The economic value of ecosystem services from the terrestrial habitats of the Isle of Man

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Executive Summary

This report presents an economic assessment of the contribution to human well-being by ecosystem services from terrestrial habitats on the Isle of Man.

Ecosystem services for each broad Manx habitat are assessed using value transfer methods. The valuation draws on the results of existing initiatives including the UK National Ecosystem Assessment (NEA) and The Economics of Ecosystems and Biodiversity (TEEB).

Six economically important ecosystem services are valued, namely outdoor recreation, aesthetic enjoyment of the landscape, nature related tourism, flood control, water supply, and water quality regulation.

Figure 1 presents the estimated annual value of each ecosystem service. The total annual value of these six services is £42 million.

Due to data limitations, not all ecosystem services from all habitats types could be valued in this assessment. The gaps are highlighted and in particular it is noted that the non-use value of biodiversity (the value that people place on the existence and preservation of biodiversity, unrelated to any direct or indirect use) is not yet measured.

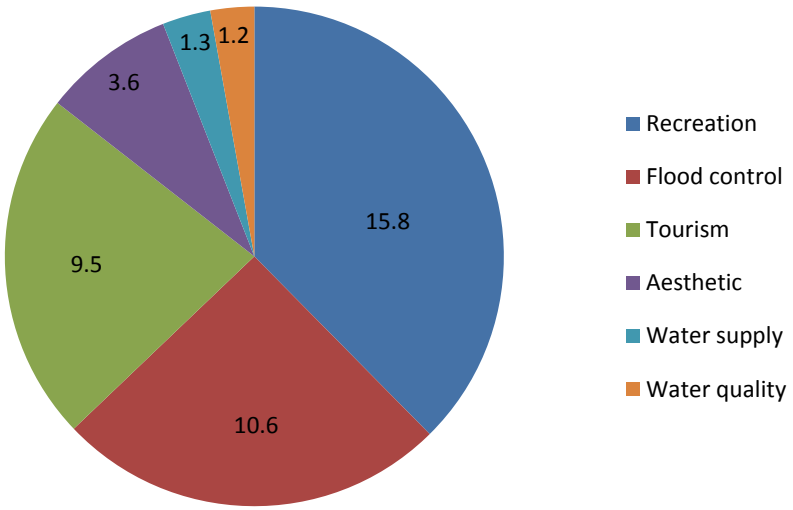

Figure 1. Summary of total annual values for six ecosystem services (£ millions)

1. Introduction

This report presents an economic assessment of the contribution that ecosystem services from terrestrial habitats make to human well-being on the Isle of Man. The overall objective is to raise awareness of the economic value of ecosystem services to the Isle of Man. The rationale for economic valuation of ecosystem services and natural capital is set out in Section 2. The specific objectives of the project are:

1. To undertake as full an analysis as possible of economic values of the Isle of Man's terrestrial ecosystems based on the available datasets.
2. Apply value transfer methods to calculate values for each broad Manx habitat.

This assessment is of particular relevance in the context of the Isle of Man's request that the Convention on Biological Diversity (CBD) be extended to it. The tenth meeting of the Conference of Parties (COP10) to the CBD adopted the New Strategic Plan of the CBD ("Aichi Target") for 2011 onwards. Specifically with regards to assessing and reporting biodiversity and ecosystem service values, Aichi Target 2 states that "By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems."

The analysis presented in this report builds on work conducted in prior initiatives that examine the economic value of ecosystem services, notably the UK National Ecosystem Assessment (NEA), the economics of ecosystems and biodiversity (TEEB) quantitative assessment, and the European Environment Agency (EEA) projects on scaling up ecosystem service values. The analysis thereby relies on secondary data sources, which are adapted to represent the natural and socio-economic context of the Isle of Man. The methods used are described in Section 3.

Due to data limitations only a limited set of ecosystem services for some habitat types could be feasibly valued within this project. The ecosystem services for which values are estimated are recreation, aesthetic enjoyment, nature related tourism, flood and flow control, water supply, and the regulation of water quality. These values and the habitats for which they are estimated are presented in Section 4. The gaps in the available data and subsequently in the values estimated are also indicated in Section 4.

The estimated values for ecosystem services are presented in terms of *annual values*, i.e. the value of the flow of services supplied each year. This information therefore provides a snapshot of the economic value of ecosystem services at the current point in time; it does not provide information on how these values will change over time under future scenarios (e.g. due to conservation policies, development, climate change etc.). As such, the main function of the information provided in this report is to raise awareness of the economic value of natural capital and ecosystem services to the Isle of Man in its current state.

