

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **Measuring Sustainable Performance in the Oil Industry: An Application of the Sustainable Value Approach**

No. of words in the main text of Thesis : 16,212

The goal of sustainable development is to “meet the needs of the present without compromising the ability of future generations to meet their own needs”. As key forces in society, organizations of all kinds have an important role to play in achieving this goal. Oil is considered to be the most valuable commodity in world trade and is extremely influential and controversial. The oil industry and the corporations that operate within thus have an even larger role to play in sustainable development.

Yet in this era of unprecedented economic growth, achieving this goal of sustainable development can seem more of an aspiration than a reality. Statistics that demonstrate positive improvements in the lives of many people around the world are counter-balanced by alarming information about the state of the environment. The contrast creates one of the most pressing dilemmas for the 21st century.

One of the key challenges of sustainable development is that it demands new and innovative choices and ways of thinking. ‘What get measured gets managed’ and hence for the transition to sustainability, goals must be assessed.

This has posed important challenges on the scientific community to provide efficient but reliable tools (Ness et al, 2007). Sustainability assessment has thus become a rapidly growing area with over 500 efforts devoted to developing quantitative indicators.

The Sustainability Value Added approach has been developed by Figge and Hahn (2004) as a response to some of the perceived limitations in other measures of corporate sustainability. This approach is arguably the most all inclusive sustainability assessment tool and is hence used to measure the sustainability performance of two of the largest companies, operating in the most influential and controversial industry in the world, namely, BP and ExxonMobil.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **The Ivory Gap: Bridging Elephant Population Ecology and Ivory Economics**

No. of words: 18,000

This paper applies a matrix population modelling approach to a hypothetical African elephant (*Loxodonta africana*) population experiencing drought and poaching scenarios. The aim of this paper is to identify the effects of such stochastic environmental events under a variety of combinations. It is hoped to contribute to understanding the links between ecological reality and economic theory in the broader context of the international ivory trade ban.

Overall, the findings suggest that elephant populations become less resilient as stochastic environmental events increase in frequency and severity, and when populations become less stable, for example as a result of sex-specific poaching. Furthermore, short time frames (>65 years) appear to be inadequate to truly capture the dynamics and responses of elephant populations to perturbation.

Overall the study suggests that international regulation of the ivory trade ban should adopt a precautionary approach, particularly when one-off sales of legal ivory are concerned. In addition, knowledge of elephant population biology and ecology should be used to identify biologically relevant habitats when linking or establishing new protected areas.

Keywords: *Loxodonta africana*, conservation, ivory trade ban, CITES, poaching, metapopulation.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **Un-scripting the role of users, energy and consumption**

No. of words: 21,392

This study explores how conventional energy systems are designed and structured to not simply produce and supply energy, but also to shape the role of users and the consumption of energy. It is proposed that these conventional systems present a disconnect between a technical and economic approach to the role of energy and energy technologies on one hand, and a social and individual understanding of energy and its use in daily practice on the other. This research further presents domestic microgeneration technologies as a means to overcome this disconnect by establishing a direct relationship between energy production and consumption, with users at the nexus. Qualitative interviews with microgenerators confirm that the attitudes and behaviours of users do not match conventional economic assumptions. Rather, they are determined by a complex confluence of social contexts, individual expectations and technological configurations. Placed within such a socio-technical model, the role of households as co-providers is considered central to the sustainable production and consumption of energy.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **Environmental Equity, Environmental Justice, and Road Use: A Case Study of Edinburgh, UK.**

No. of words in the main text of Thesis: 15,311

Environmental justice is an academic discipline that has been developing since the 1960s, but which has only come to prominence in the last 20 years. The roots of the discipline can be found in environmental racism and territorial justice research, and, more generally, social justice theories. Despite this, there is still ambiguity regarding the precise definition of environmental justice. Most commonly, it is understood to be something akin to 'environmental equity.' However, it can be defined in many different ways. Potential bases for environmental justice include need, rights, desert, procedural fairness, and participation and recognition.

This thesis includes a study of environmental justice in Edinburgh. There are two relevant conceptualisations of justice in this case: *environmental equity* and *environmental justice as desert*. By calculating the concentration of nitrogen oxides emitted by automobiles, and the deprivation levels of postcode sectors it is possible to draw conclusions about the environmental equity situation in Edinburgh. It is suggested that areas of moderate deprivation suffer from the greatest amount of car-produced air pollution.

Environmental justice as desert can be tested by estimating the concentration of nitrogen oxides emitted by automobiles, and the average level of car use in postcode sectors. This analysis reveals that there is a tendency for areas where residents use cars relatively infrequently to be greater affected by car produced air pollution. This can be seen as an instance of environmental injustice if one adopts the 'desert' approach.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
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Title of Thesis: **The Wind of Change - Feed-in Tariffs and Tradable Renewable Certificates: Case Study of Germany and Great Britain**

No. of words in the main text of Thesis: 18078

In April 2009 the British government adopted a new Renewable Obligation Order that puts forward banding for different renewable technologies. It recently announced the introduction of feed-in tariffs for small producers, in 2010 for electricity and in 2011 for heat. Germany on the other hand, has for almost two decades and in particular since 2000 had very stable renewable energy scheme without any major amendments, which has fostered a remarkable development of the domestic renewable energy industry and has made Germany one of the world leaders in the sector.

