

The University of Edinburgh
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: MSc Ecological Economics

Date: 2007

Title of thesis: **Evaluation of the non-market water-related recreational values of Scottish surface water bodies using the benefit transfer method**

Recently adopted EU Water Framework Directive (2000/60/EC) has established integrated approach to the water management requiring that all waters in Europe reach “good water status” by 2015.

However in some cases water bodies will not be able to reach this objective due to natural conditions, technical feasibility or disproportionate costs. In such cases, the Directive allows for derogations. Disproportionality analysis, i.e. comparison of costs and benefits of reaching “good water status”, is critical for justification of such exemptions. While costs of measures are quite straightforward to assess, it is benefit side of “good water status” in Scotland which constitutes the focus of the research responding to the need for better estimates of the values associated with water-related recreational uses.

Estimation and physical quantification of recreational bathing, angling, water sports and bird watching in Scotland by the WFD Area Advisory Group is carried out to form the basis for monetary evaluation. Recreational bathing and water sports are the most significant water-related recreational uses in Scotland.

Given significant number of individual water bodies in Scotland, application of conventional valuation methods is unfeasible due to limited time and financial resources. Application of the Benefit transfer method is then proposed and assessed as an alternative methodology for deriving benefit estimates of “good water status” in the context of justification of derogations and implementation of the WFD in Scotland. Monetary values of water-related recreational uses in Scotland are then assessed by applying this method. While the method yields less accurate results than site-specific valuation, it is justified in the circumstances where precision is less critical to the decision-maker due to limited time and/or financial resources.

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Title of thesis: **The Ecological Footprint of the Scottish Agricultural College Using an Input-output Approach**

Academic institutions impact the environment in a number of different ways. Their activities and production require input in the form of products, energy and services; in return, they produce outputs that are consumed by others. As knowledge and research establishments in society, they should be at the forefront of educating about and implementing environmental sustainability. Ecological Footprint (Footprint) analysis is one way of assessing the environmental sustainability of academic institutions. However, there are problems with the use of the component based approach, which is most commonly used.

This paper looks at how this new analysis is used for the Scottish Agricultural College (SAC) and checks its reliability. This novel approach differs from other reported studies that use Footprint analysis to measure environmental sustainability in academic institutions.

This paper uses a novel hybrid input-output model to analysis the Ecological Footprint of the Scottish Agricultural College activities. The results from using this approach indicate the footprint of its activities to be 6.1 global hectares per student, 5.8 global hectares per staff member and 3.1 times the educational sector benchmark.

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Title of thesis: **Overview of Drivers and Barriers to Biomass Fired Combined Heat and Power Development in Europe and Financial Appraisal of a Biomass Fired CHP Plant in Italy**

In the context of European energy policies the contribution of biomass is vital in meeting the targets set for renewables and among all technologies combined heat and power for the high overall energy efficiency and the generation of heat and electricity, will effectively play a crucial role.

The effectiveness of European and national support measures for biomass fired CHP plants varies according to the type of economic instrument adopted, but also long-standing political support and clear targets are crucial to overcome non-technical barriers that hinder biomass potential. The analysis of bio-energy policies in Austria, Finland and Italy reveals that there are not absolute barriers in biomass CHP investments.

A financial appraisal of a biomass combined heat and power investment in Italy reveals that despite generous support measures for the electricity generated, the investment financial performance relies on the investor's capacity to sell at least two thirds of the maximum heat generated, a requirement that is not currently guaranteed.

The sensitivity analysis shows that any downturn in energy support measures and the adoption of private investment parameters, further reduce the margin to obtain positive financial benefits. The paper suggests strategies and policies that should be implemented in order to make investments in biomass CHP plants more financially competitive and attractive for private and public investors.

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Degree: MSc Ecological Economics

Date: 2007

Title of thesis: **Establishing a Framework for Environmental Accounts for the Agricultural Sector in Scotland**

In the context of growing concern over sustainability, adjusted or 'green' accounts provide a truer economic measure of societal welfare by including the net external benefits and costs arising from production. The agricultural sector in the UK is under increasing scrutiny as it gives rise to many categories of environmental damage as well as being the recipient of large government subsidies. These costs, however, may be recovered once the value of environmental services provided is appropriately apportioned to agriculture. Methodological issues arise in assessing the non-market costs associated with these; however, growing awareness of the need for accurate valuation and benefits transfer has spawned a wealth of studies, some of which are reviewed here. This study establishes a framework for environmental accounts for the agricultural sector in Scotland and provides a preliminary estimate of the external costs and benefits attributable to the sector. In comparing net income and subsidies with these external costs and benefits, it appears that agriculture is a net contributor to the country's economy and is, in this respect, sustainable.