2. The rationale for valuing ecosystem services

It is well established that human well-being is dependent upon ecosystem services provided by nature.[1,2,3] The term ecosystem services (ES) covers the broad range of connections between the environment and human well-being, including: supporting services (e.g. nutrient cycling, soil formation), provisioning services (e.g. food, fresh water), regulating services (e.g. climate regulation, flood attenuation), and cultural services (e.g. recreational, spiritual, aesthetic).[4]

Many of these ecosystem services have the characteristics of 'public goods' such that the people who benefit from ecosystem services cannot be excluded from receiving the service provided (e.g., downstream flood control provided by upstream wetlands); and that the level of consumption by one beneficiary does not reduce the level of service received by another (e.g., recreational opportunities provided by open natural areas). Due to these characteristics, the potential for private incentives to sustainably manage ecosystem services is limited and markets for such services do not exist. In economic jargon, there is a 'market failure'. In other words, by their inherent nature, ecosystem services will be under supplied by the market system.

As a result, ecosystem services are often undervalued in both private and public decision-making relating to their use, conservation and restoration. The lack of understanding of, and information on, the value of ecosystem services has generally led to their omission in public decision making. Without information on the economic value of ecosystem services that can be compared directly against the economic value of alternative public investments, the importance of natural capital has tended to be ignored. The aim of this report is to provide information on the value of ecosystem services from terrestrial habitats for the Isle of Man.

3. Methods

For the assessment of ecosystem service values for the Isle of Man, given time constraints and limited budget, it was decided to use value transfer methods where feasible. The value transfer methods used are introduced below after a brief general introduction to non-market valuation approaches.

A number of economic methods have been developed over the past 40 years to estimate the value of environmental goods and services that are not traded directly in markets. These so-called 'non-market valuation methods' include approaches that use information on consumers' actual behaviour related to environmental services ('revealed preference' methods) and information collected in consumer surveys on hypothetical behaviour related to environmental services ('stated preference' methods). These valuation methods have been used to estimate values for virtually all ecosystem services for most habitat types. Thousands of value estimates for ecosystem services have been published in economic

reports and journals. Conducting primary valuation research is, however, time intensive and expensive to conduct since it generally involves collecting new data or fielding public surveys. For this reason methods have been developed for transferring estimated values from existing valuation studies to inform other policy contexts.

Value transfer

Value (or benefit) transfer is the procedure of estimating the value of an ecosystem service of current policy interest (at a 'policy site') by assigning an existing value estimate for a similar ecosystem (from a 'study site').

Value transfer methods can be divided into three broad categories: unit value transfer (values are transferred without or with adjustments; usually for income differences); value function transfer (values are transferred using a value function from an individual primary study); and meta-analytic function transfer (values are transferred using a value function estimated from the results of multiple primary studies).

Meta-analytic function transfer offers a relatively accurate approach to value transfer by enabling important differences in site and context variables to be controlled for. This approach is generally understood to produce lower transfer errors than unit value transfer and value function transfer. From a practical perspective, this approach is well suited to valuing large numbers of diverse policy sites because the value function can be applied to a database containing information on the habitat and socio-economic characteristics of each policy site.[5]

The main components of a meta-analytic function transfer are represented in Figure 2. The meta-analysis itself involves a review of the available literature on the value of the ecosystem service that is of policy interest. Data from the meta-analysis is then used to estimate a value function that relates the value of an ecosystem service to the characteristics of the ecosystem service. Characteristics might include the type and size of the ecosystem, the availability of other similar ecosystems nearby, and the number of people that benefit from the service. Often it is useful to use a geographic information system (GIS) to obtain information on some of these characteristics. Finally, the characteristics of the policy site are plugged into the value function to estimate the value of the ecosystem services at that policy site. Again, a GIS is often used to obtain information on the characteristics of policy sites.