This study analyzes the two most often implemented support mechanisms – tradable renewable certificates and feed-in tariffs. It compares the British Renewable Obligation and the German feed-in tariff scheme on the basis of four criteria – ability to guarantee investment security and stability, support for different technologies, for small producers, and digressive level of support. Since the adoption of the Renewable Energy Sources Act in 2000, feed-in tariffs in Germany have met all criteria. In contrast the British Renewable Obligation scheme meets one criterion only, i.e., support for different technologies since the introduction of banding in April 2009. Before that the scheme failed to include any of the above criteria.

Comparison of installed capacity and renewable energy production is in line with these findings and demonstrates that Germany has been far more successful than Great Britain in this respect. Furthermore, several studies conclude that the German system is also more cost-efficient both in terms of static and especially dynamic efficiency. Due to its targeted support it has to a large extent avoided windfall profits while the Renewable Obligation scheme has led to a high level of excessive and unnecessary subsidies. I conclude that the present British support mechanism may not be able to reach the long-term goal of increased reliance on renewable energies.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
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Title of Thesis: **When the Ship Doesn't Sail; Measuring Socioeconomic Resilience on the Isle of Lewis**

No. of words in the main text of Thesis: 18816

Globalization forces have concentrated systems of food production, creating a global dynamic of food supply networks that are tightly interconnected and less diverse. Panarchy Framework teaches us that simple connected systems are less resilient and are prone to disturbances. In light of this the dissertation investigated the change in community socioeconomic resilience within the Isle of Lewis over the past 60 years. The study demonstrated that elements of social capital like reciprocity and social memory historically aided the community in adapting to disturbances in their food supply. Furthermore past practices of local production of food and fuel provision and the indigenous understating of the functioning of ecosystem services created a food security-net that the community relied upon in times of shortage. These findings highlighted the important roles socio-ecological understanding and diversity play when examining a community's level of socioeconomic resilience. The study found that forces of modernization predicated on comparative advantage often swallow-up small-scale production practices creating an acute state of socioeconomic resilience when supply chain dynamics fail.

THE UNIVERSITY OF EDINBURGH
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Title of Thesis: **Sustainable Tourism on the isle of Lewis. Local Attitudes and Expectations**

No. of words in the main text of Thesis: 21082

Sociological and Anthropological literature show that the development of sustainable tourism might be harmful for local communities' economic and cultural systems, if it focuses exclusively in environmental conservation overlooking pre-existing power relations over land use. Case studies show that negative socio-economic and socio-cultural impacts depend on the fragility of the context and increase to the extent by which local communities are involved in the market economy. In order to overcome social conflicts that might arise from these relations, sustainable tourism industries apply mainly two measures: economic compensation and participation in decision-making and/or management. However, local empowerment is proposed by academics as a shift of power relations from the national to the community level. Fieldwork research in the community of the isle of Lewis shows that the island has recently started becoming more involved in global market systems that are transforming traditional forms of land use and community values. In parallel, tourism-related economic activities have been developing and tourism is now in an emerging state. With the use of Q methodology, this dissertation shows three different discourses about the development of tourism in Lewis held by local people involved in tourism. All of them have positive attitudes and expectations towards tourism; however, they express also that some regulations are affecting the wellbeing of local communities in different forms. These include problems around indigenous knowledge, financial support and integration with traditional economic activities, Sabbath observance, seasonality, participation, and other issues. The paper comes to the conclusion that local empowerment is necessary to integrate this perspectives and their values to decision-making. These need to be understood as principles for driving the industry and for measuring the desirability of its impacts, before they happen.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
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Title of Thesis: **AN INVESTIGATION OF PUBLIC PERCEPTIONS OF ONSHORE VERSUS OFFSHORE WIND FARMS: A Q METHODOLOGY STUDY**

No. of words in the main text of Thesis 16,566

The utilisation of wind as a source of energy can help abate climate change and relieve the need for fossil fuel use. It has also engaged the interest of the public because of the impacts wind farms have on communities. Numerous studies have ascertained public opinions on onshore wind farms, and more recently studies have started to gather opinions on offshore wind farms. This study aims to bridge a gap in this research by comparing the preferences of community members on whether or not they prefer onshore or offshore wind farms, and what underlies their individual preferences.

In order to accomplish this, a community in Scotland was identified that has familiarity with both onshore and offshore developments: Stonehaven, approximately 15 km from Aberdeen. Q Methodology was used in order to discover the various attitudes across the population. Participants were asked to rank statements from “most like how I think” to “least like how I think” on issues including visual impacts and financial burdens. This data was then analysed using a statistical program, PQ Method, which looked for common themes among participants.

Three discourses were found using PQ Method. The first, Anti-NIMBY, Pro Renewables, was characterized by strong support for wind power, onshore or offshore and had an affinity for renewable energy regardless of the impact on society. The second discourse, Pro Offshore, supported the use of offshore wind power, and had severe concerns about the impact of onshore developments. Pro Alternative Energy recognized the need to shift from fossil fuels, but believed other energy sources to be a more suitable option than wind power. These three discourses lend insights into how the public confronts the pertinent issues relating to wind power, and how their opinions are involved in wind power developments and the associated policies.

THE UNIVERSITY OF EDINBURGH
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Title of Thesis: **IN THE PURSUIT OF SUSTAINABILITY: SYSTEMS MODELING AND ANALYSIS OF TWO CITIES (Edinburgh & Findhorn)**

No. of words in the main text of Thesis: 18,527

This is a dissertation integrating the traditional sustainability debate with a systems theory perspective that materializes in the form of a computer-based systems model. The model utilizes data from the two case-study cities of Edinburgh and Findhorn. Our goal is highlight the interconnection between the three pillars of sustainability, society, the environment, and they economy, and emphasize the relevance of new resources in the debate, such as that of social capital.

