalverband Nordschwarzwald 2007).

The SEPP project team contributed to previous projects dealing with soil evaluation and spatial planning in the Alpine space (TUSEC-IP – cp. Landeshauptstadt München 2006, Tusch et al. 2007a) and to the "Thematic Soil Plan" for the City of Munich (cp. Geitner et al. 2007, Tusch et al. 2007b).

2.3 Legal requirements

2.3.1 Alpine Convention – Protocol on soil conservation

The Protocol on the Implementation of the Alpine Convention of 1991 in the Domain of Soil Conservation (CIPRA 1998) today constitutes the most important transnational regulation concerning soil protection in the Alpine space. It was signed by all statutory member states of the Alpine Convention and was ratified so far by Germany, Slovenia, Liechtenstein, France, Austria and finally also the European Union (in October 2006). The Protocol on Soil Conservation is focused on the economical and prudent use of soils and extraction of mineral resources (art. 7 and 8) in general, conservation of moors and wetlands (art. 9), the protection of soils against landslides, erosion and compaction by using sound practices in agriculture, pasture farming and forestry (art. 10–13) and the limitation of potentially harmful immissions (art. 15–17). Article 14 (effects of tourism infrastructures) is of particular relevance for proposed extensions of ski resorts. The stipulation that "permits for the construction and levelling of ski runs (...) are not granted for fragile

areas" recently led to the alteration of plans for ski runs for the upcoming Alpine Skiing World Championships in Garmisch-Partenkirchen (CIPRA 2007). In Austria, a precedent was set when both the Independent Environmental Council (*Unabhängiger Umweltsenat*) and the Supreme Administrative Court (*Verwaltungsgerichtshof*) ruled that article 14 is directly applicable international law and hence was the legal basis to dismiss plans for a development of the ski resort "Mutterer Alm – Axamer Lizum" (cp. BLFUW 2007).

2.3.2 German Federal Soil Protection Act

In 1998, Germany adopted the Federal Soil Protection Act (*Bundesbodenschutzgesetz* – BBodSchG 1998). In combination with the respective Ordinance it constitutes the most comprehensive soil-related law on national level in all Alpine countries. Even though intended purposes of the law are both the sustainable protection and restoration of soil functions it includes more detailed regulations about remediation of contaminated sites than actual preventive or precautionary soil protection measures. However, it also stipulates that *if soils are affected [by human activities] impairments of natural (ecological) soil functions and of the function as archive of natural and cultural heritage must be avoided as far as possible (BBodSchG 1998, Art. 1).*

2.3.3 SEA-Directive (2001/42/EC)

The "Strategic Environmental Assessment" Directive is intended for the assessment of the effects of certain plans and programmes on the environment in order to provide a high level of protection of the environment and to (...) promote sustainable development (European Communities 2001/42/EC, Art. 1). Soil is explicitly stated as part of the environment in Annex I and therefore has to be included in the environmental report, the core feature of Strategic Environmental Assessments (European Communities 2001/42/ EC, Art. 5 and Annex I). It contains, amongst others, a description of the current state of the environment, likely significant environmental effects of each reasonable planning alternative and measures to prevent and reduce adverse effects. Objectives of environmental protection (and thus of soil protection) stated in the Alpine Convention or its protocols respectively have to be taken into consideration in SEAprocedures (BLFUW 2007, 27).

3 Scope of work

Corresponding to the main objective of the project and to experiences from previous work four successive work steps can be distinguished (cp. Geitner & Tusch 2007): 1. Definition of evaluation criteria

- To meet the requirements of spatial planning, certain objectives must be specified in the run-up to the actual evaluation. Therefore a set of criteria relevant for soil evaluation should be defined in collaboration with planners.
- 2. Preparation of a pool of basic data For a specific work area all available data are collected, sifted through, checked for their applicability in the evaluation procedure, processed and amended if

necessary and possible. If no or only insufficient soil data exist for a certain area, methods to derive soil information from secondary data can be applied as an alternative or missing data must be surveyed in field work.