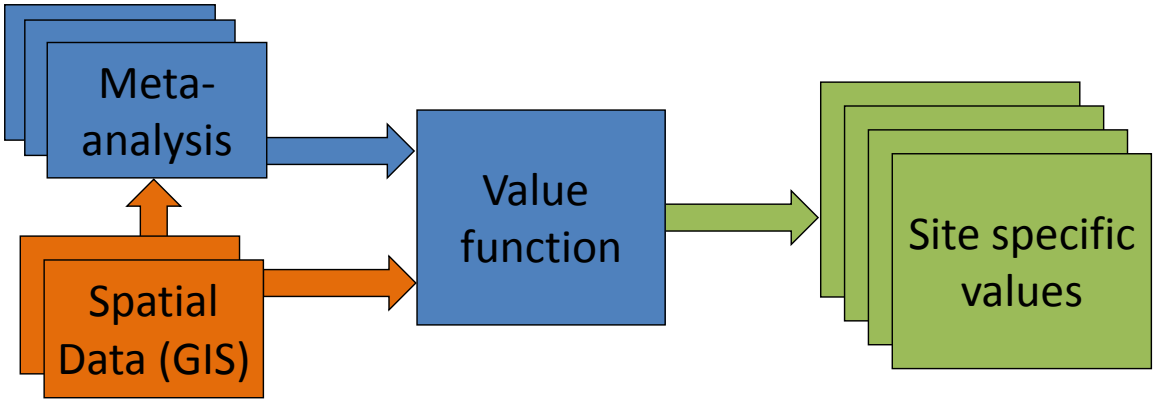

Figure 2. Meta-analysis based value transfer

In this study we use a number of meta-analytic value functions for different ecosystem services from the economic literature. These are introduced at the point that they are used in Section 4.

To provide an indication of the level of precision or reliability of the value estimates, we calculate the 95% prediction intervals for each value. A prediction interval gives an estimated range of values which is likely to include the unknown true ecosystem service value. The estimated range is calculated from the sample data used in the meta-analysis and the variation in predicted values.[6] The '95%' denotes that, if we were to repeat the value transfer exercise repeatedly, 95 times out of 100 the prediction interval would contain the unknown true ecosystem service value. The width of a prediction interval therefore gives an indication of how uncertain we are about the predicted value. A very wide interval indicates high uncertainty.

All ecosystem service values presented in this report are obtained using the above describe value transfer approach except for the value of nature related tourism. This ecosystem service is valued using a net factor income approach. The profit or producer surplus gained from nature related tourism is calculated as the gross revenue from tourism minus the costs of providing tourism services. Based on a review of existing cost estimates in the tourism sector, we make the assumption that costs are 50% of total revenues. The prediction intervals presented for tourism values are derived from a sensitivity analysis. This sensitivity analysis varies the assumed cost proportion by 20%, i.e. costs are assumed to be 60% and 40% of revenues to give a lower and upper bound to the estimated value.

All values are reported in pounds stirling at 2010 price levels. Values that are initially estimated in US dollars are converted to pounds stirling using purchasing parity adjusted exchange rates. Values that are initially estimated for other price level years are converted to 2010 price levels using GDP deflators.

GIS analysis of habitats in the Isle of Man

GIS analysis is used to obtain data on the number and area of patches of each terrestrial habitat type in the Isle of Man landscape. The broad habitat types that are identified are: arable land, bracken and ruderal, coastal habitats, grassland, heath, swamp, water bodies and courses, wetland and mire, and forest and woodland. In addition, boundaries such as hedgerows and earth banks were quantified in terms of total length. Given that a similar assessment of the ecosystem services provided by the marine environment is due to be conducted and it is important to avoid overlap, we specify the coastal habitats as intertidal mud/sand, intertidal shingle/cobbles, shingle above high tide, salt marshes, dunes, hard and soft cliff, and coastal grassland and heath. Specifically, cultural ecosystem services (recreation, aesthetics and tourism) provided by beaches are included in the present assessment of terrestrial habitats.

The spatial data used is from the Isle of Man Ecological Habitat Survey.[7] The Isle of Man was surveyed between 1991 and 1993 by experienced field surveyors who walked all land parcels and mapped the habitats using standard Joint Nature Conservation Committee (JNCC) Phase 1 notation onto hard copy maps. The data was digitised as ArcView 3 shapefiles in 2001 by Salford University.

Data was extracted for the present assessment in ArcGIS10 by selecting data for each habitat, calculating the areas and perimeter of each polygon and exporting as a table to MS Excel.

There are a number of recognised limitations to the data. Due to the scale of maps it is likely that areas of less than 0.25 ha are not mapped with accuracy. Many habitat types will also be under-represented due to the small size of many of the sites, e.g. flush, swamp, tall ruderal, open water and coastal grassland and heathland. As maps are a flat representation of land, taking no account of angle and slope, this will also result in a misrepresentation of habitats on steep slopes and vertical exposures, such as maritime cliffs. Errors in most cases, however, are likely to be less than 5%.