Part I is a literature review that sets the context for the experimental component to this dissertation. Sustainability issues are examined in their traditional contexts in regards to ethics and economics. Following, a systems theory perspective is taken which reveals some contradictions in the traditional understanding of sustainability. While the term itself is hardly agreed upon between theorists, it generally represents maintenance of desired conditions. Systems theory, on the other hand, places flexibility and adaptability as the targets of true sustainability, evolving our understanding of the popular concept.

Part II is an experimental paper presenting a computer-based systems model. The model portrays a ecological-economic system and is engineered to utilize city data in an attempt to apply reality to theory. Building off previous examples of socio-economic systems models and popular sustainability theories, Edinburgh and Findhorn are analyzed as representations of the traditional sustainability debate. In our effort to discern which approach is sustainability is superior, we examine the significance of social capital, and find both approaches can coexist, assisting each other in the pursuit.

Part III directly addresses the relation between Parts I and II in a few concise paragraphs.

THE UNIVERSITY OF EDINBURGH
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Title of Thesis: **Mapping stakeholders' perceptions on issues concerning Transboundary Rivers: the case of the Maritza/ Meric/ Evros River Basin.**

No. of words in the main text of Thesis:18,500

Humanity faces daunting challenges regarding present and future availability of water resources. The need to utilize all remaining resources efficiently, yet sustainably, is evident. This requirement is rather difficult in the case of transboundary rivers. As these complex ecosystems traverse national boundaries they are subjected to various pressures; asymmetries, both of domestic and international nature, market failures, political and administrative inadequacies, multiple and diverse perceptions, rigid state mechanisms and interstate power games that act cumulatively, augmenting the deterioration of these resources. Any endeavor that wishes to promote an appropriate management must acknowledge the multifaceted nature of transboundary rivers. This study seeks to explore the ways such a holistic approach can be achieved. For this reason it proposes the use of a Fuzzy Cognitive Mapping approach. This methodology is employed in the case of the Maritza river basin, shared between Bulgaria, Turkey and Greece. Through an analysis based on the perceptions of stakeholders, of various national and occupational backgrounds, it provides some illuminating contributions to this discourse. The Fuzzy Cognitive Maps derived from this research are useful information and communication tools for bridging the information gap that characterizes management efforts. Their potency is enhanced, as they are able to integrate in the analysis any kind of information deemed necessary. Moreover they provide some insights in the qualities of cognition, highlighting similarities and disparities between stakeholders' perceptions. The situation, in the end, is characterized as highly intricate, requiring a new configuration, where state power and authority will manage the issue in collaboration with a robust regional population.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: MSc Ecological Economics

Date: September, 2009

Title of Thesis: **Environmental Accounts for Agriculture**

No. of words in the main text of Thesis: 16,300

Against the backdrop of increasing awareness of sustainable developing, the action plan Agenda 21, approved in the Earth summit in 1992, introduced the concept of “environmental accounting” as a tool for integrating environmental impacts into national development. The concept of environmental accounting has been gradually introduced into the agricultural sector. It is necessary to include multiple non-commodity outputs of agriculture into an accounting system to evaluate and monitor the sustainability of agricultural activities and policies. However, many challenges still exist to establish the framework of environmental accounts for agriculture. One of the most challenging tasks is how to adequately monetize non-commodity output. In addition, the international consensus on an environmental accounts system is also required because agriculture has large positive and negative environmental impacts across borders.

This dissertation intends to address the issues of application of environmental accounts for Japanese agriculture. The comparison of economic valuation between the UK and Japan is examined toward development and unification of the environmental accounts framework. As a result, it becomes clear that the previous studies of economic evaluation for rice paddy fields in Japan show significantly high value tendencies compared to other types of agricultural land use in the UK. This study also explores the reasons for the large gap in economic value between the UK and Japan in terms of agricultural structure and economic valuation method. The findings of this dissertation reveal some shortcomings of Japanese studies, such as the lack of sufficient environmental indicators and evaluation focusing exclusively on positive impacts. These outcomes will be of some help to develop economic valuations and international consensus on the framework of environmental accounts for agriculture.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: MSc Ecological Economics

Date: 24/08/09

Title of Thesis: **Facilitating the deployment of micro-renewable heating technologies through cross-country comparisons: An analysis of heat pump adoption in the UK and Sweden**

No. of words in the main text of Thesis: 20,495

Energy issues are currently high on the UK policy agenda, with commitments to achieve ambitious targets, such as an 80% reduction in CO₂ emissions by 2050 and a tenfold increase in renewables capacity by 2020, putting pressure on the Government to radically transform energy generation and use. Increased deployment of micro-renewable heating technologies, such as heat pumps, has been identified as important for meeting these objectives. Heat pumps are a well-developed technology, which have achieved widespread uptake in many countries but have only seen limited installations in the UK domestic sector to date. Given this, it may be informative to draw on the experiences of countries that have successfully deployed this technology when designing current UK policy in this area. Sweden has the most developed heat pump market in Europe, making it an interesting case for comparison.

