SEVENTH FRAMEWORK PROGRAMME

THEME 6: Environment (including Climate Change)

REFRESH

# Adaptive strategies to Mitigate the Impacts of Climate Change on European Freshwater Ecosystems

Collaborative Project (large-scale integrating project)
Grant Agreement 244121
Duration: February 1st, 2010 – January 31st, 2014

# Deliverable 7.23: Policy Document – Implications for Agricultural Policy

Lead contractor: **UPatras**
Other contractors involved: **N/A**

Work package: 7

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Estimated person months: 1

| Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)<br>Dissemination Level (add X to PU, PP. RE or CO) | | |
|---|---|---|
| PU | Public | X |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

## Policy Document – Implications for Agricultural Policy

*The Context*

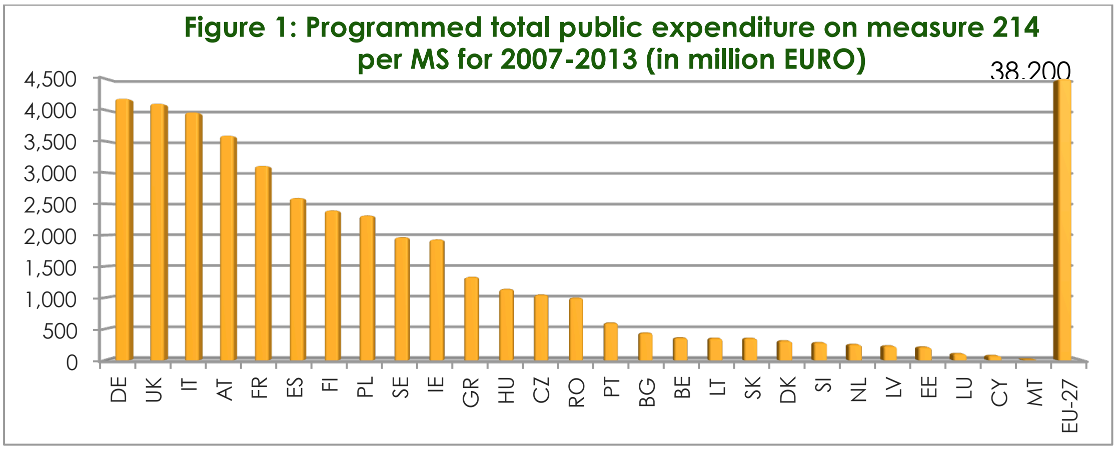
Rural areas in Europe are nowadays facing considerable environmental challenges, mostly associated with rural land use and the key role of agriculture and forestry in producing environmental public goods (and bads). Over the past decades, the wide acceptance of this role has led to significant efforts aiming to reduce environmental pressures associated with agricultural and forestry activity. However, despite considerable progress achieved (EEA, 2010a), a wide range of environmental indicators shows that several ecosystems across Europe continue to face problems (Allen and Hart, 2013). Indicatively, according to the European Environment Agency (2010b), in 2011 only 17% per cent of habitats of Community interest and 11 per cent of ecosystems protected under EU legislation were found to be in favorable status, while it is also noted that the EU did not manage to meet biodiversity targets for 2010. Also, in several cases a decline is observed in water quality, and pressures on water quantity are evident, especially in the south, while soils are also threatened from erosion, compaction and loss of organic matter (Hart et al., 2011).

Ceteris paribus, these problems are likely to be aggravated by external factors, such as climate change, which further stresses biodiversity, water levels and soil erosion. Nowadays, there seems to be a consensus amongst scientists and policy makers that human induced climate change is occurring (IPCC, 2007) and that regardless of future greenhouse gas emission reductions, substantial climate change is unavoidable. Further, in regions such as Southern Europe, projected climate changes are expected to have a direct impact on water resources and irrigation requirements, crop growth conditions, crop productivity and crop distribution, agricultural pests and diseases and the conditions for livestock production. These impacts will generate changing land use patterns and trigger notable economy-wide effects (Skuras and Psaltopoulos, 2012).

