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## ECOVALUE: Valuing the Ecosystem Services of Irish Forests



### Key external stakeholders:

From the perspective of regulatory authorities and policy makers, this study is the first step in delivering on the Irish Government's commitment made at the Oslo Ministerial Conference to estimate "the full value of forest ecosystem services across Europe" by 2020. They provide the baseline figures and foundation for future assessments in this regard. They can also be used to inform policy as they show how forest management practices can influence the extent of ecosystem services delivered.

From the perspective of the scientific community, the study identifies data gaps where research should be focussed to collect the required scientific data (e.g. interaction between forests and water quality and quantity) in order to make valuation of the service possible.

For consumers, knowledge of the range of ecosystem services that forests provide and the value of these services is important for the continued support for afforestation programmes.

### Practical implications for stakeholders:

Predicting future values for ecosystems services is challenging. What this study shows is that an expanding forest estate arising from continued afforestation is likely to lead to an increase in biodiversity value. It also highlighted that such an expansion is essential to avoid the estate becoming a net source of carbon by 2025. As future afforestation is likely to be carried out by the private sector and the general public do not currently have access to private forests, the recreational value of these new forests will be negligible unless this situation changes. Further data will be required to estimate how other ecosystem services would change over time.

### Main results:

- The volume of carbon sequestered by Irish forests (including those planted prior to 1990) in 2013 was 3,946.9 kt CO<sub>2</sub> yielding a value of €22.9 million.
- The annual value of forest biodiversity is estimated to be €68 million.
- The influence of forest cover on biological measures of water quality (i.e. Q-values) was shown to have had a negligible (although statistically significant) impact on changes to water quality.
- The value of recreation in Irish forests is estimated at €179 million.

### Opportunity / Benefit:

This study is the first to address the value of ecosystem services delivered by the forest estate in Ireland. The results are relevant and have positive impacts for stakeholders and end-users and are being disseminated through peer reviewed publications, conference presentations and workshops.

### Collaborating Institutions:

UCD, UCC, UL.

**Teagasc project team:** Mary Ryan PI, Dr. Vincent Upton, Prof. Cathal O'Donoghue  
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### 1. Project background:

The diversity of benefits that flow from forests and other ecosystems has long been recognised by society but the dramatic decline in many of these in recent decades led to the formation of the Millennium Ecosystem Assessment (MEA) in 2000 (MA, 2005). One of the primary observations of the MEA was that ecosystems and the services they provide are being degraded rapidly and that the consequences of this for society, and for future generations in particular, will be drastic. More detailed assessment of the economic consequences of changes in the delivery of ecosystem goods and services has been undertaken by the UN-sponsored 'The Economics of Ecosystems and Biodiversity' (TEEB) initiative, which has provided guidance and recommendations for policy-makers and businesses (TEEB, 2010). Central to discussions of ecosystems and society is the concept of ecosystem services (ES). The definition of ES is challenging given the complexity of ecosystems, their role in delivering outputs and the nature of their interaction with human beings. The MEA define ES as 'the benefits people obtain from ecosystems' and the TEEB employs 'the direct and indirect contributions of ecosystems to human well-being'. Both definitions are broad in nature and have been supported with classifications of ES and examples to facilitate further comprehension. These global initiatives have had a significant impact on national and international policies, particularly those that relate to land use. EU forestry, agriculture, biodiversity and water policies are increasingly adopting an ecosystem approach to the management of natural resources and the sustainable supply of ES (Maes et al., 2013).

### 2. Questions addressed by the project:

Reflecting the significance now being attached to ecosystem services, the Oslo meeting of the Ministerial Conferences on the Protection of Forests called for the estimation of "the full value of forest ecosystem services across Europe" by 2020 ([www.foresteurope.org](http://www.foresteurope.org)). This desktop study was undertaken to:

- Identify the ecosystem services associated with Irish forests.
- Quantify the benefits from these services in relation to climate change mitigation, biodiversity conservation, forest recreation and human health/ well-being, and water quality/quantity.
- Model the value of the ecosystem services provided by the current forest estate and an afforestation programme.

### 3. The experimental studies:

This is a desktop study; hence no new surveys were conducted from which data could be drawn to model the value of ecosystem services. Instead, the valuation work relied on data from previous national/international studies where available for each of the forest ecosystems services addressed:

**Biodiversity:** Benefit transfer was used to model the value of forest biodiversity. In simple terms, this method draws on previously conducted valuation studies and uses the values derived in these studies to estimate the value of a comparable good or service. The value can be transferred directly with adjustments for the character of the good or of the relevant population in Ireland. Alternatively, where available, the function derived to calculate value can be transferred directly and employed.

**Recreation:** To determine the value of forest recreation estimates of the value of a single forest visit and the total number of visits made to forests were required. The former was derived from data collected in a previous Irish household study (Ni Dhubhain et al., 2011). This study collected data on distance between respondents' homes and the closest recreation forest. Converting this information into travel costs, and modelling the resulting values against a range of socio-economic factors, a WTP value for a single visit to a forest was derived.

**Carbon sequestration:** A recent Department of Environment, Community and Local Government report (2015) estimates that 31,533.45 kt CO<sub>2</sub> have been sequestered due to afforestation since 1990 (when emissions arising from deforestation have been accounted for). It also indicates that in 2013 the amount of carbon sequestered by Irish forests (including those planted prior to 1990) was 3,946.9 kt CO<sub>2</sub>. There are

various approaches that can be used for valuing carbon sequestration including: international carbon market pricing; marginal abatement cost and social cost. Each approach has its associated strengths and weaknesses. In this study the market price approach was employed using prices published in a recent Department of Finance report (2015).

**Hydrological services:** For the valuation of flood mitigation services, it would be necessary to quantify the contribution of forests in reducing the frequency and intensity of flooding events at a spatial scale. Quantitative data on the flood mitigation services of Irish forests are lacking, making it impossible to assign a value to this service. To estimate the value of the water quality services of forests in Ireland, data collected by Howley et al. (2014) on Q-values (where Q-values are measures on a 1-5 scale of water quality employed by the EPA since 1971 and are based primarily on macroinvertebrate communities) and independent variables including spatially referenced septic tank distribution data from the small area Census of Population, levels of agricultural activity from the Census of Agriculture, forest land cover data from the Forest Service, data from the indicative soil map of Ireland and climatic data were collated. Regression analysis of these data was used to determine the relationship between forest cover and Q-values in order to use benefit transfer to assign a value to water quality services.

#### 4. Main results:

**Carbon sequestration:** Using a market price of €5.80 per tonne, the total value of carbon sequestered due to afforestation since 1990 is €180 million. The value of the carbon sequestered by Irish forests (including those planted prior to 1990) in 2013 was 3,946.9 kt CO<sub>2</sub> yielding a value of €22.9 million.

**Biodiversity:** Using the benefit transfer approach an annual willingness to pay value (WTP) per person for forest biodiversity was estimated to be €19.78. This was then expanded across the adult population of Ireland of 3,439,565 suggesting that the annual value of forest biodiversity is €68 million.

**Hydrological services:** Quantitative data on the flood mitigation services of Irish forests are lacking, making it impossible to assign a value to this service. The influence of forest cover on biological measures of water quality (i.e. Q-values) was modelled. The model showed that forest cover had a negligible (although statistically significant) impact on changes to water quality as assessed using the Q-values. Given this negligible effect the value of the effect was also considered negligible.

**Recreation and human health benefits:** Using data collated in a previous Irish study a WTP value for a single visit to a forest was estimated to be €6.16. The total annual visitation to Irish forests was estimated to be 29,105,759 visits per annum. Combining this with the WTP estimate gives a value of €179 million for forest recreation. The benefits from recreating in forests can be both physical and mental. To address the latter, a review of a pilot programme which involved people suffering from depression spending time in Irish forests was undertaken. It showed that organised 'forest walks' was considered by medical professionals as effective adjunctive interventions for those suffering from depression. This could provide significant economic benefits for the Health Service, which would include reduced medical drug dosage, reduced clinical appointments and reduced residential care in hospitals.