In evaluating the relevance of Swedish experiences to UK policy, it is important to consider the social, technical and institutional context within which heat pumps have been developed and deployed. This study drew on findings from the literature on technological innovation and systems change to conduct a holistic analysis. However, given that the technology under analysis is a household object, the study also brought in findings from research on energy use and consumer behaviour. Significant desk-based review of relevant literature was complemented with interviews of key stakeholders in order to identify barriers and facilitators of heat pump adoption in both countries. The study uncovered important differences between the energy systems and institutional contexts of the Swedish and UK cases. However, forecasted transitions in UK energy generation, coupled with a shifting policy culture, make elements of the Swedish case relevant to current UK policymaking around micro-renewables, and policy recommendations were offered based on the research findings.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: MSc Ecological Economics

Date: 21/08/2009

Title of Thesis: **An examination of Ecosystem Service Valuation, Benefit Transfer and the Cost of Policy Inaction**

No. of words in the main text of Thesis: 15,998

Applying financial values to natural resources has become a significant area of research over the last few decades. Using the values obtained in small scale studies to extrapolate larger values through benefit transfer has also become relatively common. Transfer exercises of this sort are fraught with possible dangers regarding the difference between sites considered and the methodologies used to perform the transfers. Benefit Transfer can be used to calculate values for use in an examination of the Cost of Policy inaction. However, purely examining financial impacts of policy will not necessarily give a full representation of the policy outcome.

The first part of this thesis contains a review of benefit transfer methodology and a suggestion for a future structure to improve the rigour with which they are performed. By examining the difference between the flow of ecosystem services and the concept of natural capital, concerns around valuing nature are addressed before moving on to examine the issues and risks encountered when conducting a benefit transfer exercise. Finally, a proposal for the development of a systematic review regime, analogous to the Cochrane review system used in healthcare is discussed.

In the second part a comparison of the impact of policy on both biodiversity and the financial value of ecosystem services is conducted. The initial section is an examination of which values should be used for a cost of policy inaction study and the factors which may affect future or projected values. By then combining output from existing studies which examine loss of GDP and loss of biodiversity, a comparison is made between the impacts on each for a number of policy actions.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: MSc. Ecological Economics

Date: 03/09/2009

Title of Thesis: **A multi-criteria analysis study on the potential for financial incentives to increase recycling participation in Edinburgh, UK.**

No. of words: 19,234

In 2007/8 Edinburgh recycled or composted 27.1% of the waste its residents generated (SEPA, 2008), slightly below the Scottish target of 30%. Recycling targets for local authorities will steadily increase in the next few years driven by UK and EU legislation which aims for an increase in the recovery of materials and reduced reliance on landfill. The success of any recycling scheme, and ultimately whether local authorities meet their recycling targets, is dependent on the participation of households to sort and store their materials. Despite increasing demands being placed on households to recycle more waste streams, recycling remains a voluntary activity, relying on positive environmental attitudes of households to participate.

This study aims to understand whether financial incentives could be used to increase householder participation in recycling schemes. Using the analytical hierarchy process, a multi-criteria analysis tool, Edinburgh residents were asked to choose between various recycling management options based around three categories; financial incentives, infrastructural improvements and educational communications of services.

It was found that residents overall would prefer infrastructural improvements over financial incentives, indicating that the greater provision of recycling services would increase participation in recycling. Residents expressed a desire for more kerbside recycling options above any other recycling management option. Financial incentives were favoured among residents who do not hold a strong positive environmental attitude, in which case a reward in the form of shopping vouchers or cheques of around £23 would incentivise such householders to change their behaviour and recycle more. This study finds that recycling rates in Edinburgh could be increased by targeting financial incentives at householders who don't hold strong positive environmental attitudes, but that overall residents of Edinburgh would prefer to see more kerbside recycling options.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: MSc Ecological Economics

Date: 24 August 2009

Title of Thesis: **Cost-Benefit Analysis of Run-of-River Hydroelectric Facilities: A Case Study of the East Toba River and Montrose Creek Project**

No. of words in main text: 12,835

The province of British Columbia (B.C.) in Canada has an ideal landscape and climate for the operation of hydroelectric power projects. This stems from the fact that much of the province is mountainous, experiences heavy precipitation much of the year and has a multitude of rivers and lakes. The province currently generates 90% of its energy with hydropower projects. The need for increasing capacity for energy production and the desire for energy independence is rising in British Columbia. These needs, combined with the global concerns about climate change caused by anthropogenic greenhouse gas (GHG) emissions have given rise to policies which mandate that a large proportion of new energy sources be from clean sources; that is, sources which are cleaner than conventional fossil-fuel burning power plants because they do not emit greenhouse gases. The most popular projects being built in B.C. are small hydro run-of-river. What have not been examined very closely are the effects these projects have on the social welfare. Cost-benefit analysis (CBA) is a tool which can be used to determine both the positive and negative effects that a project has on the welfare or utility of the public as well as weighing its economic efficiency. This makes it a useful tool in making policy decisions. This report will discuss the application of CBA in the evaluation of run-of-river hydroelectric projects in British Columbia. There are two papers in the report. The first, Paper 1: Literature Review, examines the ecological economic theory behind CBA and its relevance in evaluating renewable energy projects. Paper 2: A Case Study of the East Toba and Montrose Hydroelectric Project, comprises a comprehensive CBA of the East Toba River and Montrose Creek run-of-river hydroelectric project being undertaken by Plutonic Power Corporation in British Columbia, Canada. The CBA conducted in the case study seeks to better understand the project's impacts on social welfare and its effects on the environment.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: Masters of Science in Ecological Economics

Date: 24th August 2009

Title of Thesis: **A Cost Benefit Analysis of the Application of Biochar in the Scottish Whisky Industry**

Number of Words in the main text of thesis: 20,955

Biochar is a carbon-negative process (Mathews, 2008) with large environmental credentials which is capable of sequestering vast amounts of carbon into the soil pool. Under the Kyoto Protocol, Biochar could one day be eligible for carbon credits and, depending on the legislation in the U.K., could be eligible for Renewable Obligation Certificates. The Scottish Whisky Industry is an ideal setting for the commercial development of Biochar due to the large amounts of draff coproducts produced through the production of Whisky. The Industry also has a high potential for the development of Combined Heat and Power projects as well as additional carbon capture and algal capture technologies which could lead to large energy and financial savings.

