Sustainable use of soil as a resource

National Research Programme NRP 68

Implementation Plan

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Content

What are National Research Programmes (NRP)?

Research carried out by National Research Programmes consists of research projects that contribute to the solution of contemporary problems of national importance. Under the provisions of Article 6, paragraph 2, of the Federal Act on Research of 7 October 1983 (version of 1 October 2011) the Federal Council se-lects the topics and foci to be researched in NRPs and mandates full responsibility for implementing the programmes to the Swiss National Science Foundation.

Article 4 of the Federal Ordinance on the Federal Act on Research of 10 June 1985 (version of 13 October 2011) describes the NRP funding scheme as follows:

"[1] National Research Programmes are a means to direct and support coordinated research projects that have a common goal. Where needed, National Research Pro-grammes should strengthen scientific research capacities.

[2] Topics of research are generally appropriate for National Research Programmes if:

a. scientific research on the problem is of national importance;

b. Swiss research can make a significant contribution to the resolution of the prob-lem;

c. solutions require research contributions from multiple disciplines;

d. the research goals cannot be met exclusively through basic research, through research within a specific section of the administration, or through industrial applications research;

e. research on the problem can be expected to produce research results that have practical applications within a five-year time period.

[3] The following criteria should be taken into consideration in setting forth the topics of National Research Programmes:

a. the programmes can provide the scientific basis for decision-making by govern-ment and the administration;

b. the programmes can be conducted with international collaboration and are also of great interest to Switzerland."

Summary

Fertile soils provide the basis for the production of food for humans and fodder for animals. Consequently, in addition to its role in production, soil has a variety of important functions. These range from providing protection against natural hazards to maintaining biological diversity. Moreover, soils substantially contribute to the regulation of nutrient and hydrological cycles. In Switzerland, land is a valuable commodity because it is in short supply. Demands placed on the resource "soil" and conflicting objectives about its use are on the rise. On the one hand, fertile soils are essential for agriculture and forestry. On the other hand, competition for land for housing, commercial use, tourism and transport have increased. In addition, more than ever before is soil subjected to the negative impacts of numerous environmental factors and increasing competition over land use.

The NRP 68 "Sustainable Use of Soil as a Resource" aims, by means of interdisciplinary cooperation, at improving our understanding of the processes occurring in the soil at the macro- and microscopic level, at quantifying its functions more precisely and at enabling a sustainable and resource-efficient soil management in Switzerland. More specifically, objectives are: (i) to improve the knowledge about soil systems, (ii) to develop tools for appraising soil as a resource, and (iii) to design concepts and strategies for a sustainable use of soil.

NRP 68 operates with an overall funding of CHF 13 million for a research duration of 5 years. Additionally, a maximum of CHF 4 million, to be shared between NRP 68 and NRP 69 "Healthy nutrition and sustainable food production", will be available for projects participating in the European Joint Programming Initiatives (JPI), such as "Agriculture, food security and climate change".

1. Introduction

1.1 What is soil?

The basis of crop production and thus the essential basic requirement for feeding people and animals is unspoiled, fertile soil. However, the importance of soil does not lie exclusively in its role as the indispensable production factor for agriculture and forestry but in a variety of functions. These include the maintenance of biological diversity (e.g. as the habitat for organisms), protection against natural hazards (e.g. by providing stability against erosion, particularly in alpine regions), hydrological balance functions (e.g. water storage), acting as a means of filtering out pollutants and as a long-term carbon sink. These functions are frequently undervalued. Soil functions are inadequately quantified and there is insufficient knowledge about their interaction.

Soil sciences traditionally include physics, chemistry and biology. Questions addressed there require a 3-dimensional perception of soil (soil considered in terms of m3). Questions dealing with land use are tightly linked to soil sciences, but also to the humanities and the social sciences. In the context of land use, a 2-dimensional perception is important (soil considered in terms of m2). In other words, soil has to be protected from a qualitative as well as a quantitative point of view. Soil is not just an important but, in densely populated Switzerland, also a scarce resource, particularly on the Swiss plateau. For decades and up to the present, more than 1 m2 of farmland has been lost every second (land use statistical data, 1992/1997; with a similar trend in 2004/2009),

mostly to housing and infrastructure development, which already account for 6.8% of the surface of Switzerland, but also to expanding woodland areas.

