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**An analytical framework for soil degradation, farming practices,  
institutions and policy responses**

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## **ABSTRACT**

There is a lack of knowledge about the effectiveness and efficiency of soil conservation policies in agriculture and little understanding of how policy measures should be designed to encourage farmers to adopt soil conservation practices. This paper analyzes institutional settings surrounding agricultural soil management in ten European countries based on the Institutions of Sustainability framework. This framework considers the interdependencies between ecological and social systems, taking into account environmental conditions, farming practices impacting on soil conservation, different types of actors, policies, institutions and governance structures. The purpose of this paper is to describe the analytical framework and the methodology that all case studies are based on, present and discuss compared findings, outline implications for successful soil conservation policy, and draw conclusions on the methodological approach. The case studies focused on the main soil degradation types occurring across Europe which are addressed by a broad range of mandatory and incentive policies. The findings highlight the following issues: i) the need to design policies that target the locally most common soil threats and processes in the light of agricultural management; ii) the need to take farming management constraints into consideration, (iii) the need for good communication and cooperation both between agricultural and environmental authorities as well as between governmental and non-governmental stakeholders; iv) the necessary mix of mandatory and incentive instruments; and v) the need for data and monitoring systems allowing the evaluation of the effectiveness of policies and soil conservation practices.

## **KEYWORDS:**

Institutional analysis, soil degradation, soil conservation policy, soil conservation measures, farming practices, policy evaluation

## **Introduction**

There is a lack of knowledge about the effectiveness and efficiency of soil conservation policies in agriculture and little understanding of how policy measures should be designed to encourage farmers to adopt effective soil conservation practices. Studies on factors influencing farmer adoption of soil conservation practices (Sattler and Nagel, 2008; Franco and Calatrava, 2008; Ryan et al., 2002; Smit and Smithers, 1992), did not discuss the link the acceptance of practices with the most appropriate policy measure to encourage farmer adoption.

Research on adoption barriers to AES (Agri-environmental schemes as an incentive-based instrument) (Falconer, 2000; Barreiro-Hurlé et al., 2008) and factors influencing participation or willingness to participate in schemes (Defrancesco et al., 2008; Vaslembrouck et al., 2002; Morris et al., 2000; Wynn et al., 2000; Wilson 1997) connect the adoption of agri-environmental measures with the particular requirements of the schemes, application procedures, contract administration and prescribed measures, all resulting in transaction costs for the farmer. As the schemes are voluntary they only cover a limited share of the total agricultural area. Research has also been conducted which focuses on the cost-effectiveness of both voluntary and mandatory soil conservation

policies (Schuler and Sattler, 2010; Schuler et al., 2006; Yang and Weersink, 2004; Fox et al., 1995).

Mandatory policies are the other option to approach soil conservation issues. They apply to all farmers and agricultural enterprises, regardless of their preferences. Winter and May (2001) identify and test a number of factors that foster compliance with environmental regulations. Work on the theory of regulation emphasizes the importance of the legitimacy ascribed to a regulation in determining the effectiveness with which it can be implemented (Davis and Hodge 2006).

Another of policy option are awareness-raising and communication measures which aim at increasing sensitivity to soil degradation processes and conservation practices. They involve advisory and information services. They may accompany incentive or mandatory policies – often designed to support the implementation of these policies – or they may be separate initiatives (Knierim, 2007).

However, there are no studies available with an integrated view on both the agronomic, environmental, economic and institutional performance of soil conservation policies. Against this background, this paper reports on the findings of ten case studies carried out across Europe.