The application of Biochar in the Scottish Whisky Industry could produce up to 6,000 tonnes of Biochar per distillery and could sequester up to 12,360 tonnes of CO₂ annually. A Cost Benefit Analysis of the application of Biochar in the Scottish Whisky Industry shows that the development and application of Biochar in the Scottish Whisky Industry could have a positive Net Present Value over a 15 year period with returns on investment for the largest distilleries of between £2 and £2.5million. However, a Sensitivity Analysis of 84 scenarios underlines the many levels of uncertainties associated with the project which remain.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Degree: MSc. in Ecological Economics

Date: September 7th, 2009

Title of Thesis: **Opportunities and Challenges in Fully Utilizing Turkish Water Resources in Israel**

Number of words in the main text of Thesis: 9382

Freshwater in the Middle East is already scarce, and climate change and urbanization are expected to further reduce freshwater availability. This report examines opportunities in trading water from a water abundant country (Turkey) to a capital abundant country (Israel), and the political obstacles to such trade. These obstacles include the history of conflict between Israel and its neighbours and the resulting tension and mistrust in the region. The economic viability of two methods of transport – freighters and underwater pipeline – are analyzed quantitatively and compared to the costs of desalination. An underwater pipeline is found to be the optimal choice in providing water to Israel as it is less reliant on energy and the associated uncertainty in energy prices. Furthermore, freshwater is found to be preferred over desalinated water for agriculture. Ideally if such a project comes to fruition it will also help to ease tension in the region and improve the quality of life of Palestinians.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
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Degree: MSc Ecological Economics

Date: 14/09/09

Title of Thesis: **Community Forest Groups in Scotland & India: Community Based Management of Forests and Forest Resources**

No. of words in the main text of Thesis: 22,800 (Approximately)

In the face of increased deforestation and forest degradation caused by prolonged periods of commercial forestry and state control of forests, community forest management (CFM) is increasingly being seen as a potential means of achieving forest sustainability. CFM seeks to improve livelihood security and welfare of local communities while protecting and conserving forests through community participation. In the past two to three decades with an increase in emphasis, universally on the importance of more participatory approaches to forestry there has been a global increase in areas of forests governed by local communities.

This study investigates community forest groups (CFG) and CFM in Scotland and India. It examines various aspects of CFGs and CFM in the context of common property resource management (CPRM), emphasising community involvement in forest management efforts.

The paper first introduces the concept of common-pool resources and provides an overview of CPRM literature. It then provides a background to forestry and CFM in Scotland and India. In addition, six case studies are presented from Scotland and India, highlighting the differences and similarities between the two countries with regard to CFM. Qualitative research methods, questionnaires and reviews of available literature were used to investigate issues pertaining to local communities and their forests in these six cases. On the whole the study revealed that local communities in both countries were capable of carrying out successful forest protection and management which provides a range of benefits to the communities themselves. However, results were site-specific and there is a need for further research on community forestry and the conditions for successful CFM, in both countries. There is also a need for increased and continued support for community efforts from governments through creation of supportive policy environments for CFM; and from relevant organisations and NGOs to promote successful CFM.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
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Title of Thesis: **Setting participation policies in agriculture and conservation. An application of Fuzzy cognitive maps in Belgium.**

No. of words in main text: approx 19,500

Considering both positive and negative externalities of different agricultural systems became evident that the present land use pattern is far from the maximization of social welfare and the level of pollutants are greater than the socially optimum level. For this reason a need for environmental policies in agriculture exists. However setting such policies is particularly difficult because a large number of independent actors are involved in agricultural activities and agricultural pollution derives mainly from non point sources.

The negative externalities of agricultural systems have a high spatial variability and a high asymmetry of information exists between farmers and policy makers. For this reason participation policies are considered appropriate to define the right local policy mix. This project is considering the opportunity of use participatory modelling to organize and select the information derived from stakeholders' participation. The general advantages of using Fuzzy Cognitive Mapping (FCM) in participation policies, considering previous experiences of participatory modelling are described in paper I. FCM is applied in a case study of agri-environmental measures application in the Dyle Catchement in Belgium in paper II.

A static analysis of the social map derived from 20 farmers' interviews is used to define the main driving forces and outcomes of policy implementation perceived by the farmers. Different scenarios have been developed to consider the effects of those forces on the application of single measures and on the general policy. The FCM is a promising technique for a quick look at the gross behaviour of the economic and environmental system in presence of limited time and resources.

THE UNIVERSITY OF EDINBURGH
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Title of Thesis: **Consumer attitudes towards food safety labelling information in the UK. An application of Q-methodology.**

No. of words in the main text of Thesis :17,625

Although food safety information is provided on food labels and through government agencies campaigns, food borne illnesses are one of the most widespread health issues in the world, with a high proportion caused by poor domestic food handling practices. In this context, this dissertation aims to explore the extent to which consumers are aware of, understand and make use of food safety messages on food labels. This study utilises Q-methodology with a group of UK rural and urban residents to uncover their attitudes and subjective views about food safety and food labelling. Four factors or viewpoints were identified, showing a diverse range of consumer concerns towards food safety issues, including product composition, production methods, nutritional content and food poisoning. Although food labels are checked by some consumers, a common opinion among three of the viewpoints is that food safety information on food labels is not particularly useful. Consumers perceive that most of this information is redundant because they think they know how to safely handle their food products, an attitude that suggests the need to design communication and educational strategies that have an impact on consumers' perception of risk.

THE UNIVERSITY OF EDINBURGH
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Title of Thesis: **Urban Green Spaces in Nicosia: a Q Methodology study mapping the response of local residents to the management of urban trees in their city.**

No. of words in the main text of Thesis: 19,418

This paper is concerned with trees in the urban space. These are important because with the growth of urbanization people are becoming increasingly dependant on inner city green. Achieving the correct relationship between urban structures and green spaces has a strong influence on the welfare of citizens of an area.

This dissertation studies the management of urban trees in Nicosia, the capital city of Cyprus. Q Methodology was used to carry out research that maps the various discourses which exist amongst Nicosia's residents regarding the trees in their city. The results of the study reveal how people think about the Authorities management and protection of trees; the current urban structure- green space ratio; the success of the Cypriot government to educate society and promote sustainable behavior; their understanding of the reasons for ecological destruction; and finally their own preferences regarding trees in their habitat.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
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Title of Thesis: **A Linear Programming Optimisation of Water Resource Management with Virtual Water through Global Trade: A Case Study of Germany**

No. of words in the main text of Thesis: 22,253

The impact of international trade of primary crops on water resources is the central focus of this dissertation. The literature on virtual water is analyzed and the methodology critiqued. A case study reveals significant global water savings (4,215,748,455 m³) and land savings (822,550 ha) resulting from Germany's exports of wheat in 2005.

A novel application of linear programming to national crop production and trade optimization is presented. The 47 primary crops considered represented 38% of the world's total crop water use (1997-2001).

Germany's baseline (1997-2001 average) production of primary crops resulted in the annual use of 41.5 Gm³ domestic freshwater and 9.6 Mha of domestic land; of this, 19% of water and 18% of land were used for exports. The virtual water and land footprints were 50.6 Gm³/yr and 12.5 Mha/yr respectively; there was an 18% water and 23% land dependency on foreign nations. Germany's exports and imports resulted in a negative trade balance of \$4.18 billion.

From the model, for scenario 1 (trade balance maximization) the trade balance was greatly increased to \$33.3 billion. It was also found that export quantity is not correlated to the efficiency of "dollar per drop". For Germany to be self-sufficient it would require 11.19 Mha/yr (~95% of total arable land) and 47.7 Gm³/yr water (~15% increase from baseline). The minimum virtual water footprint for German consumption of primary crops is 46.3 Gm³/yr; resulting in a 16% water dependency and a cost of \$1.53 billion/yr. The minimum virtual land footprint is 11.04 Mha/yr with a 17% land dependency and cost of \$2.1 billion/yr. The author could find no previous study using mathematical programming to optimize a country's crop production and trade strategy with virtual water and land as important inputs. The model was adapted for Germany, but could easily be used for other nations.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **Social Discourse and Environmental Policy Making - An Application of Q Methodology to Increase Public Support for Environmental Policy**

No. of words in the main text of Thesis 16,331

This paper presents an investigation of how to increase public support for environmental policy. As environmental policy failure leads to a series of negative implications including ineffective environmental protection, and public opposition towards future environmental policies, avoidance of failure in policy implementation should lie in the interest of policy makers. In this paper I argue that a way to improve public support for environmental policy, thereby avoiding failure and creating better environmental protection, is to understand and incorporate public opinion on the environment, also termed social discourses on the environment, into policy design. This also increases citizen participation in policy development. In order to identify social discourses on the environment I conducted a case study amongst German voters using Q methodology. The aim was to establish, with respect to the upcoming parliamentary elections in Germany, participants' preferences concerning a trade-off between environmental and climate protection and economic support for an alleviation of the economic crisis. The Q study produced three distinct discourses, one strongly tending towards ecological objectives, one pursuing mainly business interests and supporting free markets and deregulation, and a third bridging the first two discourses. Analysis and interpretation showed that the principles of ecological modernization correspond best with all three discourses' preferences. Policies pursuing ecological modernization stress the economic benefits that increased investment into environmental and climate protection entail and are therefore most likely to gain broad public support. An indirect conclusion drawn from this study is that increased citizen participation in policy development can not only increase public support for policies, but also retrieve voters' interest and general confidence in politics.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis **TO WHAT EXTENT DOES THE EU ETS ENCOURAGE SUSTAINABLE DEVELOPMENT? ANALYSIS OF THE INFLUENCE OF CARBON PRICE ON COAL INTO NATURAL GAS SWITCH IN THE BRITISH ELECTRICITY SECTOR**

No. of words in the main text of Thesis 20,366

The European Commission has created the market for CO₂, commonly called the carbon, by introducing its Emissions Trading Scheme (EU ETS). Only the most energy-intensive industries in the EU have been embraced by the cap-and-trade system so far; power generation is the most carbon-intensive sector. The first phase of the EU ETS, treated as a trial period, taught many lessons. Therefore, ex-post analyses have been conducted to reveal major reasons of the failure in the emissions reduction between 2005 and 2007. However, in the literature on the carbon price's influences there has been a scarcity of data on the introduction of emissions abatement technologies. This study analyses the extent of the impact of the CO₂ allowances' price on fuel switching. The change from coal to less carbon-intensive natural gas in the electricity generation sector in the UK is included. The major objectives are inter alia the analysis of the current and historical feasibility of the fuel switch and the criteria defining it. The methodology involves the review of literature and interviews with the British utility companies' representatives. The research has indicated the higher importance of other factors than the price of carbon. However, the extent to which the price of EU allowances encourages the shift from coal to less carbon-intensive technologies increases when the carbon price is high. Therefore, it is treated by the utility companies as one of the "ingredients" of the fuel price. Calculating the switching price allows defining the time when it is more economic to burn gas than coal in electricity generation plants. Finally, current regulatory uncertainty on the post-2012 EU ETS is the major concern of the British utility companies, creating complications for their investment decisions related to new power plants' construction. Recommendations related to the subject of this study include further analysis of criteria for fuel switching within the electricity sector and of the interplay between the British Government's policies (i.e. ROCs, LCPD) with the influence of the EU ETS.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **The valuation of ecosystem services on military land: A case study of RAF Leuchars and Barry Buddon Training Centre**

No. of words in the main text of Thesis: 11409

Land in the UK under ownership by the MoD makes up approximately 1% of the land surface. Management strategies are in place to ensure that the environment and biodiversity on this land are protected but there is as yet no provision made for ecosystem services. As is increasingly being shown in the literature the services provided by ecosystem functions play an extremely important role in human welfare. Military land is often protected from being used for other purposes which may cause damage to the environment such as intensive agriculture and urban development. As a result of this the value of services provided by ecosystems on this military land may be greater than the value of the ecosystem services on land surrounding military sites that has not had this protection from damaging uses.

A study was carried out on two MoD sites in Scotland, at RAF Leuchars and Barry Buddon Army Training Area, to compare the annual value of the ecosystem services provided by these sites with that provided by two areas of the same size surrounding the sites. Habitat plans provided by the Defence Estates Environmental Support Team were used along with SPOT satellite images to determine land cover categories over the four study sites. Previously published coefficients were used to determine the value of ecosystem services provided by each hectare of each land cover type and this was summed across each site.

It was determined that at RAF Leuchars the value of ecosystem services provided was US\$63.5 thousand per year while that provided by the surrounding land was US\$50.1 thousand per year. At Barry Buddon the results were more pronounced with the land within MoD ownership providing US\$239.6 thousand per year in ecosystem services while the surrounding land provided US\$88.1 thousand per year.

These results could have serious implications for the way in which the Defence Estates prioritises the environmental management of their land. With the current large-scale sell-off of military land and the increasing intensity of use of the rest of the training estate is it time that the Defence Estates began considering the valuation of ecosystem services provided by their land as an important management feature and out in place strategies for their continued protection.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **Addressing water scarcity: Is seawater desalination an effective and sustainable solution? An analysis and case study of Sydney's desalination project at Kurnell, Australia**

No. of words in the main text of Thesis : 19,863

Globally, seawater desalination has become economic feasible due to technology development. Droughts, deterioration and overexploitation of groundwater aquifers and lower levels of river catchments stress local freshwater sources in places all over the world. Add to this, migration of people from rural areas to urban centres and population growth. Governments seek for sustainable solutions to meet future's water demand with desalination, one promising option to tackle water scarcity. However, critics debate whether desalination causes environmental damages due to its high electricity requirements and the disposal of concentrated seawater into the ocean environment. Recently, seawater desalination has been implemented in Sydney, Australia and has become a part of the water supply portfolio for Sydney's Metropolitan area. This dissertation discusses desalination in general and analyses Sydney's desalination plant using a costbenefit analysis (CBA) in order to value economic costs and benefits of the project including the external effects. The results show that the methodology of a CBA at present can not be used to fully assess all costs and benefits of Sydney's desalination plant. Nonetheless, seawater desalination provides a reliable water supply for the area. Additionally, a continuing environmental impact assessment can help to examine negative outcomes of the desalination plant. Research and development on technology development is vital. Moreover, it is important to monitor environmental impacts of the Kurnell desalination plant in Sydney long term.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **Considering the options for regulating forest carbon projects in the UK.**

This paper considers the case for developing a standard for regulating forest carbon projects on land in the United Kingdom. I discuss the threat posed to the UK by climate change and go on to explain the role that forest management can play in helping to address it. I then discuss the issues of permanence, additionality, leakage and property rights as the key issues that any standard must seek to address. Other issues such as monitoring and verification and avoiding double counting of carbon credits are considered to be more of an operational issue and as such are not discussed in any great detail.

This is followed by a conversation on the role that eco-labelling can play in securing consumer confidence that forest-based carbon projects can reduce the level of atmospheric greenhouse gases in a sustainable way. I consider the risk that any standard and associated labelling scheme could be considered to be greenwashing and the reputational risk that this may pose to any regulatory body.

An overview of forestry in the UK is given and the role of international, national and Forestry Commission policy on climate change is explained. The penultimate chapter considers the options for regulating forestry carbon projects from both voluntary and statutory perspectives, and the key criteria (permanence and additionality) that any standard must address. The relative merits of voluntary and statutory perspectives are discussed and an intermediate option that would involve a government body regulating the standard without the support of a statutory regulation is considered. A simplified economic appraisal confirms that whatever option is employed the benefits outweigh the costs by more than an order of magnitude.

The paper concludes that the market for forestry carbon projects on UK land would benefit from statutory regulation. The do nothing option would fail to address consumers concerns about additionality, permanence and double counting. The intermediate option, although practical and potentially more cost effective initially, runs the risk that it lacks credibility. It is also possible that any regulatory organisation could suffer damage to its reputation if there are any shortcomings with the approved projects. On balance, the introduction of a statutory regulation to control forest carbon projects will reduce the risks that projects may be seen as greenwashing and the reputational risks to a regulatory body. The added advantage of introducing a statutory control is that it sends a powerful political message that the Government is serious about the role that sustainable forest management can play in tackling climate change.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **Cutting Emissions: Developing a Predictive Model for European Union Emissions Trading Scheme Abatement Levels**

Number of Words in Main Text: 16,067

This paper aims to create a predictive model for abatement levels, and ultimately abatement investment, in the EU ETS. It begins by giving a background of cap and trade programs and the EU ETS as a whole. Certain factors affecting emission levels and abatement in the EU ETS are then discussed in further detail. These factors include fuel prices, discount rates, economic growth, and other factors. Once these factors have been discussed the methodology for the design and distribution of the survey will be described, followed by the results from said survey. Following the results will be the analysis. The formula of the predictive model will be formulated from three main factors, EUA price, fuel price, and economic growth. This formula will be applied to three main scenarios: a scenario based on historic measurements of these factors, a scenario based on the baseline assumptions of the EU ETS, and a scenario based on the survey responses. Once abatement levels have been calculated they will be compared to each other with the results indicating that companies within the EU ETS have had more accurate estimates than the baseline assumptions used for the design of the scheme.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **This View of Life: Paradigms, Parasites and Praxis**

No. of words in main text: 19,918

This dissertation looks at the potential application of the biological concepts of symbiosis, in particular parasitism and mutualism, to the disciplines of ecological and evolutionary economics. Adopting the concept of metabolism for the relationship between human socio-economy and the biosphere, I apply both co-evolutionary theory and models of symbiosis to explore the concept of sustainable development and its implications. The current metabolic relationship between socio-economy and the biosphere is found to be parasitic, and the alternative model of mutualism (and its implications) is then explored. The application of evolutionary theory, in particular Punctuated Equilibrium, is then used to investigate potentials for breaking a 'lock-in' of the parasitical metabolic relationship. The role of ecological economics is then examined in the context of praxis and its potential to facilitate the conscious socio-economic evolution of a mutualistic metabolism with the biosphere. It is found that capitalism is inherently incompatible with sustainable development, and that insights into this are provided by Marxist theory.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
(Regulation 3.5.13)

Title of Thesis: **SUSTAINABILITY AND PROTECTED AREAS: WHAT ARE THE PROSPECTS FOR A NEW NATIONAL PARK IN SCOTLAND?**

No. of words in the main text of Thesis: 16,724

The aim of this paper is to bring key insights from ecological economics to bear upon the problems of implementing sustainability in protected areas. By drawing upon concepts such as carrying capacity, systems, capital and total economic value, this paper aims to discuss issues fundamental to implementing sustainability, before applying these principles to a hypothetical case study area: the Glencoe Nevis National Park, Scotland. Building from an overview of Western epistemology where it is shown that there is a human-nature dichotomy that underpins such thought, the paper then discusses the resultant economic and ecological theories pertaining to sustainability in protected areas. In drawing out economic value and types of economic good, and then discussing the more subjective ecological theories that apply to protected areas, the paper establishes key concepts for use in a pluralist approach to assessing the sustainability of protected areas. From this basis, a historical review into parks and protected areas then is undertaken, highlighting the influence of Western epistemology, economic and ecological considerations throughout. The historical review concludes that IUCN Category V protected areas, in particular, resolve the human-nature dichotomy, and offer the most sustainable approach to protected areas. Finally, applying these facets to a case study area, the hypothetical Glencoe Nevis National Park, this paper aims to show that pluralist approaches to establishing a protected area can achieve an outcome that is ecologically, economically and, thus, socially sustainable.

THE UNIVERSITY OF EDINBURGH
ABSTRACT OF THESIS
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Title of Thesis: **CCS and Carbon Lock-In: An Integrated Innovation Systems and Multi-Level Framework Assessment**

No. of words in the main text of Thesis: 21, 853

While there are a sizeable benefits associated with Carbon Capture and Storage, there also exists considerable risks. Several of these risks and areas of uncertainty could not only impede CCS's ability to fulfill the sizable expectations associated with the technology, but also impede the development of alternative low carbon energy technologies, and by consequence, hinder Canada's ability to achieve its emissions reductions targets.

The gravity of this risk merits the assessments carried out within this dissertation with regards to CCS's impact on other low carbon energy technologies, and also the technologies' effect on the flexibility and balance of the overall energy sector. An assessment of these impacts is carried out using an integrated combination of innovation systems and multi-level framework approaches. The study employs two additional low carbon energy technologies wind and fuel cells in these evaluations to highlight CCS perceptions and impacts.

Indications emerge from the paper that CCS may likely be and/or has a strong potential to crowd out support for other low carbon energy technologies particularly at early stages of development.