MEAScope: Micro-economic instruments for impact assessment of multifunctional agriculture to implement the Model of European Agriculture

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Project partners:
- ZALF, Leibniz-Centre for Agricultural Landscape Research, ZALF, Institute for Socioeconomics
- IAMO, Institute of Agricultural Development in Central and Eastern Europe, Germany
- FiBL, Research Institute of Organic Agriculture; Switzerland
- ECNC, European Centre for Nature Conservation, Netherlands
- DIAS, Danish Institute of Agricultural Sciences, Denmark
- SIU-IEM, Institute of Environmental Management, Univ. of Gödöllö, Hungary
- RCAFE, Research Centre for Agriculture and Forest Environment, Poland
- SSCRI, Soil Science and Conservation Research Institute, Slovakia
- Cemagref, Agricultural and Environmental Engineering Research Centre, France
- IRPI, Research Institute for Hydrogeological Protection, Italy
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Introduction
Rural landscapes in Europe fulfil many functions. Land use is more and more regarded as an integral part of sustainable rural development. At all times agricultural land use provided food and other primary goods. But increasingly also the functions, goods and services which are jointly produced by agricultural land use are considered as highly important. The concept of multifunctionality includes the various contributions of agricultural land use to the economic, environmental and social functions of rural landscapes. At the same time the reforms of the Common Agricultural Policies set up the policy framework for an improved implementation of multifunctional agriculture as an instrument to achieve sustainable rural development.

In order to assess the impact of the existing and future agricultural policy options on the degree of multifunctionality reached in different European countries, at different geophysical sites and in different urban-rural configurations, specific tools are required. MEA-Scope is a policy oriented EU research project of the Sixth Framework Research Programme, which develops such a tool for the ex-ante assessment of policies impact on the multifunctionality of agriculture and addresses the multifunctionality of agriculture. The project, which started in May 2004, is coordinated by ZALF and is executed by 11 partner research institutions in 9 European countries. The research objective is to assess the impacts of the Common Agricultural Policy reform on multifunctionality: the structural change of agriculture, kind and intensity of land use, resulting impacts on income and environment, but also
on employment and on quality of life in rural areas. So MEA-Scope concerns the impact assessment of EU Agricultural policies on the development of rural areas.

**Background**
The Brussels Agricultural Policy has redefined the role of agriculture in the past years. The Model of European Agriculture (MEA) strongly bases on the term of “multifunctionality”. By this it is in general understood that agriculture, apart from its typical agricultural products (food, so called commodity outputs, COs), produces numerous other outputs that are requested at the market only indirectly (joint products, and called non-commodity outputs, NCOs): These are for instance the preservation of the cultural landscape and the biodiversity, but also recreation and education amenities. With that, agriculture takes up a new status within society which is irreplaceable for the provision of functioning rural areas.

**Project objectives**
Whilst the term multifunctionality is on everyone’s lips within politics, a sound concept of making it operational for means of evaluation and scientific research was missing so far. During the recent years the situation changed as research discovered the theory of multifunctionality as well as the impact assessment as a field of interest. For example, a comparative analysis of the agricultural policies’ and scientists’ views towards MF led to the development of a framework for the analysis of the research and knowledge production practices (Concept Oriented Research Cluster). (CARON, LECOTTY 2005). Several EU projects have been launched during the last three years to address this issue from different analytical approaches and viewpoints, e.g. they differ in focussing on multifunctionality of agriculture, of land use or of rural landscapes or regions. Accordingly also the approaches for impact assessment and the scale on which the impact assessment is performed vary.

On the one hand, such a concept is developed in the course of the project as an “Analytical Framework of Multifunctionality (AFM)”. Political questions about the implementation of the concept of multifunctionality in agricultural politics are answered specifically and decision support for the policy development is offered. By the linking of three micro-economic models which use data on farm structure, production schemes and on site characteristics, an internet accessible tool is created which enables the assessment of the impact of different policy options and strategies on the provision of commodity outputs and non-commodity outputs. The tool will be tailored exactly to the requirements of the users in the European Commission (the “policy developers”) as well as in the different European regions (the “policy implementers”) and tested in case study areas in seven European countries.
The MEA-Scope objectives

**Approach**

**Development of an operable concept of multifunctionality**

Within the framework of literature surveys, first of all an analysis and evaluation of the different currently discussed interpretations on the issues of “functions of agriculture – related potential joint products (NCOs) – indicators” was carried out. The respective research report (D2.1) presents an actual overview on the relevant basic concepts and gives an outline of the MEA-Scope approach for making them operational for impact assessment. This report is available for pdf-download at the MEA-Scope website and is used by comparable research projects working on the field of multifunctionality as a relevant background information.