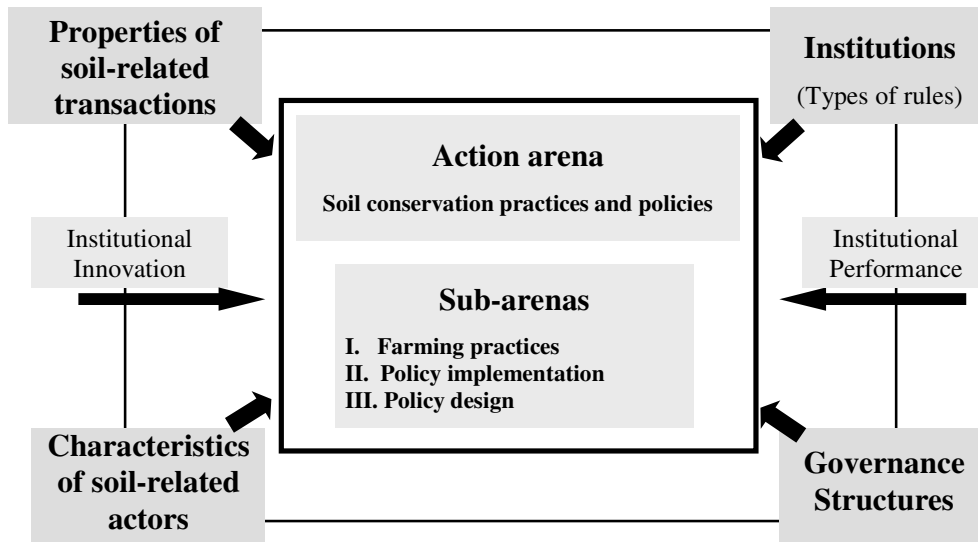
The case study areas are located in Belgium, Bulgaria, the Czech Republic, Denmark, France, Germany, Greece, Italy, Spain, and the United Kingdom (UK). With the exception of Denmark and Italy, the individual cases are discussed in the special issue “The Challenge of Developing Effective Soil Conservation Policies” in “Land degradation and development” (Barbayiannis et al. 2011; Calatrava et al. 2011; Penov et al. 2011; Posthumus et al. 2011; Prager et al. 2011a; Prazan and Dumbrovsky, 2011; Prosperi et al. 2011; Verspecht et al. 2011). These papers discuss soil management and soil conservation policies in nine specific contexts, highlighting major insights from the individual case studies. Therefore, some papers place the focus on institutional aspects of soil conservation while others emphasize the suitability of particular practices and technical measures to mitigate soil degradation.

The purpose of this paper is to describe the analytical framework and the methodology that all case studies are based on, and draw conclusions on the methodological approach and requirements for successful soil conservation policy based on the case study results (see also Louwagie et al. 2011). This paper analyzes institutional settings surrounding agricultural soil management in different European countries and discusses the factors that influence farmer adoption of soil conservation practices, thereby shedding light on the impact of soil conservation policy on farmer adoption of soil conservation practices.

## **Theory: A common analytical framework**

As outlined above, soil degradation is not only an ecological problem but also an institutional problem. We regard the issue of soil degradation as a problem of institutional change that needs to be addressed from a multidisciplinary perspective. The concrete research, in turn, needs to be guided by a common framework that takes the interdependencies between ecological and social systems into account. The Institutions of Sustainability (IoS) framework captures the complexity of determinants affecting soil degradation and soil conservation. It has the capacity to provide a systematic frame for

analyzing and understanding the diverse issues and relationships that play a role in soil degradation and conservation. It also serves to integrate the diverse research approaches deriving from soil science, farm economics, political science, and institutional economics (Ehlers, 2008; Theesfeld, 2005; Schleyer, 2004; Sikor, 2004).



**Figure 1: The IoS Framework as adapted for the analysis of soil conservation policy** (source: adapted and extended from Hagedorn et al., 2002; Hagedorn, 2008)

Agricultural practices can both increase or mitigate soil degradation. Soil degradation and soil conservation depend on the choices actors make, especially in three interrelated action arenas (see Figure 1). We follow Ostrom’s concept of action arenas as the focal point of analysis in the Institutional Analysis and Development (IAD) framework (Ostrom 2005). As the overall action arena we defined “Soil conservation practices and policies”. The actions relevant for soil conservation and degradation take place in three sub-arenas:

- I) at the farm level (e.g., a farmer deciding to adopt a particular soil conservation practice),
- II) at the level of policy implementation (e.g., agricultural or environmental administrations implementing a particular procedure to monitor farmers’ compliance with a restriction in soil use), and
- III) at the level of policy design (e.g., policy makers at EU, national, or regional level defining concrete restrictions in land use in nature protection zones or determining the set of agri-environmental measures to be offered in a region).