#### 5. Opportunity/Benefit:

The study is the first to address the value of ecosystem services delivered by the forest estate in Ireland. Previous research on this topic focused on the afforestation programme/and or the public forest estate only. The results are relevant and have positive impacts for regulatory authorities as they provide the baseline figures and foundation for future assessments; for policy makers as they show how forest management practices can influence the extent of the ecosystem service delivered; for the scientific community in identifying data gaps and future research needs and for consumers in providing knowledge on the range of ecosystem services provided by State afforestation programmes.

#### 6. Dissemination

##### Main publications:

Upton, V., Ryan, M., O'Donoghue, C. & Ní Dhubháin, Á. 2015 Combining conventional and volunteered geographic information to identify and explore recreational resources. *Applied Geography*, 60: 69-76.

Upton, V., Ní Dhubháin, Á., and Bullock, C. 2012. Are forest attitudes shaped by the extent and characteristics of forests in the local landscape? *Society and Natural Resources*. DOI:

10.1080/08941920.2014.933925.

Upton, V. Payments and markets for forest ecosystem services in the USA. Submitted to Irish Forestry.

Iwata, Y., Ní Dhubháin, Á., Brophy, J., Roddy, D., Murphy, W., and Burke, C. (submitted) The effects of activity in forests for persons with significant mental ill-health. Submitted to Ecopsychology.

### Conference presentations/Workshops:

Upton, V., Ryan, M., and O'Donoghue, C. 2014. A spatially explicit national demand model for forest recreation in Ireland. In: Agricultural Economics Society 88th Annual Conference, Paris, France, Apr 10<sup>th</sup>, 2014.

Upton, V., Ryan, M., and O'Donoghue, C. 2013. The value of forests and afforestation for recreation. In: Agricultural Economics Society of Ireland Annual Conference, Dublin, Nov 7<sup>th</sup>, 2013.

Upton, V., Ryan, M., and O'Donoghue, C. 2014. The value of forests and afforestation for recreation. 4<sup>th</sup> General Conference of the International Microsimulation Association. Australian National University, Australia, 10-12<sup>th</sup> December 2013.

Ní Dhubháin, Á., 2013. The cultural services of planted forests. Keynote address at 3rd International Congress on Planted Forests - Dublin Workshop, Ireland: Planted Forests providing Ecosystem Services and Landscape Restoration. 17th May 2013.

Upton, V., 2014. World Forestry Centre. The Irish Forester Newsletter, Winter 2014.

Ní Dhubháin, A., Bullock, C., Iwata, Y., Upton, V., Ryan, M., O'Halloran, J., Irwin, S., O'Callaghan, C and Byrne, K. 2015. Valuing the ecosystem services of Irish forests. Final Scientific Report of ECOVALUE project.

Upton, V., and Ryan, M., 2013. Presentation to COFORD Council Land availability working group.

A website dedicated to the project has been established: <http://www.ucd.ie/ecovalue/>

### 7. References

Howley, P., Buckley, C., Jordan, R., O' Donoghue, C., Hynes, S., Green, S., 2014. A spatial analysis of the distribution of river water quality benefits and the major forces affecting river water quality across the Republic of Ireland. EPA Strive Report, 2011-W-DS-8.

Maes, J., Egoh, B., Willemsen, L., Liqueste, C., Vihervaara, P., Schagner, J. P., Grizzetti, B., Drakou, E. G., Notte, A. L. & Zulian, G. 2012. Mapping ecosystem services for policy support and decision making in the European Union. *Ecosystem Services*, 1, 31-39.

Ní Dhubháin, Á., Bullock, C., Moloney, R., and Upton, V. 2011. An economic evaluation of the market and non-market functions of forestry. Final Report on FORECON project. COFORD.

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### 8. Compiled by: Mary Ryan

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