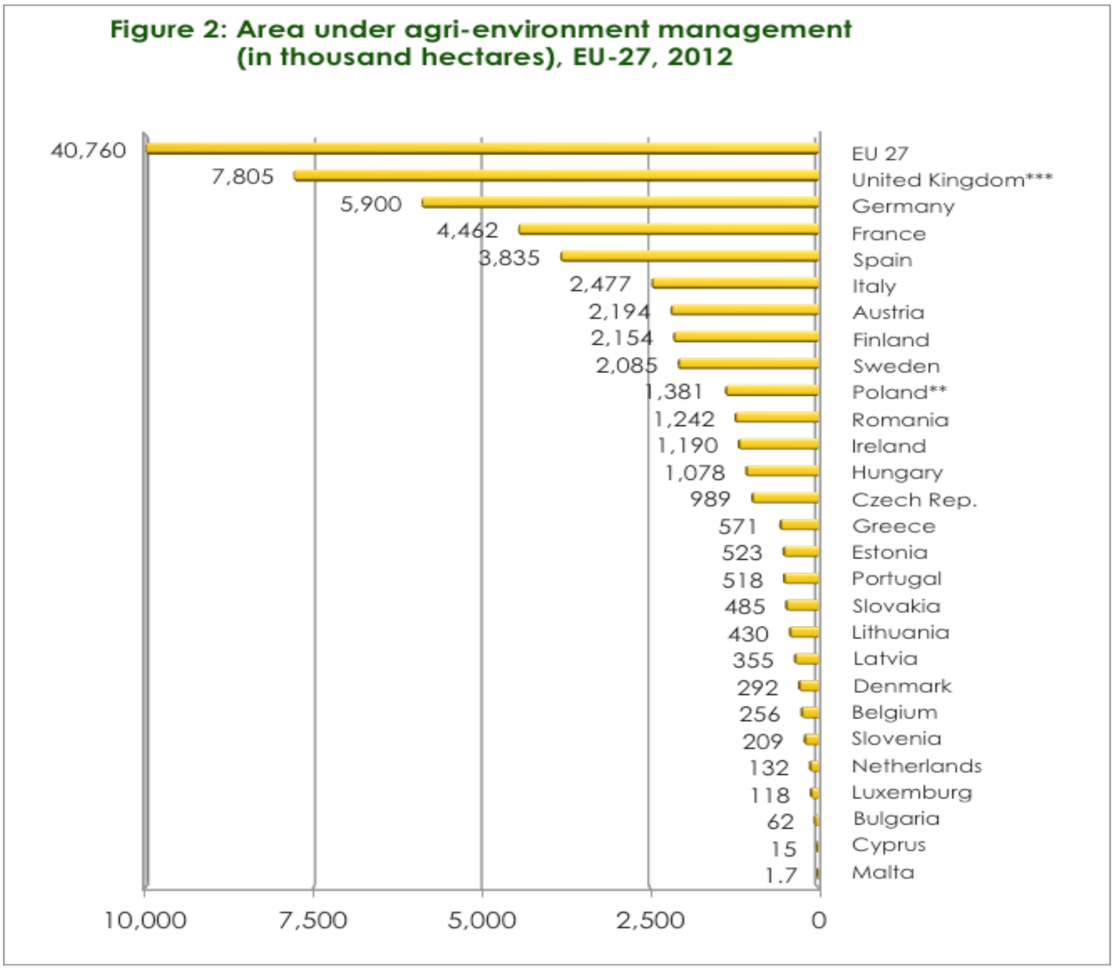
*EU Policy Initiatives and the Environment*