1.2 Challenges and stress factors

Currently, soil/land is under pressure from a variety of factors. These factors need to be taken into account to achieve a sustainable and resource-efficient management of soil. Examples of such challenges and stress factors are:

_ Increasing demand for infrastructure and logistics (e.g. roads, railways, power lines and cables)

_ Tourism and recreation (e.g. infrastructure in alpine areas)

_ Increasing need of land due to population increase und uncoordinated expansion of settlement areas (housing sprawl) and increasing need for living space (in terms of m2 per inhabitant)

_ Changes in soil usage (e.g. from agricultural to recreational, woodland expansion)

_ Erosion (e.g. in alpine areas) and soil degradation (e.g. through compaction, pollutant accumulation)

_ Pollution (e.g. atmospheric depositions, use of fertilisers and pesticides)

_ Energy production and energy provision (particularly bioenergy production)

_ Climate change (e.g. increased demand of irrigation)

1.3 Research field at national and international levels

In both the national and international context, research in the field of soil and land use focuses on understanding specific processes or on individual disciplines. Integrating basic science with a trend towards practical implementation, as proposed in NRP 68, hardly exists. None of the current NRPs or NCCRs focus on soil as a resource, although some of their subprojects may investigate elements also found in NRP 68 (e.g. the NCCR "Climate" and the NCCR "North-South", NRP 31 "Climatic Changes and Natural Hazards", NRP 54 "Sustainable Development of the Built Environment", NRP 61, "Sustainable Water Management", and the recently launched NRP 65 "New Urban Quality" and NRP 66 "Resource Wood").

The European FP7 projects as well as the COST initiatives and ESF networks are significantly more specialised. They only cover partial aspects of soil as a system without using the integrated methodology of an NRP and there is no implementation of the results foreseen, as in NRP 68. However on an international level, a good example of an integrative effort in a field related to the present NRP is GLOWA (www.glowa.org) which includes both physical research and research in the humanities and social sciences. Another initiative in the area of soils is LUCAS (www.lucas-europa.info), a project supervised by the DG EUROSTAT that monitors land use changes in Europe and Eco FINDERS (http://eusoils.jrc.ec.europa.eu/projects/ecofinders/), an EU-initiative which aims at implementing soil strategies for a sustainable use of soils.

Approximately 25 years ago, a National Research Programme (NRP 22) entitled "Use of Land in Switzerland" was initiated. Within this programme, strategies for a prudent use of land were developed and implemented. The main topic of former NRP 22 was "land use" in terms of spatial planning; "recommendations for an economical use of land" and a soil protection strategy were developed and implemented (e.g. the crop rotation strategic plan). However, in the meantime new challenges have emerged and the concepts for a sustainable use of soil/land have to be expanded. Hence, in contrast to NRP 22, soil quality aspects need to be integrated in NRP 68.

1.4 Mandate

On 30 March 2011, the Federal Council mandated the Swiss National Science Foundation (SNSF) to launch NRP 68. The National Research Council of the SNSF elected an ad hoc expert. This expert, in collaboration with the Research Council and the Administrative Office of the SNSF, organised a hearing comprising specialists from disciplines that were judged of relevance to the thematic of the programme. Based on the outcome of the hearing, the form and content of the programme was defined and summarised in the implementation plan of the programme. A Steering Committee will be established for the strategic management of the programme.

NRP 68 will operate with an overall funding of CHF 13 million for a research duration of 5 years. Additionally, a maximum of CHF 4 million, to be shared between NRP 68 and NRP 69 "Healthy Nutrition and Sustainable Food Production", will be available for projects participating in the European Joint Programming Initiatives (JPIs), such as "Agriculture, food security and climate change".

This implementation plan was approved by the Head of the Federal Department of Home Affairs on 09.12.2011.

2. The objectives of the programme

In order to rise above existing and new challenges as described under chapter 1.2, Switzerland urgently needs an integrated, sustainable and efficient system for the management of soil and land as a resource. Objectives of NRP 68 stem from insights gained from past experiences. These include the implementation of spatial planning legislation, the crop rotation strategic plan and various environmental legislations. Further insights to be taken into account include knowledge gained from soil monitoring by the federal government and cantonal authorities, and knowledge gained through a combination of approaches from the soil sciences, economics and socio-cultural studies.

The objectives of this programme are: (i) to improve the knowledge about soil systems, (ii) to develop tools for appraising soil as a resource and (iii) to design concepts and strategies for a sustainable use of soil. It is essential to note that the goals of this NRP can only be reached if far-reaching collaborations are initiated. In most cases, projects will require interdisciplinary approaches.

3. Main research topics

3.1 Research module 1: Knowledge about soil systems

Questions to be addressed in this module may include:

_ How does soil biodiversity influence terrestrial ecosystems and soil functions? Which agricultural practices support essential soil functions?