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Degree: MSc Ecological Economics

Date: 2007

Title of thesis: **Cost effectiveness Analysis of Biodiversity Conservation Policies in Mexico: Analysis of the case of the Sea of Cortes**

One of the fundamental subjects in our day is, without a doubt, the conservation of biodiversity, since it is a subject that has acquired relevance in different scopes of human activity. During the last decade, the preoccupation for its conservation has become a paradigm for what we have and at the same time what we are losing. (Leemans, 1999). For economic reasons, human beings have converted complex ecosystems into simple ones, putting in danger the stability of the biophysical processes of life and triggering what scientists have called "the crisis of the biodiversity". The focus of this research is biodiversity conservation in Mexico, specifically applied to the Gulf of California or Sea of Cortés, since it is considered to be one of the most important regions for conservation efforts since it is one of the most spectacular and biologically diverse areas in the world (Alvarez Borrego, 2007). The initial purpose of this dissertation was to make a cost-effectiveness analysis of the Mexican biodiversity policies applied to the Sea of Cortés and to make use of the QALY'S methodology applied by a prior New Zealand study. However, due to the complexity of the appliance of this methodology in a marine ecosystem, the main focus of this research was therefore canalized to the analysis and synopsis of the outputs of five current major conservation projects taking place in the area by different environmental organizations.

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Degree: MSc Ecological Economics

Date: 2007

Title of thesis: **Measuring the Sustainability of Scottish Agriculture by Ecological Footprint Analysis**

In order to measure progress in areas other than mere economic development, sustainability indicators have gained popularity since the Brundtland Report (1987) that emphasised the importance of sustainable development. The first paper of this dissertation focuses on ecological footprinting as a sustainability indicator and analyses its effectiveness as a policy tool. It gives an overview to its underlying assumptions, its different methodologies together with its strengths and weaknesses to assess the validity of the tool. It was found that some deficiencies in methodology and standardisation problems were the biggest obstacle to the wider adoption of the indicator and its use as a policy tool.

The aim of the second paper is to use ecological footprint analysis and measure the sustainability of Scottish agriculture. The focus is on three different aspects: (i) the sustainability of Scottish agriculture with particular emphasis on LFA sheep and LFA beef farms, (ii) the effects of Single Farm Payment (SFP) on Scottish agriculture, (iii) the relationship between farm size and ecological impacts in Scotland. The results that have been obtained through the input-output model used by Bottomline show that Scotland's agricultural production is within sustainable limits with the exception of LFA beef farms and that the SFP has had the expected outcomes so far in promoting more environmentally friendly agricultural practices. No consistent pattern has been observed with respect to the relationship between the farm size and ecological impacts in Scotland.

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Date: 2007

Title of thesis: **Biomass-fired combined heat and power in urban community heating schemes in the UK. Challenging the concept of carbon-neutrality of biomass as a fuel source**

This study evaluates the feasibility of using woody biomass in urban areas in the UK. Two main points are the foci of this evaluation: (a) the importance of location of a plant and supply source and related transport distances for biomass supply have been investigated; (b) the problematic lack of supply and demand and the need for a stable domestic biomass market have been illustrated and put into the context of UK policies to foster the use of biomass.

This technological context is narrowed down to the use of biomass in combined heat and power installations that supply heat to a community heating network. A cost benefit analysis has been conducted for a project located at Falkirk. The project will be initially gas-fired; phase II of the project foresees conversion to biomass gasification. The net present values (NPVs) of the two projects have been analysed for its sensitivity to (a) future gas fuel prices; (b) costs of carbon emissions from gas conversion and transport of biomass; and (c) costs of traffic congestion from transporting the biomass to the plant.

The project is feasible under the present financial outlay. The result of the sensitivity analysis was that the feasible biomass supply distance does not so much depend on the costs of carbon emissions involved but on the costs of traffic congestion. Even at a distance where carbon emissions from transport equal those of the gas-fired scheme, the NPV of the biomass-fired project would still not reach its switching value. Regarding traffic congestion, the NPV/dwelling reaches zero at half the transport distance. However, this result needs to be considered under the circumstance of an as yet underdeveloped supply infrastructure for biomass that predominantly relies on road transport. The supply infrastructure is expected to improve with the further development of a domestic biomass market.

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Date: 2007

Title of thesis: **Employment Effects of Rural Stewardship Scheme and Land Management Contract Menu Scheme in Orkney Islands, Scotland**

This dissertation examines the employment effects of Rural Stewardship Scheme (RSS) and Land Management Contract Menu Scheme (LMCMS) in Orkney Islands as agri-environment schemes (AESs) in Scotland. The AESs have been developed across the EU last two decades since the Environmental Sensitive Area scheme created in UK in 1987. The Common Agricultural Policy (CAP) reformed in 1999 and strengthened a role of agri-environmental programme and defined the rural development programme as the second pillar of the CAP. In spite of the importance of the AESs, the studies on the evaluation of the employment effects of the AESs are very scarce, especially in Scotland.

The paper consists of three sections: the first section is literature review which examining development of the AESs in a context of the CAP and agriculture in Scotland: the second section is literature review identifying direct and indirect employment effects of the AESs in Scotland: the third is research on the Orkney Islands to identify the employment effects of LMCMS and RSS.

The research presented the RSS and LMCMS created 11.38FTEs and 40.5FTEs for each and the sum of the FTEs was accounted for around 6.7% of full time employments in agricultural sector in the Orkney Islands. Around 78% of the employments of the schemes have been created in family labours. The agricultural multiplier effects of the schemes were calculated and demonstrated around 86.1FTEs for both the schemes. The research thus has shown the substantial employment effects of RSS and LMCMS in Orkney Islands.