In an EU perspective and in an effort to combat these problems, environmental objectives have been gradually integrated into the Common Agricultural Policy (CAP), which arguably constitutes the largest source of funding and the main form of public intervention influencing rural land use and management. As described in a recent very comprehensive review (Matthews, 2013), since the mid-1980s, environmental conditions have been imposed to the receipt of direct payments in Pillar 1 (cross compliance), and mostly delivered through rural development (Pillar 2) funding. With regards to the latter, the 1992 MacSharry reform provided a compulsory status to agri-environment measures (AEMs), while Agenda 2000 established "Good Farming Practice" as a prerequisite of support associated with several Pillar 2 measures. In 2005 the revision of Pillar 2 led to the specification of the "Improving the environment and countryside" Axis 2 and obliged Member-States to commit at least 25 per cent of their Pillar 2 budget on measures promoting environmental land management. AEMs constitute the main policy tool (and source of funding) through which CAP pursues its environmental objectives.

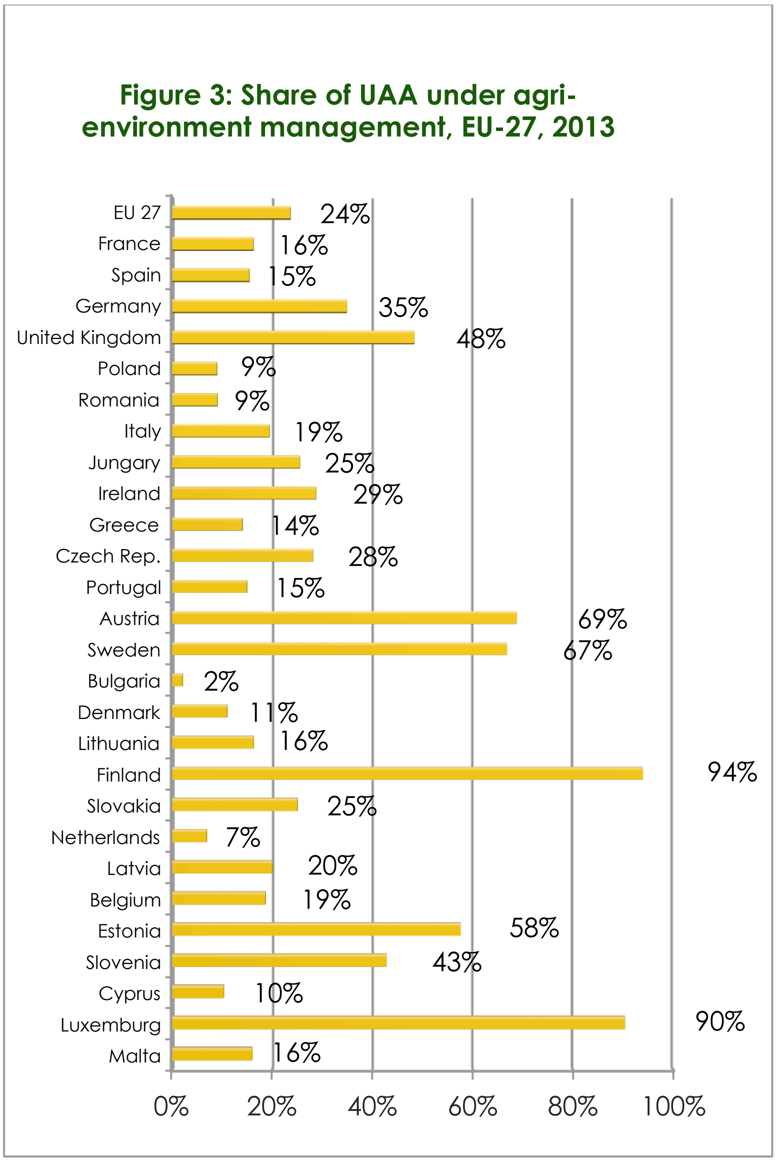
As shown in Figure 1, in the 2007-2013 programming period, AEMs and Natura 2000/Directive 2000/60/EC measures have been allocated 25 per cent of programmed public funding (38.5 bn EURO), while current expenditure amounts to 28 bn EURO (30% of realized public spending) (ENRD, 2013). This expenditure seems to concentrate considerably in Germany, the UK, Italy, Austria, France, Spain, Finland and Poland.