_ How does soil structure influence soil stability and natural hazards (e.g. land-slides, floods)? Are there any links between climatic change and erosion?

_ How will climate change affect and alter the regulating, protective and productive functions and adaptability of soils in Switzerland? Where and how large are sources and sinks for greenhouse gases?

_ How do changes in energy and resource policies influence the soil (e.g. a changeover to renewable energies such as biomass, increasing access to subterranean resources, increasing use of subterranean regions for infrastructure?)

_ How are soil functions and land use affected by population growth and increasing need for land for housing, commercial activities and transport in Switzerland?

_ How can different ecosystem services be compared with each other? How can the contribution of soil as a resource be assessed economically and politically in terms of commercial output, similar to marketable goods?

_ What impact do the use of soil and the forms of cultivation have on soil functions and vice versa (land use, forestation, etc.)?

_ How do soils and forests mutually impact each other?

_ How can land use models depict the urban system of Switzerland and explain land use both in its scope and in its spatial distribution? Which land use models can ideally complement the existing national traffic model and most accurately depict the reciprocal effects between settlement and traffic development. Can these models provide a base for the evaluation of spatial and traffic planning policies?

3.2 Research module 2: Tools for appraising soil as a resource

Questions to be addressed in this module may include:

_ What indicators are suitable for recording soil fertility, soil quality and changes in soil functions? Which indicators are suitable to be implemented in production systems (e.g. DPSIR indicators)? Are there any "early warning" tools?

_ How can soil quality issues be considered in planning procedures?

_ How can soil characteristics, quality and functions be mapped in a spatially explicit way (i.e. for an entire region)? How can current ecosystem mapping and prediction systems be improved? Can classification, qualification and validation systems be harmonised on a national and an international level?

_ Can we develop new and more timely methods for analysing and monitoring land use changes, including remote sensing techniques? Can we benefit from synergies with methods applied in Europe and globally?

_ How can past and present developments in urban, suburban and rural areas be analysed? How can we estimate the ecological, economic and social consequences of different development scenarios on soil structures and soil functions?

3.3 Research module 3: Concepts and strategies for a sustainable use of soil as a resource

Questions to be addressed in this module may include:

_ What fiscal incentives or market based instruments can be employed to take account of the ecological value of soils and to encourage careful and efficient handling of soil as a resource?

_ How to improve the interplay between spatial planning, energy and resource policy and qualitative soil protection? How to minimise the fragmentation of land?

_ Can we develop strategies to harmonise apparently conflicting goals such as biodiversity, fertility, land use, productivity?

_ Which policies can enhance quantitative soil protection, reduce the pressure of settlement development on soils and limit the extension of urban sprawl in a sensible and socially acceptable way?

_ How do socio-cultural aspects influence the perception of the problems and possible solutions?

_ Are existing ordinances appropriate to guarantee sustainable use of soil and land? Which of the existing regulatory frameworks should be maintained and which removed? Are there shortcomings? Can we design novel concepts?

_ What can and should be done on an international level (European Union, United Nations, international trade agreements, etc.)? What are the consequences of using fertile soils abroad (keyword "land grabbing")?

3.4 Types of projects sought and interdisciplinary collaboration

Examples of research questions listed under each of the research modules above (1 to 3) are not all-inclusive. Other topics of research are welcome.

The central focus of NRP "Sustainable Use of Soil as a Resource" is the increasingly scarce natural resource soil and the numerous functions soil fulfils. Soil function and soil use must therefore be the core business of each project submitted.

Projects submitted may address soil either as a two dimensional (e.g. land use, quantitative soil protection viewpoint) or as a three dimensional entity (e.g. soil functions, qualitative soil protection viewpoint), or combine the two approaches.

NRP 68 aims, by means of interdisciplinary cooperation, at improving our understanding of the processes occurring in the soil at the macro- and microscopic level, at quantifying and qualifying its functions more precisely, and at defining ways to manage it sustainably and in a resource-efficient manner. Therefore, inter- and multidisciplinary projects are strongly encouraged. Projects falling within more than one of the research modules described above (1 to 3) will be given preference (Fig. 1).

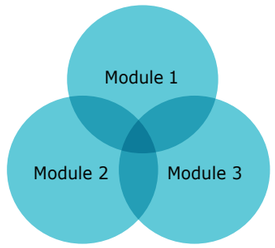

Fig. 1: Projects: module-specific projects may be submitted. However, interdisciplinary projects that cover questions from two or three modules and are thus positioned at the intersections will have funding priority.