Vice versa the MEA-Scope work in WP2 was inspired by other current projects. The MULTAGRI project e.g. analysed the relationship between the concept of sustainability and multifunctionality, by pointing out the dependencies between the normative and analytical concepts (CARON, LECOTTY 2005). HAGEDORN (2005) conceives of multifunctionality as a tool for achieving increased sustainability.

The preliminary idea for this MEA-Scope theoretical approach (D2.3 pdf available at the website) was as follows: An operable multifunctionality framework has to integrate the functions and criteria, which are addressed in existing concepts for sustainability and multifunctionality (agri-environmental issues) and their assessment. While the dimensions in the view of multifunctionality as a policy goal in a normative sense refer to social, environmental and economic functions, the dimensions by an economic theory view (fields of action from policy) concentrate on questions of distribution, allocation and stabilisation as well as on the positive viewpoint of joint production. Since both views have to serve different expectations in a concrete situation there is no clear decision in favour of one or the other analytical approach to multifunctionality. The MEA-Scope project, finally, decided for a framework split in two parts: a demand based theoretical approach based on the functions of agriculture to find the representative indicators on the one hand and a supply oriented economic modelling approach on the other hand. In this way, multifunctionality is regarded from two sides.
Making the multifunctionality concept operational

Selected NCOs of multifunctional agriculture

By the selection of suitable indicators for economical, ecological and social functions, the interface for the analysis of the practical meaning of the multifunctionality approach was created. A compilation of indicators from the most relevant indicator frameworks and of those used in relevant recent projects was set up. The indicators have been classified into functional groups (considering the FAO concept) and NCOs (considering the OECD concept). In a well structured step by step reduction the basic indicator list was adapted to the different levels of use on the demand and supply analysis side of the project. The resulting research report D2.4 (pdf available at the website) with the multifunctionality indicator framework is used and discussed by the scientific community. The results have been presented at international conferences on multifunctional land use in Tartu, Estonia, and in Leipzig, Germany. The co-ordinator of WP2 published the relevant results in peer reviewed paper in the IJARGE journal, for which she was guest editor in charge for an special issue on multifunctionality. The partners involved in the research tasks mentioned in this paragraph are Cemagref, DEART, ZALF and ECNC.

Which multifunctional contributions does society request?

The societal demand on NCOs is analysed more detailed by surveys in the MEA-Scope case study regions. To do so, selected representatives, deputees of different societal groups, employers of the administration and local experts were interviewed about a general assessment of the social, economical and ecological quality of life and the rural development feasibilities in their region and they are invited to a workshop. The societal “demand” ascertained in this way is then confronted with the “supply” on the part of agriculture ascertained by means of modelling.

By reflecting the demand side (the stakeholder surveys’ results) of NCOs in the case study regions against the supply side (the modelling results) we will be able to identify a gap. This will be an important project outcome, as it delivers information about deficiencies on the awareness of certain issues of relevance (e.g. social…), on the limitations of our models, on data availability deficiencies (monitoring), and on preferences and differences in the EU-25. By this the chosen approach will help to identify further research areas.

The lead partner for the demand oriented research in MEA-Scope is FIBL (Switzerland), regional stakeholder surveys have been carried out by RCAFÉ (Poland), DEART (Italy), DIAS (Denmark) and ZALF (Germany).
Which multifunctional outputs are produced by agriculture and which impacts come from agricultural politics?

The recent CAP reform has introduced significant changes to the European agricultural sector. Further new developments are expected from the implementation of the new EAFRD. A respective analysis has been carried out by FIBL (D6.1 pdf available at the project website). In view of these changes, the specific regional implementation, and depending on how farmers react to the policy change, the CAP might change the multifunctional character and joint production capabilities of agriculture. Therefore, a substantiated knowledge of the site specific potentials and the characteristics of and conditions for CO production provide the basis for the identification of site specific potentials for NCO production and the development of feasible joint production techniques.