As shown in Figures 2 and 3, in 2012 nearly 41 ml hectares of farmland (24% of UAA) are under agri-environment management in the EU-27. The programmes supported under measure 214 include a wide range of commitments such as organic agriculture, environmentally favourable extensification of farming, management of low-intensity pasture systems, integrated farm management, preservation of landscape and historical features such as hedgerows, ditches and woods, conservation of high-value habitats and their associated biodiversity and many others. About 7.8 ml ha of them are in the UK, 5.9 ml in Germany, 4.5 ml in France, 3.8 ml in Spain, 2.4 ml in Italy and around 2.2 ml in each of Austria and Finland.



In terms of share of UAA under agri-environment management (Figure 3), very high rates are observed in Finland (94%), Luxembourg (90%), Austria (69%), Sweden (67%), Estonia (58%) and the UK (48%).




The October 2011 legislative proposals for the future CAP featured environmental concerns (or 'greening') as a core element of the objectives of the post-2013 era. The 'sustainable management of natural resources and climate action' is one of three core objectives proposed for the CAP for the period 2014–2020, alongside viable food production and balanced territorial development in line with the objectives of the EU2020 Strategy (European Commission, 2010) and is justified due to the fact that environmental public goods are not adequately provided by the market.

Subsequently, the December 2013 agreement on the post-2013 CAP (Council of the European Union, 2013) introduced a "greening" payment, in the context of which 30% of direct income support for farmers will be granted only if they observe certain farming practices that are beneficial for the environment and the climate, particularly growing at least three different crops on their arable land, maintaining a minimum area of permanent grassland, and preserving areas and landscape features with a particular ecological value ('ecological focus area'). In Pillar 2, measures concerning the environment and climate change have been strengthened to increase their effectiveness and their implementation has remained compulsory. Also, flexibility has been introduced by allowing for shorter commitments periods and periods of conversion, in order to encourage a wider uptake of the measures. At least 30% of the total EAFRD funds must be reserved for measures related to the environment and climate change adaptation and mitigation (including not only Articles 28 to 30, but also forestry and investments in physical assets). In financial terms and if a minimum of 30% is assumed (which does not seem to be the case) this means around 38.2 bn EURO, that is a small decline in real terms compared to budgeted expenditure of 2007-2013. However, if one adds the Pillar 1 "greening" payment, the total amount associated with the provision of environmental services by farmers in 2014-2020 could double, even if the provisions on the exclusion of small farms from "greening" are taken into account.

Further, in the context of its environmental policy, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 established a framework for community action in the field of water policy (WFD; EU, 2000). The WFD sets in-stream standards or thresholds to achieve a desirable ecological level in EU water catchments. Nowadays the WFD implementation is reaching a critical point throughout the EU whereby catchment management plans have to be put in place (the first target being 2015, with 6-year cycles thereafter) in order to meet specific water quality and ecological thresholds for rivers, lakes, wetlands and groundwater. In most cases, the fact that data scarcity and system complexity have made traditional optimization approaches impractical (Hall, 2013), has led into the adoption of a decision-making strategy (involving several stakeholders), which attempts to meet an acceptable threshold (Whitehead et al., 2013).

A wide range of measures have been proposed and applied in an EU context to achieve the improved status. As the high levels of phosphorous (P) and nitrogen (N) caused by the excessive application of fertilizers are often the main pressures, AEMs have constituted the main policy tool through which compliance is pursued. More than often (Slee, 2012) the coherent specification of such measures (and catchment management plans) involves a complicated negotiation process involving riparian land owners, farmers, water companies, environmental agencies, the scientific community and Ministries.

*Main Findings of REFRESH*

The above-described context and policy developments clearly indicate two needs. First, that a non-conventional approach, which integrates science and social science is required for analysing complex environmental issues often associated with case-specific physical ecosystems and at the same time, assess the efficacy of policy measures associated with substantial financial flows; this is especially valid in the case of interconnected policy frameworks which have the potential to induce synergies on the basis of sustainable management. Second, that especially in the case of policy tools, which are specific to longer-term commitments and irreversible decisions, monitoring should also consider climate change parameters in order to ensure minimum costs to the European taxpayer.