Four key exogenous factors are identified by the IoS that influence every action situation by shaping the situational context and, largely, determine its outcome: 1) the properties of the transactions that are induced or prevented in the action situation (including the bio-geophysical conditions), 2) the characteristics of the actors involved in the action

situation, 3) the institutions (i.e., sets of rules or property rights), and 4) the governance structures in place to make the rules effective. Which institutions and governance structures emerge depends on the properties of transactions and the characteristics of actors. The four exogenous factors are interconnected and also influence each other (Hagedorn, 2008; Prager, 2010).

## **Methodology**

Based on the distinction made between technical soil conservation measures (such as farming practices beneficial for soils and specific soil conservation measures) and policy measures (including institutions, instruments, and governance structures) we operationalized the analytical framework set out in Figure 1. Literature and document analyses were complemented with a stakeholder survey and expert interviews in order to generate primary quantitative and qualitative data. The survey required questionnaires whose design was guided by the translation of the research clusters and operational steps A-I.

The most important actors for implementing conservation measures are actors in the Farming practices arena (I) (e.g. farmers, family farms, farming companies or cooperatives. Farm extension or advisory services if privately organized). Actors involved in policy implementation and policy design (arena II and III) (e.g. policy makers and administrators from environmental agencies, nature conservation agencies, local/regional government and agencies involved in local level policy delivery, authorities responsible for implementation of rural development policies, the Ministry of Agriculture, the Ministry of the Environment, other national or federal agencies or institutes dealing with agriculture or the environment, advisory services if organized by the state). Across the three arenas there are actors that are part of groups or organizations in civil society (e.g. agricultural associations, farmers' unions, farm extension services if organized by a civil society group, environmental and nature conservation NGOs, monitoring bodies e.g. rural monitoring organizations, land consolidation organizations, irrigation associations, research institutes, the policy evaluation community, policy experts, privatization agencies and land funds). The perception of these actors regarding the urgency of soil degradation will influence what type of policies is designed and how they are implemented and administered (including monitoring, enforcement and sanctioning). Questionnaires were designed for these three categories of actors. The questionnaires had a modular structure allowing them to be adjusted to the position and expertise of the respective interviewee. The majority of questions were open ended, thus allowing for a qualitative analysis of the responses.

Scientific experts on soil conditions and farming practices were asked to fill in a detailed survey form with quantifiable data. The information comprised data on the technical inputs and outputs of farming practices, their cost and benefits, an expert-based estimation of the soil degradation effects of each practices and regional adapted estimations on the effects of soil conservation measures. Based on this data, the differing effects of similar farming practices under different regional conditions were highlighted. The data served also as an input for further recommendations in the overall project.

## Results on policies, institutions and governance structures

The case studies provided a review of all relevant policy measures with an impact on soil conservation in the locality. Following the above mentioned categories on the categorization of the EU-wide policy review (Kutter et al., 2011), the measures discussed below are divided into three broad groups (i.e. mandatory measures, voluntary, incentive-based measures and advice and awareness-raising measures). In the following we want to focus on the category of mandatory measures (Table 1). For a full overview, see Prager (2011b).

The European framework of regulatory policies and incentive policies applies to all case studies. In addition, countries have their own policies relevant to soil conservation. The great majority of policy measures apply at the national or regional level; few are targeted solely at the case study areas themselves. A significant proportion of the national or regional measures have been introduced in response to EU environmental legislation or agricultural policy.

**Table 1: Summary of policy instruments significant for soil conservation in the ten case study areas (mandatory measures)\***

Mandatory policy measures		
EU legislation	National legislation	Regional legislation
Cross compliance (Council Regulation (EC) 1782/2003)	Cross compliance GAEC measures (more important in GR, ES, UK, FR, DE, IT)	
Nitrates Directive (91/676/EEC)	National implementation of the Nitrates Directive (CZ)	
	Action Program for Nitrate Vulnerable Zones (IT)	
	Manure Decree (C-2006/ 37097) (Belgian transposition of the Nitrates Directive)	
	Fertilization Ordinance (German transposition of the Nitrates Directive)	
	Royal Decree 261/1996 (Spanish transposition of the Nitrates Directive)	
Water Framework Directive (2000/60/EC)	Law 62/2003 that modifies the Water Law (Royal Decree 1/2001) (ES)	
	Water Resources Act (German transposition of the Water Framework Directive)	<ul style="list-style-type: none"> <li>• Brandenburg Water Management Act (DE)</li> <li>• Brandenburg Waters Classifications Act (DE)</li> </ul>
	Well Registration (BG)	
	Aquatic Action Plan III (2005-2015: DK)	
Habitats Directive (92/43/EEC)		
Sewage Sludge Directive (86/278/EEC)	Decree 1310/1990 (Spanish transposition of the Sewage Sludge Directive)	
	Sewage Sludge Directive (German transposition)	
Plant Protection Products Directive (91/414/EEC)	Plant Protection Products Directive (German transposition)	