Survey work was completed over 20 years ago. In this time the relative areas of habitats are likely to have changed due to changes in land management and development. Likely changes will include the spread and removal of scrub in different areas. There is also likely to be a loss of semi-natural grassland, an increase in the area of buildings and a change in the ratio of grassland to arable cropping. Most habitat changes will be insignificant on a whole-island context.

4. Ecosystem Service Values

The ecosystem services valued in this assessment include provisioning, regulating and cultural services. Table 1 identifies the main ecosystem services in these categories that are

likely to be provided by terrestrial habitats on the Isle of Man. The table also lists the main habitat types as categorised by the Isle of Man Ecological Habitat Survey. The ecosystem services for each habitat type that are valued in this assessment are indicated.

The only provisioning service quantified in the assessment is the supply of fresh water by forests, woodlands and wetlands. The two regulating services that are assessed are flood/flow control and water quality regulation, again for forests, woodlands and wetlands. Three cultural services are assessed, namely recreation, aesthetic enjoyment and nature related tourism. These services are assessed for almost all habitat types.

Table 1 also provides an indication of what is *not* valued in this assessment. Due to data limitations, regarding both bio-physical and value data, most ecosystem services cannot be assessed for all habitats or not at all. Notably, the non-use value (the value that people place on the existence and preservation of biodiversity, unrelated to any direct or indirect use) is not measured. The value information presented in this report therefore only represents a sub-set of the total economic value of ecosystem services from terrestrial habitats on the Isle of Man. This should be borne in mind when considering the aggregate values presented at the end of this section.

4.1 Recreation

Outdoor recreation is a major leisure activity for many people on the Isle of Man. There are approximately 1.2 million outdoor recreation visits made per year (see Table 2). This estimated number is obtained from a variety of sources and include recreational visits made by both residents and tourists. For almost all natural and semi-natural areas that are used for outdoor recreation there is no charge for access. The recreational opportunities provided by natural and semi-natural areas generate substantial value, however, to the people that participate in outdoor activities. It is likely that changes to the natural environment would affect those values in ways that should be considered in public decision making.

The economic value of outdoor recreation at the areas listed in Table 2 is estimated using a value function following the method described in Section 3. We use the recreation value function developed for the UK NEA.[8] This allows us to estimate a value for each recreational visit for each habitat type. The value per visit therefore varies depending on the habitat type of the recreation site. The value per visit is then multiplied by the annual number of visitors to each recreation site to obtain a total annual value of recreation at each site. For some recreation sites, actual count data is available for the number of visitors (e.g. South Barrule MTB trail); for most sites estimated visitor numbers are used. The annual values in millions of pounds, together with the 95% prediction interval, are presented in Table 2. This same information is presented graphically in Figure 3. The total annual value of outdoor recreation on the Isle of Man is estimated to be just under £16 million, with a 95% prediction interval of £10.5–21.2 million.

Table 1. Ecosystem services and habitats valued in this assessment (indicated with an X)

		Ecosystem Services								
Habitats		**Provisioning**		**Regulating**			**Cultural**			
	Area (ha)	Water supply	Timber	Flood control	Carbon sequestration	Water quality	Recreation	Aesthetic	Tourism	Biodiversity (non-use value)
Woodlands - semi natural	1,190			X		X	X	X	X	
Plantation forests	3,460	X		X			X	X	X	
Wetland - bog	669	X		X		X	X	X	X	
Wetland - swamp	19	X		X		X	X	X	X	
Wetland - salt marsh	7	X		X		X	X	X	X	
Heath	5,956						X	X	X	
Bracken	2,024						X	X	X	
Upland grassland	5,897						X	X	X	
Coastal grassland	157						X	X	X	
Coastal heath	323						X	X	X	
Coastal habitats	84						X	X	X	
Farmland (incl. hedges)	33,149							X		
Amenity grassland	1,011						X	X	X	
Water bodies	105									
Hedges (length, km)	4,967									
Total semi-natural habitat	16,326									
Total highly altered habitat	37,620									
Total habitat area	53,946									
Total island area	56,509									