Water and watersheds are an inseparable part of most habitats. The WFD imposes watershed and water management rules and action plans and thus increases the synergies for positive effects among the Habitats, the Birds and the Nitrates Directives at a local scale.

Nutrients follow a complex pathway from the time they are applied to the soil to the time they reach the watercourse and then travel to the sea. This pathway is highly influenced by the physical environment, the climate, the soil and the wide range of activities contributing nutrients directly to the soil or directly into the watercourse. In addition, nutrients undergo a number of transformations during their transport from the soil in the river and down the estuaries. This ascertainment makes every agri-environment case unique.

This complex set of interactions during nutrient transport may be captured by integrated nutrient transport models, which become an invaluable tool for setting up and monitoring agri-environmental programmes related to nutrient transport.

Assessing the effectiveness of mitigation measures in terms of reduced quantities of applied nutrients or in terms of simple leaching functions is very naive. Seemingly polluted areas due to high disposition of fertilizers may not show extreme water pollution because of absorption mechanisms of the soil-hydrosphere system in the various stages of the transport process.

The cost of applying agri-environment measures is high due to loss of production that is reflected on income forgone. The most cost efficient methods are those that involve the combination of good and low input farming practices.

The cost of applying agri-environment measures sometimes exceeds the expected benefits and makes the measures disproportionate. There are various reasons why benefits are low. The most important however is the fact that benefits are aggregated on the basis of the use of the water without taking account of non-use benefits such as biodiversity. At the same time most watersheds end up to a Habitats area where non-use values and especially conservation and protection are very important. If one takes into account benefits accruing from non-use values then, even high costs, do not exceed benefits. This is a case for supporting agri-environment measures as a mean for producing public goods.

Agri-environment programmes imply long-term engagement (usually 5 to 7 years long). Within this time frame, climate change may bring spectacular overturns. Agri-environment measures should take into account and incorporate projected climate changes in order to "climate change proof" the agri-environmental policy.

*Implications for Agricultural Policy*

Within this context, the adoption of agri-environmental measures is under the risk of two fallacies. First, adopting a policy when this is not needed (Type I error – the true effect of agricultural activity is zero but we reject it and adopt an agri-environmental policy) and second, not adopting a policy when this is needed (Type II error – the true effect of agricultural activity is significant but we fail to reject it and do not adopt a policy). The first may be due to the polluting contribution of activities other than agriculture or due to a combination of abiotic and biotic factors that increases absorption. The second may be due to bad baseline monitoring or due to a failure to incorporate forecasted climate changes in our pollution generating activities.

The overall policy objective is to safeguard an efficient set of measures that serve public interests and can be maintained under climate change.

The most crucial step is to define "target abatement" and consequently define the abatement cost. Once, for example, the Nitrates Directive defines environmental targets as the concentration of nitrogen in water, the environmental policy should not set its target in terms of a different unit such as the weight of nitrogen applied by farmers. This will cause confusion and it will not allow policy to address the real issue, which is water pollution. Thus, the target should be set not as the quantity of nutrients to be abated but as the concentration of nutrients in the water as a result of the quantity of fertilizers abated.

We propose that policy makers should seek an integrated approach in measuring and monitoring the nutrients transported through the soil to the watercourse and through it to the estuarine zone before deciding to adopt expensive and long-term policies. Integrated simulation of nutrient transport also allows for the different alternatives to be assessed in terms of cost and expected effects.

Future climate changes should be simulated to "climate change proof" the contemplated measures and policies. Climate change may gradually increase precipitation and thus increase runoff with an effect on nutrient transport and increased levels of nutrients dissolved in the water. In other places, climate change may decrease precipitation and reduce the amount of nutrient transported through the soil in the watercourse. This will decrease the concentration of nutrients in the water.

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