A key objective of MEA-Scope is to develop a tool that allows to simulate the supply of a set of CO and NCOs and which can be used to study interactions between multifunctionality and policy instruments at farm and regional scale. The tool consists of three linked simulation models and it combines three existing distinct programming and simulation models (MODAM, FASSET and AgriPolis) to capture different environmental, economic and social facets of multifunctionality.

The MEA-Scope tool development

Online accessible MEA Scope impact assessment tool

user interface

results

MEA-Scope tool

AgriPolis
farm structure data

MODAM
production schemes

FASSET
site characteristics

Framework for models

multifunctionality indicator set

regional data

regional stakeholders' demand

end users' information needs

current state at midterm
The models focus on different complementary aspects relevant to modelling the multifunctional aspects of agriculture. AgriPoliS (delivered by IAMO in Halle) is a dynamic agent-based model that simulates is used to simulate the impact of policies on regional structural change. MODAM (delivered by ZALF in Müncheberg) and FASSET (delivered by DIAS in Tjele, Denmark) capture the farming processes and the joint production of non-commodity outputs in detail.

In the modelling framework, the individual farm is the unit, which combines the three models. AgriPoliS recreates the regional farm structure in a region. The model simulates the development of a large number of individually acting farm agents which were derived from real-farm data. Thereby each farm evolves due to its initial conditions, the local competition for land and the regional economic framework conditions. At various time steps (e.g. every 5 time periods), either all farm agents or a subset of them is transferred down through the hierarchical modelling structure. More specifically, for each selected farm agent, MODAM receives data from AgriPoliS on land use and production. Based on these specifications, MODAM calculates detailed optimal land use patterns for each farm. Moreover, an environmental impact assessment is carried out. To simulate the consequences of specific management practices for matter flows, MODAM transfers the farm specifications to FASSET. MODAM produces output that details the area of different crops and the field operations performed upon them (e.g. ploughing, sowing, fertilisation and harvesting).

**MEA-Scope tool development: model relationships and workflow**

1. **Analysis of regional characteristics**
   - IAMO: Description of regional farming structure and identification of typical farms based on IACS / FADN data and/or expert knowledge
   - ZALF: Survey on production techniques based on expert knowledge
   - DIAS: Analysis of geographical data and identification of a site typology

2. **AgriPoliS**
   - create synthetical landscape, based on typical farms
   - simulate for e.g. t=20 periods and observe structural change
   - get specification of typical beef production farms
   - assess production structure

3. **MODAM**
   - run LP based on specification of typical beef production farms on the basis of detailed production activities
   - assess impact on habitat quality, biodiversity
   - get land use for typical sites

4. **FASSET**
   - nitrate leaching
   - emission of greenhouse gases
   - pesticides
   - energy consumption

Four broad categories of data were collected for each case study regions: data describing the structural characteristics of agriculture including total production and information on individual farms, data on livestock and crop production systems, and GIS data on environmental configuration (potential specific exposure and potential...
“market” for requested NCOs) With this, regional effects (e. g. at district level) as well as farm and/or site specific effects of joint production can be analysed.

**Interface 1**  MODAM → Agripolis (Before the first period)
- economic coefficients of production activities

**Interface 2**  Agripolis → MODAM (After each 5 periods in AgriPoliS)
- farm capacities and prices for typical farms at specific locations.

**Interface 3** MODAM → FASSET (After each period in MODAM)
- production system and size
- ecological coefficients of production activities (timing, work step, amounts …)

The diversity of the selected case study regions, in terms of e.g. site conditions, economic and employment situation, farm structure, environmental problems and potentials, broadly characterises the situation given in the EU-25. The MEA-Scope tool is adapted to the different production realities in these 7 case study regions, emphasising on beef production systems. Beef production is chosen as it is practised in all of these regions and is proved as a sector highly impacted from agricultural policy changes. The research institutions involved in the models’ specification and application to the case study regions are ZALF (Germany), DIAS (Denmark), SIU-
IEM (Hungary), RCAFE (Poland), SSCRI (Slovakia), Cemagref (France) and IRPI and DEART (both Italy).

**Tool implementation in 7 European case study regions**

The fact that the simulation tool we are going to develop, can be applied on different spatial scales and that it will indicate diverse joint production impacts, is the special, innovative potential of the MEA-Scope research approach.

References:
