Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

Research Stimulus Fund

Final Report

An ecological economic analysis of agrobiodiversity in the Irish uplands.

DAFF Project Ref No: **RSF 07 554**
Start date: **01/12/07**
End date: **31/05/13**

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Other Principle Collaborating Researchers: Dr Hugh Kelley, School of Business and Economics, NUIG

Please tick below the appropriate area on the research continuum where you feel this project fits

BASIC/FUNDMENTAL ⟶ APPLIED/PRE COMMERCIAL

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Key words: *(max 4) Biodiversity, agri-environment, valuatio*

1. Rationale for Undertaking the Research

This section should outline the rationale for carrying out the research and identify the need / problem to be addressed

The aim of this project is to investigate the provision of agrobiodiversity in the Irish uplands under the reformed CAP. The effects of agri-environment measures on biodiversity remains at best ambiguous and the attitudes, motives, economic behavior and market allocation decisions of Irish farmers as stewards of upland agrobiodiversity is poorly understood. Using detailed ecological and socio-economic on-farm surveys the study aims to evaluate the impact of REPs on upland biodiversity as well as the attitudes, knowledge of and economic behavior of farm households in relation to the provision of agrobiodiversity.

2. Research Approach

Specify the research methodologies employed, emphasising novel techniques and also outline any modifications from the original approved project proposal

The research involves the use of both economic and ecological data to study biodiversity in managed agricultural landscapes in Ireland. Detailed household farm surveys have been conducted in order to gather economic farm household input/output data from 400 farm households (Counties Donegal, Kerry, Mayo and Galway) and to establish key variables that affect biodiversity provision on upland livestock farms. With respect to ecological data two indicators of biodiversity are used. First, a measure of landscape diversity (based on habitat diversity and quality) is employed. Second, field level biodiversity indices for plant and insect diversity were collected during habitat mapping on thirty of the farms with a view to identifying key household variables that influence biodiversity. The project identifies key drivers of biodiversity, evaluates the relationship between biodiversity and farm profitability and considers the interaction between biodiversity oriented environmental efficiency (BEE) and profit efficiency. A stated preference public survey and land portfolio allocation model was employed to put an economic value on biodiversity and evaluate the social costs and benefits of biodiversity provision using a targeted scheme (BurrenLIFE).

3. Research Achievements

Outline results achieved

A literature review was conducted (task 1) which highlighted the fact that more information is required in Ireland on the public benefits of biodiversity, the social and economic value of policies associated with biodiversity, land abandonment and part time

employment, the adoption of REPs biodiversity undertakings, the productive role of biodiversity and the efficacy of REPs with respect to biodiversity provision compared with targeted schemes.

A total of 400 farm household surveys have been collected (100 surveys for each of the four counties – Mayo, Galway, Kerry and Donegal). The analysis of the data reveals a positive relationship between biodiversity and farm productivity and farm income. We find no evidence to suggest that farm payments from REPs or the single farm payment enhances biodiversity. Instead biodiversity is positively enhanced by habitat quality and by spatial habitat patterns and arrangement. Biodiversity is negatively influenced by animal body size, by fragmentation of habitat and a more homogenous landscape but not by livestock stocking rates. A novel finding is that the study reveals a clear trade-off between Biodiversity oriented environmental efficiency (BEE) and profit efficiency. In simple terms BEE represents how effectively farmers use the biodiversity available to them (as an input into the production process) to produce farm output. Farmers with higher levels of profit efficiency tend to have lower levels of BEE and are thus using biodiversity (in production) less effectively than farmers with lower levels of profitability. There are differences between sheep only, cattle only and mixed grazing systems with respect to biodiversity. Results show that mixed grazing systems are associated with higher levels of biodiversity compared to single species livestock systems.

This work shows a positive relationship between land abandonment and off-farm employment. Farmers who avail of off – farm employment are more likely to abandon agronomic activities such as mixed grazing, hay making and commonage management. Results indicate that REPs payments reduce abandonment.

Two indicators of biodiversity were developed. First, a measure of landscape diversity (based on habitat diversity and quality) is used. Second, field level biodiversity indices for ground beetle, and based on a flora relevé, habitat survey were compiled for thirty of the farms. These biodiversity indices are represented as a Shannon Weaver Index. Shannon Weaver indices were used in the economic analysis described above.