The programme will include a number of schemes to promote collaboration among investigators and to endorse coordination of the research efforts towards the goals of the programme. Schemes available are yearly scientific events, and/or workshops, and/or summer schools. The structure and contents of the schemes will be decided by the Programmes division of the Research Council of the SNSF, on the recommendation of the Steering Committee of the programme.

4. Practical significance and target group

Soil as a resource plays a major role in many professional areas. Stakeholders engaged in Swiss agriculture and forestry, those involved in land development and those active in the area of environmental protection will be highly interested in the results from NRP 68. Since Switzerland is characterised by densely populated areas and scarce land resources, the results of NPR 68 will serve as a basis for sustainable decision-making processes. Basic data and its implementation must ensure that the country's fundamental diversity, which stems from its wide range of climate, geology, topography, vegetation cover, cultural habits and socio-economic aspects, is respected. Understanding the effects of environmental changes, the effects of changes in land use, and the effects of natural hazards on soil and soil's ecosystems is essential for a sustainable management of soil functions, for risk assessment, for structural, institutional and financial investments as well as decision-making.

In order to implement the results of NRP 68 it is particularly important to adopt an interdisciplinary approach. This is the only way to test the applicability and effectiveness of the new concepts and techniques.

5. Programme specificities

Switzerland joined in with several European Joint Programming Initiatives (JPIs), among others with the initiative entitled "Agriculture, food security and climate change" (FACCE JPI). Some of the main objectives and core topics of the initiative are partially related to the objectives and topics of NRP 68.

NRP 68 may answer calls from the FACCE JPI or other JPI initiatives, provided that the thematic of the JPI call fits with the overall goals of NRP 68. Specific funding is available to support projects with Swiss partners within the European initiatives.

NRP 68 will be implemented in two phases. After the initial 36 months, project funding may be continued for a maximum of 24 months. This second phase will include continuation of research activities focusing on Swiss soil specificities. In addition, during this second phase, NRP 68 research groups may participate in research initiatives and calls within the FACCE JPI and other JPI initiatives. Since timing between the JPIs and NRP 68 is not synchronised, participation in JPI calls may also take place during the first phase of NRP 68.

A maximum of CHF 4 million, to be shared between NRP 68 and NRP 69 "Healthy Nutrition and Sustainable Food Production", will be available for projects participating in the European JPI. Participation in the FACCE JPI and other JPI initiatives will be decided by the Programmes division of the National Research Council of the SNSF, on the recommendation of the Steering Committee of the programme.

Projects submitted to the JPI initiatives will be funded provided that the thematic of the call is pertinent for Switzerland and fits with the overall goals of NRP 68. Successful participants will adhere to the regulations and implementation regulations of the NRPs and of NRP 68 in particular.

Information on the FACCE programme and on current and future calls for proposals is available on the programme's website (http://www.faccejpi.com/).

6. Submission procedure

The implementation plan as well as the relevant instructions, regulations and forms for submission of proposals via the *my*SNF portal can be found on the website of the SNSF: www.snsf.ch. The implementation plan in English is the binding basis to compose pre- and full proposals. The French and German releases are translations of the English version.

A two-stage submission procedure will be implemented: pre-proposals are to be submitted first, followed by full proposals. Both the pre- and the full proposals must be submitted in English since they will be evaluated by internationally recognised experts.

Pre- and full proposals must be submitted online via the *my*SNF portal. For submission via the *my*SNF portal, user-registration is needed and can be obtained from the homepage of the *my*SNF website: www.mysnf.ch. User accounts obtained in the past should still be valid and provide access to all the funding instruments of the SNSF.

New user accounts must be opened at least two weeks before the submission deadline so that proposals can be submitted in good time. The submission of proposals by postal delivery is only accepted in exceptional cases after consultation with the SNSF.

Research projects must adhere to SNSF guidelines and must be limited to a period of no more than 36 months. Based on the evaluation of interim reports, the Steering Committee of the programme will decide whether individual projects can be extended for a maximum of 24 months.

Collaboration with research groups in other countries is encouraged if the planned cooperation brings significant added value or substantially enriches Swiss research in

terms of content or methodology. The SNSF has signed agreements with various governmental funding agencies for this purpose. More information on these agreements can be found on the website www.snsf.ch. The Austrian Science Fund (FWF) has confirmed that it will cooperate in NRP 68 projects within the framework of the D-A-CH agreement. However, based on a decision by the German research foundation (DFG), the D-A-CH procedure with partners from Germany is not applicable to NRP 68.

