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Carrot or stick: Impacts of alternative climate and energy policy scenarios on agriculture

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ABSTRACT

The climate and energy strategy of the European Union presents the aims for all economic sectors to cut carbon dioxide emissions. In this paper, we studied what kind of conflicts, synergies, opportunities and control measures the climate and energy policy brings to farms in Finland. We used the Delphi method to assess possible outcomes of three scenarios based on the strength of mitigation policy. The scenarios scrutinised were (1) Baseline, (2) Tight Control and (3) Energy Plus Food. These scenarios create different adaptive needs and measures on farms. Baseline scenario follows the present and forthcoming development in agriculture and Tight Control scenario, in turn, constitutes all possible mitigation measures recently introduced in the scientific discussion. In Energy Plus Food scenario, farms increasingly produce renewable energy in addition to food and, therefore, have new opportunities to develop their businesses. The Delphi panel estimated how the farms would cope with different future developments represented by the scenarios. Based on our results, it is evident that interdisciplinary analysis in research and inter-sectoral cooperation between agricultural and energy policies are required.

1. Food production in the presence of climate policy

Human induced climate change and its mitigation policies have become overarching issues which can still be doubted and resisted but cannot be excluded from decision-making in any fields of economy or policy. Climate issues cross traditional sectoral boundaries and call for interdisciplinary analysis. They challenge conventional wisdom as well as prevailing trends. An evident case of such sectoral mingling is the interplay and trade-offs in the agricultural and energy sectors.

The agricultural sector accounted for 10–12% of the total greenhouse gas emissions in the world (Smith, Martino, Cai, Gwary, & Janzen, 2007) and 9% in our Northern European case country, Finland, in 2011 (Statistics Finland, 2013). The European Union (EU) set a target to cut the 1990-level greenhouse-gas emissions by 20 percent by the year 2020 increasing 20% of energy from renewable sources and achieving a 20% increase in energy efficiency. Under these goals, there are various policies and processes which aim to reduce the climate impact of agriculture (the Common Agricultural Policy of the EU, the rural, climate, energy and trade policies of the EU and nations) and it is likely that more ambitious climate change goals are to be adopted in the EU to create a low-carbon economy in the following years.

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Numerous environmental targets have been imposed on agriculture: water protection, nutrient recycling, biodiversity, and climate change mitigation (Kivimaa et al., 2012). The Finnish Government has published a Climate and Energy Strategy in which the agricultural sector is given a 13% reduction target for greenhouse-gas emissions in 2005–2020 (TEM, 2013). The strategy does not define which measures should be used to reach the target but outlines important issues to be elucidated, for example, the possible measures to reduce emissions on organic soils and in animal production (Regina, Lehtonen, Nousiainen, & Esala, 2009; Lehtonen, 2012). Agricultural emissions come from various sources and are officially reported in different climate change sectors in the United Nation Framework Convention on Climate Change (UNFCCC) process. These are emissions of methane (CH_4) and nitrous oxide (N_2O) from production animals, manure and soils (reported under sector "Agriculture"). In addition, emissions of carbon dioxide (CO_2) from soils and liming are reported under sector "Land use, land use change and forestry" and energy use on farms under sector "Energy". The EU defines a 16% reduction target for non-emission trading sectors in 2005–2020 (Bionova Engineering, 2008; Regina, Lehtonen, Palosuo, & Ahvenjärvi, 2013).

Concerns related to climate change and forthcoming mitigation policies pose a key external factor probably influencing agricultural development in the future. Measures should be implemented to decrease emissions along the lines defined in the national and international climate policies. This is considered difficult since the agricultural emissions range from point source pollution to more diffuse non-point source pollution. The main findings in recent Finnish studies presented that it is almost impossible to mitigate emissions significantly without measures affecting the area of organic soils (Regina et al., 2009, 2013). It has to be noted also that CO_2 emissions from soil are included in LULUCF-sector (Land Use, Land-Use Change and Forestry). Therefore in the IPCC sector reporting they cannot be counted for the benefit of agricultural sector. If the area of cultivated organic soils was stabilised or even reduced and some other measures were also brought to practice, the total reduction could be significant but still likely less than 13% (Regina et al., 2013).

Against this background and in the context of the current common agricultural, climate and energy policies, this paper aims at delivering answers to a set of measures and strategies in farm-level solutions related to climate change mitigation in agriculture.

Our overall objective is to give an overview as to how farms and agriculture in general may participate in greenhouse-gas mitigation efforts in the future. As this is a question of changing current farmers' behavioural habits rather than estimating incremental changes based on current behaviour and preferences, we use a heuristic method instead of a formal one. The Delphi method is used to assess the potential outcomes of three scenarios up to the year 2030. The scenarios are (1) Baseline, (2) Tight Control and (3) Energy Plus Food. The scenarios create different adaptive needs and measures on farms. Baseline scenario follows the present and forthcoming development according to the Common Agricultural Policy (CAP) of the EU and Tight Control scenario, in turn, constitutes all possible mitigation measures recently introduced in the social and scientific discussion which could be applicable to a country located in the Boreal vegetation zone North from the 60° Northern latitude. In Energy Plus Food scenario, farms increasingly use and produce renewable energy in addition to food and, therefore, have new opportunities to develop their businesses (Rikkonen & Tapio, 2009).

2. Principles of Delphi study

Delphi, as it originally was introduced and practiced, tended to address technical topics and seek a consensus among homogeneous groups of experts. Fundamentally, the Delphi method was considered a version of survey analysis (Bell, 1997). With the development of Delphi variants, the use of the method has many variations, such as trend Delphi, policy Delphi, argument Delphi and problem-solving Delphi (Turoff, 1975; Kuusi, 1999). The Delphi method concentrates on assessing and forecasting the future. The users of the Delphi technique aim at exploring alternative future images, possibilities, their probabilities of occurrence, and their desirability by tapping into the expertise of respondents (Bell, 1997). Linstone and Turoff (1975a) characterised Delphi in a more flexible way as a method for structuring a group communication process in such a way that the process is effective in allowing a group of individuals, as a whole, to address a complex problem (see also Sackman, 1975a,b; Kuusi, 1999; Rowe & Wright, 2001; Tapio, 2002).

The Delphi method consists of experts' judgement by means of successive iterations of a given questionnaire to show convergence of opinions and to identify dissent or non-convergence. Anonymity and feedback can be considered two irreducible elements of the Delphi technique. Traditionally, a third feature of consensus seeking has been one element (Turoff, 1975; Kuusi, 1999).

The Delphi method generates expert information of a desirable and probable future. An important part of utilising expert information and scenario planning is its connections with actual strategies which emerge from alternative scenarios. The scenario approach is usually connected with the evaluation of possibilities of the operational environment where an organisation operates. Alternative scenarios can input information in influencing the choices of strategies, in the establishment of strategic objectives and action plans and in the evaluation of long-term budgets and investments (Van der Heijden, 1996; Van der Heijden, Bradfield, Burt, Cairns, & Wright, 2002). Scenario thinking can be used within the process of strategic planning to enrich and broaden planning perspectives.

Scenario analysis has evolved within a variety of disciplines such as management, economics, environmental science, and policy science. Usually, a scenario typology can be approached, for example, through a specific project goal, process design or scenario content according to Van Notten, Rotmans, Van Asselt, & Rothman (2003). There is also a distinction between descriptive scenarios which explore possible futures and normative scenarios which describe probable and desirable futures (Godet, 2000). Despite the variety in scenario methodology, the utilisation of scenario planning can be based on the strategy

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