- 3. Application of evaluation procedures Taking evaluation criteria and available soil data into account adequate evaluation procedures are selected (and adjusted or improved, if required).
- 4. Implementation in test areas

The evaluation system will be implemented in the district of Kufstein. Besides a general evaluation of the entire territory three to four smaller test areas of approx. 5–10 km² are selected. It is intended to transfer methodological findings of the project to other areas within the Alpine space. Therefore locations covering a wide range of possible prerequisites concerning environment, land use and topical planning objectives are chosen. The latter is important because only by testing the system in "real life"-situations it is possible to practically experience the implementation of evaluation results in spatial planning and to improve suggested measures accordingly.

4 Methodology and data sources

4.1 Soil data

Most important sources of information for soil evaluation on the regional level are *soil maps* (or more precisely: maps of soil types) in scales from 1:5,000 to 1:50,000, which are available for open land in most Alpine countries. Accompanying booklets describe soil parameters for each horizon of profiles at representative locations.

In Austria and Germany, additional data can be obtained from the *land taxation* containing a register and detailed maps with information about the agrarian value of soils as basis for fiscal assessments. It includes information about natural fertility, climatic and hydrologic factors, and relief. Detailed registers of soil parameters from underlying mapping campaigns exist, but are usually not available for the public. *Forestal Site Maps* (1:5,000 to 1:50,000) also include information about the most important soil parameters. For Austria, these sources are presented and discussed in detail in a publication by the Austrian Society of Soil Science (Österreichische Bodenkundliche Gesellschaft 2001).

A major shortcoming of these high quality data sources is their limitation to agricultural areas, open land and forests. For soil evaluation in urban areas or high mountain regions usually no such sources exist and the necessary data either has to be derived from secondary sources or surveyed in soil mapping campaigns. Existing algorithms to derive soil information from secondary data (McBratney et al. 2003) or to interpolate mapped point data shall be tested with available datasets for the entire test area – district of Kufstein – or selected sections thereof.





Figure 1: Soil evaluation procedure exemplified for soil as a component of the water balance.

4.2 Soil evaluation

Soil evaluation for effective soil conservation tries to assess the ecological value of soils. This is actually an assessment of "potentials", i.e. the degree to which soil functions are fulfilled (cp. Hepperle & Stoll 2006). Standard evaluation algorithms use basic parameters to describe certain soil characteristics. These are combined according to defined methods to assess soil potentials. Figure 1 exemplifies this procedure for the function "soil as component of the water balance" in which one of several assessed potentials is the retention capacity for precipitation and surface run-off from adjacent sealed areas (Geitner et al. 2007, cp. BayGLA 2003). The plethora of existing soil evaluation methods are listed, described and compared e.g. in Ad-hoc-AG Boden (2003) and LABO (2003).

A major challenge for the project SEPP is the design of a flexible evaluation system to work with input data of varying scale, contents and level of detail and to give precise and target-oriented answers to a variety of planning questions.

5 Intended outcome

5.1 Soil evaluation system

A set of evaluation algorithms aiming at the soil functions listed in art. 1 of the *Protocol on Soil Conservation* of the Alpine Convention will be provided as part of a practical manual. As far as possible, existing algorithms shall be applied and adjusted to meet special requirements in the Alpine region. One important output of TUSEC-IP, the web-based evaluation tool ILSE (*Information on Land and Soil Evaluation* - see http://demo.grid-it.at/ilse) will be adopted, extended and improved in the current project. As a core feature of SEPP it shall comprise three major functionalities:

- flexible management of soil data, ideally using international standards,
- display of soil data in maps and tables allowing simple queries ("GIS-Viewer"),
- evaluation of (ecological) soil functions based on available or newly sampled soil data.

5.2 Planner guidelines

A practical guide book for end users will be developed and published after the project. It will include a discussion of the objectives of soil evaluation in general, a description of scopes and limits of the evaluation system, a manual explaining the applied algorithms and user guidelines for the evaluation tool.

Experiences from tests during the project will be portrayed to exemplify the implementation of the system in actual planning procedures. In addition, general suggestions will be given for possible fields of application like the elaboration of the environmental report in Strategic Environmental Assessments.

5.3 Thematic maps

For the district of Kufstein, the designated test area of the project, a set of thematic maps on a scale of 1:25,000 or 1:50,000 (depending on the level of detail of input data for the evaluation) will be elaborated. These will display evaluated soil potentials referring to the functions listed in the Protocol on Soil Conservation of the Alpine Convention along with additional soil-related information that might be interesting for planning practice. Maps showing the susceptibility or vulnerability of soils for erosion (cp. European Soil Thematic Strategy – European Commission 2006) or compaction, the rareness, and the hemeroby of soils are intended.

In the aforementioned smaller test cases practically useful results are sought after, so more detailed maps will be made and tangible suggestions for planning decisions will be given.

6 Outlook

Soil as a subject of protection still is of very little importance in planning procedures. According to planners it seems doubtful that this will change any time soon due to the vast number of other aspects (more) relevant in spatial planning. However, a legal framework already exists and calls for the consideration of soil characteristics for a variety of spatially relevant decisions (cp. CIPRA 1998). Being mandatory for the elaboration or alteration of most spatially relevant plans and programmes the Strategic Environmental Assessment (European Communities 2001/42/EC) seems to be a potentially powerful instrument to integrate soil conservation aspects in spatial planning at various levels.

The significance of soils in planning practice can be gradually increased by

- "hands-on" soil evaluation to meet planners needs,
- easily comprehensible presentation of general soil information and evaluation results,
- intensive communication of the comprehensive relevance of intact soils and soil functions.

Therefore one of the strategic aims of the project SEPP is to get in touch with a number of planning experts, to sensitise them for the importance of this "hidden resource" and to contribute to according soil its central strategic role in the discussion about sustainability.

References

- Ad-hoc-AG Boden 2003, Methodenkatalog zur Bewertung natürlicher Bodenfunktionen, der Archivfunktion des Bodens, der Gefahr der Entstehung schädlicher Bodenveränderungen sowie der Nutzungsfunktion "Rohstofflagerstätte" nach BBodSchG, Hannover
- BayGLA Bayerisches Geologisches Landesamt (Hrsg.) 2003, Das Schutzgut Boden in der Planung. Bewertung natürlicher Bodenfunktionen und Umsetzung in Planungs- und Genehmigungsverfahren München
- BGBI. I 1998 502, Gesetz zum Schulz vor schädlichen Bodenveränderungen und zur Sanierung von Altlasten (Bundesbodenschutzgesetz BBodSchG), Berlin
- BLFUW Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Hrsg.) 2007, Die Alpenkonvention: Handbuch für ihre Umsetzung. Rahmenbedingungen, Leitlinien und Vorschläge für die Praxis zur rechtlichen Umsetzung der Alpenkonvention und ihrer Durchsetzungsprotokolle, Wien
- BUWAL Bundesamt f
 ür Umwelt, Wald und Landschaft (Hrsg.) 2001, Bodenschutz beim Bauen. Leitfaden Umwelt 10, Bern
- CIPRA International Commission for the Protection of the Alps 1998, Protocol on the implementation of the Alpine Convention of 1991 in the domain of soil conservation. Protocol on Soil Conservation Bled, Schaan
- CIPRA 2007, "Alpenkonvention in Bayern erstmals berücksichtigt". (http://www.cipra.org/de/alpmedia/ news/2000), (10.09.2007)
- European Commission 2006, COM (2006) 231 final Communication From The Commission: Thematic Strategy for Soil Protection, Brussels
- European Communities 2001, "Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment", *Official Journal L 197*, 30–37
- Geitner, C. 2007, "Böden in den Alpen Ausgewählte Aspekte zur Vielfalt und Bedeutung einer wenig beachteten Ressource", in: A. Borsdorf & G. Grabherr (eds.), *Internationale Gebirgsforschung*, (IGF-Forschungsberichte, Bd. 1), Innsbruck/Wien 56–67 & 82–83
- Geitner, C. & M. Tusch 2007, "Bodenbewertung im Mittleren Massstab als Grundlage f
 ür den Bodenschutz in der Planungspraxis am Beispiel einer Testregion des Österreichischen Alpenraumes", Mitteilungen der Österreichischen Bodenkundlichen Gesellschaft 75 (in press)
- Geitner C., M. Tusch & J. Dittfurth 2007, Fachplan Boden der Landeshauptstadt München. Bewertung natürlicher Bodenfunktionen. Textliche Erläuterungen. Abschlussbericht des Projekts KATI (Konkrete Anwendung von TUSEC-IP), München
- Hepperle, E. & T. Stoll 2006, Ressourcenplan Boden. Ein Konzept zum planerisch-nachhaltigen Umgang mit Bodenqualität. Umweltwissen 0633, Bern
- LABO Bund/Länder-Arbeitsgemeinschaft Bodenschutz (eds.) 2003, Zusammenfassung und Strukturierung von relevanten Methoden und Verfahren zur Klassifikation und Bewertung von Bodenfunktionen für Planungs- und Zulassungsverfahren mit dem Ziel der Vergleichbarkeit, Hannover
- Landeshauptstadt München (eds.) 2006, Soil Evaluation in Spatial Planning. A contribution to sustainable spatial development. Results of the EU INTERREG III B Alpine Space Project TUSEC-IP, München/Bozen

McBratney, A., M.	. Mendonça Santo	s & B	. Minasny	2003,	"On	digital	soil	mapping",	Geoderma	117,
3-52										

- Mosimann, T. 1999, Integration des Bodenschutzes in die Raumplanung. Ziele, Konzept und Methodik zur Bestimmung besonders schutzwürdiger Bodenflächen am Beispiel des Kantons Basel-Landschaft, Liestal
- Müller-Mahn, D. & U. Wardenga (eds.) 2005, Möglichkeiten und Grenzen integrativer Forschungsansätze in Physischer Geographie und Humangeographie. Forum ift, Heft 2, Leipzig
- Österreichische Bodenkundliche Gesellschaft (eds.) 2001, "Bodenaufnahmesysteme in Österreich", Mitteilungen der Österreichischen Bodenkundlichen Gesellschaft 62, Wien
- Regionalverband Nordschwarzwald (eds.) 2007, Regionalplan 2015 Nordschwarzwald, Pforzheim
- SenStadt Berlin Senatsverwaltung f
 ür Stadtentwicklung der Stadt Berlin 2006, Digitaler Umweltatlas Berlin: 01.12 Bodenfunktionen, Berlin (http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/ia112. htm), (10.09.2007)
- Tusch, M., C. Geitner & J. Stötter 2005, "Soils in Urban Planning (Project TUSEC-IP). A Survey in Alpine City Regions", CABERNET: Proceedings of Cabernet 2005. The International Conference on Managing Urban Land, 395–401
- Tusch, M., C. Geitner, J. Stötter, S. Huber & A. Bartel 2007a, "Bodenbewertung in Stadtregionen des Alpenraums – Ergebnisse des Projektes TUSEC-IP", *Mitteilungen der Österreichischen Bodenkundlichen Gesellschaft 75 (in press)*
- Tusch M, C. Geitner & J. Dittfurth 2007b, "A Thematic Soil Plan for the City of Munich Scopes and Limits of Soil Evaluation in Urban Planning Procedures", *Proceedings of Real Corp 2007*, Vienna, 305–314
- Umweltbehörde Hamburg 2003, Großmaßstäbige Bodenfunktionsbewertung für Hamburger Böden Verfahrensbeschreibung und Begründung, Hamburg

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: <u>IGF-Forschungsberichte (Instituts für Interdisziplinäre</u> <u>Gebirgsforschung [IGF]) (Institute of Mountain Research)</u>

Jahr/Year: 2007

Band/Volume: 2

Autor(en)/Author(s): Geitner Clemens, Tusch Markus

Artikel/Article: <u>Soil evaluation for planning procedures: providing a basis for soil</u> protection in Alpine regions 287-294