6.1 Pre-proposals

Pre-proposals should provide information on the following points:

A. To be submitted online, using the predefined form:

_ Basic data and abstract

_ National and international cooperations

_ Estimation of financial support required for salaries and running costs (budget).

B. To be submitted as uploaded PDFs on the *my*SNF platform:

_ Research plan

· Research hypotheses and objectives of the project

· State of research

· Methodology

· Timeframe and milestones

· Possible applications of results

· References

_ For each applicant: a CV and list of the five most relevant publications in the area of the proposal (maximum 2 pages each).

The project description mentioned above must be submitted using the template to be found on the *my*SNF portal. The project description must be in English. The PDF file should not exceed six pages, including the cover page.

The pre-proposals are evaluated by a panel composed of international experts. This panel proposes a selection of applicants to be invited for submission of a full proposal. This list will be submitted for approval to the Programmes division of the National Research Council.

The deadline for submission is 22 March 2012.

6.2 Full proposals

In a second stage of the submission procedure, the Research Council will invite the authors of the selected pre-proposals to submit detailed full proposals online via the *my*SNF portal (see above). Proposals must adhere to standard SNSF rules and guidelines.

All full proposals will be subjected to international peer review. Principal investigators will be invited to present their projects to the Steering Committee of the programme, which is to be composed of members of the panel. Following the evaluation procedure, the Steering Committee of the programme will select the projects to be recommended for approval or rejection by the National Research Council (Programmes division, Presiding Board).

Research in the approved projects must not start later than six months after the date of the ruling.

6.3 Selection criteria

The Secretariat of the Programmes division will check whether the proposals satisfy the formal criteria such as completeness of application, adequate formal presentation and submission by the deadline. Applications that do not satisfy these formal criteria will not be processed further.

Pre- and full proposals will be reviewed on the basis of the following criteria:

_ **Scientific quality and originality:** pre- and full proposals must fulfil international state-of-the-art criteria with respect to scientific quality and originality as well as methodology.

_ **Feasibility and compliance with the goals of NRP 68:** proposals must reflect the programme's objectives, selection criteria and comply with its overall framework.

_ **Application and implementation:** National Research Programmes focus on objectives leading to potential practical applications. For this reason, projects with practical relevance are given priority.

_ **Personnel and infrastructure:** projects have to be carried out within a framework that provides adequate infrastructure and personnel.

6.4 Schedule and budget

At present, the following schedule is envisaged for NRP 68:

Call for pre-proposals	12 January 2012
Submission of pre-proposals	22 March 2012
Invitation to submit full proposals	from 13 June 2012
Submission of full proposals	4 September 2012
Final decision on full proposals	December 2012
Start of research	January 2013

Total funds of CHF 13 million are available for this NRP with a research duration of 5 years. The provisional allocation of this funding between the different research modules and administrative activities is as follows:

Research module 1	± CHF 3.8 million
Research module 2	± CHF 3.8 million
Research module 3	± CHF 3.8 million
Implementation, workshops and administration	± CHF 1.6 million

Additionally, a maximum sum of CHF 4 million, to be shared between NRP 68 and NRP 69 "Healthy Nutrition and Sustainable Food Production", will be available for projects participating in the JPIs - such as "Agriculture, food security and climate change".

6.5 Contacts

For questions regarding the submission of pre-proposals and full proposals, please contact the programme coordinator: Pascal Walther, nfp68@snf.ch or 031 308 22 26.

For questions concerning salaries and eligible costs, please contact the Head of Finances, Marcel Schneider: mschneider@snf.ch or 031 308 22 22.

Technical help with *my*SNF and electronic submissions

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7. Organisation

Steering Committee of NRP 68
President

Professor Josef Zeyer, Institute of Biogeochemistry and Pollutant Dynamics, ETH Zurich

(5-6 members)

The members of the Steering Committee will be elected after the evaluation of the pre-proposals.

Delegate of the Programmes division of the National Research Council

Professor Thomas Bernauer, Center for Comparative and International Studies, ETH Zurich

Programme Coordinator

Dr Pascal Walther, Swiss National Science Foundation (SNSF), Berne

Head of Knowledge Transfer

TBA

Representatives of the Swiss Federal Administration

Professor Daniel Wachter, Federal Office for Spatial Development (ARE)

Dr Christoph Wenger, Federal Office for the Environment (FOEN)

Dr Roland von Arx, Federal Office for the Environment (FOEN, deputy representative)

For the State Secretariat for Education and Research (SER)

Dr Claudine Dolt, Berne