Mandatory policy measures		
EU legislation	National legislation	Regional legislation
Groundwater Directive (80/68/EEC)		
Council Regulation (2092/91/EEC) on organic production of agricultural products	Common Ministerial Decision 245090/10-2-06 (GR)	
	<ul style="list-style-type: none"> <li>• Water User Association Act (N34/2001, BG)</li> <li>• National Environment Monitoring System, established under the Law for Preservation of Environment (Prom. SG. 91/25 September 2002, BG)</li> <li>• Law on Soil Protection (334/1992, CZ)</li> <li>• Law on Land Consolidation and on Land Settlement Boards (139/2002 Coll. and 309/2002, CZ)</li> <li>• National Action Program to fight against desertification (August 2008, ES)</li> <li>• Federal Soil Protection Act (DE)</li> <li>• National decree 'Zones under environmental constraints' (FR)</li> </ul>	<ul style="list-style-type: none"> <li>• Erosion Decision (07/12/2001 of the Flemish Government; BE)</li> <li>• Brandenburg Nature Conservation Act (DE)</li> </ul>

\* As identified in the case study reports

To implement the rules and instruments described above, governance structures are required that enforce the compliance of actors with the rules set out in the policies. The governance structures relating to extension and learning opportunities play an important role: The effectiveness of nearly all mandatory and incentive measures appears to be enhanced if they are supplemented and backed up by advice and technical support, not least because it encourages the buy-in of stakeholders – including farmers, input suppliers and crop purchasers – and stimulates farmer uptake and longer-term behavioral change. The performance of advisory organizations varies between the case studies, as well as between the respective policy measures that organizations are implementing.

To summarize the soil policies framework, policies create or affect institutions (sets of rules) and instruments (direct interventions), in some cases also governance structures. The regulatory policies described above can be characterized as formal institutions, i.e. the rule has been designed intentionally, there is an enforcement agency, and it is an explicit rule. These institutions are designed at the European level and transposed into national law (which usually entails the creation of a corresponding national law or regulation), or they are designed at the national level or even regional level (in states with a federal structure such as Germany and Belgium). Agri-environmental schemes are direct interventions and impact on farmer behavior directly by providing payments for a certain action or behavior (maintaining soil cover, or not ploughing). Schemes are designed at the national (regional) level in accordance with the European framework (EAFRD regulation). Advice and awareness-raising measures are in some cases incorporated in a formal institution (such as a grant scheme). In other cases they are separate organizational structures that exist independent of soil conservation policies but may be used as a governance structure to implement soil-related institutions.



## **Discussion: Effectiveness of policies for soil conservation (mandatory measures)**

The case studies provide a predominantly local or regional perspective on policy effectiveness, generally based more on the views of stakeholders rather than formal evaluations. Such evaluations are uncommon, partly because of the limited availability of data on changes in soil conditions over time or on policy impacts, either nationally or locally. We could not refer to any internationally comparable time-series or cross-section data on decision-making in soil conservation policy. Data on the institutional and environmental performance simply do not exist. Collecting precise data on decision-making structures, public transaction costs, and environmental utility losses in each of the 10 case study areas would have been too costly in terms of time and resources.

We therefore opted to use stakeholders' perceptions and preferences as a basis for the empirical analysis of institutional performance, and institutional innovation. Saleth and Dinar (2004: 125-153) provide a detailed discussion on using such data in institutional analysis.

There was some evidence of the effectiveness of regulation in the case study areas, in particular relating to the management of slurry and manure. Regulations had changed practice, often over a long period of time, with the Nitrates Directive a key factor in several countries and the Water Framework Directive in others. Regulations had led to improved nutrient management, better timed application, less application in some cases and improved storage.

Regulation also appears to have been effective in relation to the control of rather precise activities, especially if they are readily monitored. Examples include the siting of buildings away from watercourses, controls on stubble burning, controls on the ploughing of permanent pasture, requirements to maintain hedgerows and penalties for allowing soil to impede highways.