Findings from the land portfolio model show that the marginal social costs and the marginal social benefits of biodiversity are closely aligned. The study finds a cost benefit ratio of at least 1.85 indicating strong economic viability for the BurrenLIFE targeted scheme representing very good value for money in terms of public exchequer spending. The Mean Willingness-To-Pay (WTP) bids per person per year for biodiversity associated with the BurrenLIFE was €56.40. WTP represents the amount a representative member of the Irish public would be willing and able to pay in increased annual taxation for changes in public goods associated with the Burren.

4. Impact of the Research

Provide a summary of outcomes of research and outline the benefits of the research to end users, e.g. industry, consumers, regulatory authorities, and scientific community etc

Study findings may also be of interest to the scientific community. Empirical studies that place an economic value on the functional value of biodiversity using integrated ecological-economic data are rare in Ireland. This study examines the relationship between biodiversity, farm income and biodiversity oriented environmental efficiency (BEE) using biodiversity indices in Ireland. It also investigates how efficiently biodiversity is used using a Translog functional form.

The work contributes toward refining stated preference valuation methods by investigating the issue of social desirability bias using a choice experiment. The results of the choice experiment are also used to compare the exchequer cost of targeted environmental schemes with their market and non-market benefits.

Few studies in Ireland explore the effects of land abandonment on biodiversity. This work shows that farmers who avail of off – farm employment are more likely to abandon activities such as mixed grazing, hay making and commonage management.

Findings from the land portfolio model show that landscapes of high biodiversity and amenity value are important to the Irish public and for international tourism. An important message for policy makers based on the BurrenLIFE scheme is that this initiative represents good value for money. Policy makers and regulators concerned with the costs of such schemes in a difficult economic environment should note that study findings reveal significant potential of a "beneficiary pays" approach to generate revenue for funding farm landscapes, which are a fundamental attractor of tourists to the region. It is suggested that agricultural and tourism agencies work together to exploit this opportunity.

Mixed grazing systems appear to benefit landscape diversity. Policy makers concerned with the design of future Agri-environmental measures should recognise that specialised sheep only or cattle only systems could result in lower levels of landscape diversity. Future Agri-environment schemes in Ireland should consider having mixed grazing as a biodiversity measure/undertaking available to farmers.

This study finds that it is not always clear that farmers understand biodiversity or its possible benefits. This work shows how biodiversity can influence actual productivity on farms. Statutory agricultural agencies need to convey this particular message through farmer training schemes, farm visits, demonstration days and workshops.

5. Exploitation of the Research

Outline the outcomes of the research that have commercial or economic importance and provide details of Intellectual Property / licences / patents generated. Details of outputs adopted by industry should also be provided

An important policy outcome is that we find no clear evidence to support the contention that environmental payments under REPs supports biodiversity. We do find evidence to suggest that REPs schemes may reduce abandonment. The role of mixed grazing also appears to be important for biodiversity. A policy recommendation from these findings is that we, therefore, think mixed livestock grazing should be better integrated into agri-environmental schemes in the future. The scope of agri-environment schemes in Ireland is too restrictive. Rather than relying on one scheme there needs to be scope for different levels of biodiversity provision from entry level stewardship, higher levels of stewardship, designated sites and conservation ownership where the marginal social benefits of biodiversity are increasing with each level. Future agri-environment schemes (AES) need to be evidence based, results oriented and involve spatial targeting, Payments should reflect the increasing social costs of biodiversity provision and be better aligned with its social benefits.

6. Summary of Research Outputs

(a) Intellectual Property applications/licences/patents

(b) Innovations adopted by industry

(c) Number of companies in receipt of information

(d) Outcomes with economic potential

(e) Outcomes with national/ policy/social/environmental potential

(f) Peer-reviewed publications, International Journal/Book chapters.

1. Yadav, L., van Rensburg, T.M., and Kelley, H., (2013). A comparison between the conventional stated preference technique and an inferred valuation approach. Journal of Agricultural Economics, 64(2), 405-422.

2. Kelley, H., van Rensburg, T.M., Yadav, L. (2013). A micro-simulation evaluation of the effectiveness of an Irish grass roots agri-environmental scheme. Land Use Policy 31, 182-195.