With the introduction of GAEC in Cross Compliance, soil conservation has been given a higher profile amongst policy makers and farmers in nearly all countries.

Regulation is usually seen as more effective where it seeks to control potentially damaging activities and in targeting the most negative practices than in promoting positive or holistic approaches. GAEC measures in particular are reported as effective, at least in some conditions, if they:

- are relatively easy to monitor and observe in the course of farm visits (e.g. drawing up a Soil Protection Review in England, UK);
- engage wider public support beyond the farming community, for example, the ban on straw burning in Greece;
- clearly constitute good farming practice and are properly understood by farmers – in some cases measures have been incorporated in codes of practice for some years;
- do not involve major cost burdens on smaller farms;
- are well targeted to farms where there are substantive problems rather than directed more broadly at all categories of agriculture;
- are enforced by a responsible authority and the responsibilities are clear-cut. However, since restrictions may not always be completely enforceable on the ground, it is highly desirable that farmers understand the rationale for the regulation and appreciate its purpose.

Issues of policy coherence and efficiency arise in relation to cross compliance and to other measures affecting agricultural land management. The issue of coherence is particularly relevant to GAEC since it is a set of requirements originally intended to avoid land abandonment but in the national implementations it has exceeded this objective becoming an instrument for soil protection (Hudec et al. 2007).

### ***Policy implications for successful soil conservation***

Findings from the case studies support the notion that policy interventions to tackle soil degradation need to be complementary, with incentives building on mandatory measures in a coherent way, supported by awareness-raising and/or capacity-building measures. A balanced policy mix is promising to be most successful. Exceptions are cases where degradation processes derive from a highly specific source and are localized. Uniform policies reduce costs but they are unable to take the specificities into account that are inherent in degradation processes and causes. A one-size-fits-all approach cannot be optimal in all cases.

European and national frameworks are required to create the right conditions for regional and local measures. The great majority of the policy measures identified were not focused mainly or exclusively on soil conservation but had another or a broader set of objectives, nonetheless affecting soil management on farms. The closest link is with measures aimed at decreasing water pollution. Therefore, opportunities should be used to address soil issues alongside diffuse water pollution priorities as required under the Water Framework Directive. Synergies also occur with the Nitrates Directive.

Increased efforts should be made to align policies better in order to avoid policy incentives for soil degrading farming practices such as direct payments for high risk crops or subsidies for irrigation farming. Trade-offs between policies that directly or indirectly aim at soil conservation, and policies that are providing incentives for farming practices which cause or foster soil degradation need to be recognized and reduced. This indicates the need for an overarching and strategic policy framework, both at European and national levels. This said, it is not sufficient to establish appropriate policies but there must be provisions for their effective enforcement, including monitoring systems and the adequate administrative capacities to carry out control and sanctions.

Farmers should receive as much responsibility as possible to adjust policy requirements to their farming context (in line with Pretty and Shah 1997). Optimal and flexible policies would determine the desired outcome and result of a policy measure (mitigating degradation, maintaining soil quality) and then let farmers choose the necessary action. This approach is preferable over policies that prescribe actions that do not fit the specific context and situation. Leaving the responsibility of how best to achieve the desired outcome with the farmer requires transparency and the provision of advice. This goes in hand with the requirement of an individual farm plan which needs, however, some control of its implementation.

This leads to the crucial question of why is it so difficult to find out what exactly the best technical measure (farming practice) for soil conservation is, and why the farmer does not adopt it without policy intervention. Farmers are still facing the trade-off between a long-term sustainable use of their resources and short-term considerations of profit maximization. Most farmers do have specific knowledge on the most effective measures,

but have to consider other objectives along with soil conservation. With regard to policy intervention, disjuncture between the long-term nature of soil degradation processes and the short-term policy cycle is an inherent barrier to progress.

The studies revealed again that there is a need to design policies that target the existing soil threats and processes in the light of agricultural management while considering the farm management constraints. Therefore, more communication and cooperation between both between agricultural and environmental authorities as well as between governmental and non-governmental stakeholders is a precondition for effective and cost-efficient policies. Where stakeholders, particularly farming organizations, have been involved in policy development, there is often more understanding and willingness to support action.

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