(g) Scientific abstracts or articles including those presented at conferences

1. 19th February: Environ 2009 Waterford Institute of Technology: An evaluation of the biodiversity of Irish uplands: are current policies delivering in terms of biodiversity and ecosystem function? Paper presented by Brendan Canning, Dr. Mike Gormally and Dr. Micheline Sheehy Skeffington

2. 14th May -16th May 2009: Annual Conference of Irish Geographers:

A paper was presented by Dr. Tom Van Rensburg at the Session on the Upland Landscapes: Making the Commons Work: Conservation and Cooperation in Ireland:

3. 9th November 2009: BurrenLIFE closing Seminar:
Papers were presented by Dr. Tom Van Rensburg, Dr. Hugh Kelley and Dr. Lava Yadav: The socioeconomics of farming for conservation in the uplands

4. 1st December – 2nd December: ISSP Annual Conference - Social Science Research and Policy Making: Bridging the Divide":A paper was presented by Dr. Tom Van Rensburg:The socioeconomics of farming for conservation in the uplands

5. 17th February – 19th February 2010: Environ Conference (Limerick Institute of Technology, Limerick). An assessment of the biological diversity of the Connemara farmed landscape. Presentation by Brendan Canning

(h) National Report

(i) Popular non-scientific publications

(j) Workshops/seminars/ open days at which results were presented (excluding those in (g))

1. 1st September 2009: Biodiversity Seminar at NUIG:
A one day internal workshop was held where papers were presented in specialized areas

7. Permanent Researchers

Institution Name	Number of Permanent staff contributing to project	Total Time contribution (months)	Average time contribution per permanent staff member
NUIG	6	70	11.7
Total	**6**	**70**	**11.7**

8. Researchers Funded by RSF

Type of Researcher	Number	Total Time contribution (months)	Average time
Post Doctorates	1	46.2	46.2
Contract Researchers			
PhD postgraduates	2	102	51
Masters postgraduates			
Temporary researcher	2	3.66	1.83
Other	1	15	15
Total	**6**	**166.86**	**114**

9. Postgraduate Research

Total Number of PhD theses: __2__

Elias Mulugeta was conferred with a PhD in Economics from NUI, Galway in May 2013. The title of the thesis is - An economic valuation of biodiversity and livestock production in Ireland.

Brendan Canning is expected to submit his thesis (NUIG) in November 2014.

Total Number of Masters theses: ____

Please include authors, institutions and titles of theses and submission dates. If not submitted please give the anticipated submission date

10. Project Expenditure

Total expenditure of the project: €546,676.93

Total Award by RSF €555,706.10

Other sources of funding (specify) €

Breakdown of Total Expenditure

Category	Name: NUIG	Name Institution 2	Name Institution 3	Name Institution 4	Total
Contract staff					
Temporary staff	18,000				18,000
Post doctorates	233,782.62				233,782.62
Post graduates	159,987.23				159,987.23
Consumables	8,299.88				8,299.88
Travel and subsistence	48,635.69				48,635.69
Sub total	468,705.42				468,705.42
Durable equipment	2,706.42				2,706.42
Other	28,394.55				28,394.55
Overheads	46,870.54				46,870.54
Total	**546,676.93**				**546,676.93**

11. Future Strategies

Outline development plans for the results of the research.

The coordinator has produced a presentation which brings together key project findings in an accessible form for policy makers and end users. A biodiversity in agricultural managed landscapes "slide show" will be presented over the course of the next year to a number of local and national forum. The coordinator will convene a meeting with key staff from the Rural Economy Research Centre, Teagasc, Athenry to discuss key findings of the study concerned with future agri-environment schemes, the beef and sheep sectors, the role of mixed grazing, biodiversity, rural tourism and CAP support. Findings from the study concerned with biodiversity valuation, abandonment, mixed grazing and the role of biodiversity in supporting rural tourism will be conveyed to a number of local groups and "Key Informant" representatives of the IFA, individual IFA groups in the counties studied in this project, one of the IFA hill committees, the Irish Uplands Forum (Wicklow) both AranLIFE and BurrenLFE projects and Failte Ireland.

Research findings on biodiversity will be submitted to a number of forthcoming conferences including the European Association of Environmental and Resource Economists (Helsinki), the forthcoming BIOECON (Biodiversity and economics for conservation) meeting in Cambridge, UK and the 89th annual conference of the Agricultural Economic Society. Finally, the coordinator will convene a discussion with members of the SIMBOSYS project (www.tcd.ie/tcbr) at the Trinity Centre for Biodiversity research on the question of how best to formulate biodiversity indices that can be used by economists valuing biodiversity in ecological-economic studies in Ireland.

12. Industry Collaboration

Summarise details of industry collaboration in the research project.

The Project team has liaised with industry on a regular basis through meetings with farmers and key informants in the counties where data was collected. The project team has also collaborated with staff from agencies and groups such as Teagasc (Athenry), Forum and BurrenLIFE.