Table 2. Recreation visits and values by site

Venue	Visits per year	Value per visit (£)	Annual value (£ millions)	Lower 95% CI	Upper 95% CI
Glens and plantations	500,000	11.46	5.73	3.46	8.00
Uplands	300,000	17.25	5.17	3.81	6.54
The Sound	92,200	13.57	1.25	0.83	1.67
Parks and gardens	65,000	11.46	0.74	0.45	1.04
Langness	40,000	13.57	0.54	0.36	0.72
Cregneash Spanish head	36,000	13.57	0.49	0.33	0.65
Niarbyl	35,300	13.57	0.48	0.32	0.64
St Michael's Isle	25,500	13.57	0.35	0.23	0.46
Ayres	20,000	13.57	0.27	0.18	0.36
Maughold brooghs	18,000	13.57	0.24	0.16	0.33
All MWT sites (except Ayres)	17,130	11.46	0.20	0.12	0.27
Curraghs	9,000	12.92	0.12	0.08	0.16
Cross Vein and Cornelly Mines	5,200	17.25	0.09	0.07	0.11
South Barrule MTB trail	7,765	11.46	0.09	0.05	0.12
Sulby Claddagh	5,200	11.46	0.06	0.04	0.08
Braid	800	11.46	0.01	0.01	0.01
Total	1,177,095		15.83	10.49	21.17

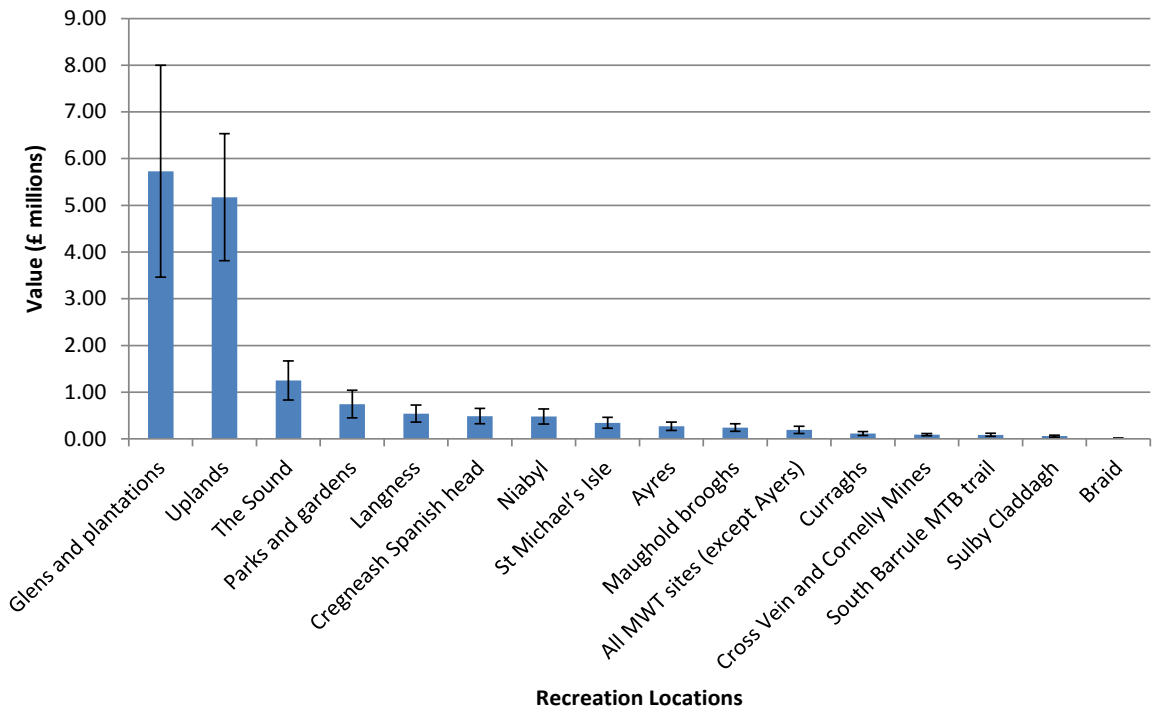

Figure 3. Annual recreation values by site (£ millions)

4.2 Aesthetic enjoyment

The aesthetic value of nature is related to the enjoyment that people experience when viewing beautiful scenery and the sense of wellbeing that they derive from it. It is associated with people's appreciation of the natural qualities and characteristics of an area that contribute to its pleasantness, aesthetic coherence, and cultural significance.

The valuation of aesthetic enjoyment of the landscape of the Isle of Man makes use of two value functions published in the economic literature. One value function provides information on the aesthetic value of wetlands,[9] and the other addresses forests, agricultural land and other green open spaces.[10] These values functions are used to estimate the aesthetic value per hectare of different habitat types, which are then multiplied by the area of each habitat.

The annual values in millions of pounds, together with the 95% prediction interval, are presented in Table 3. This information is presented graphically in Figure 4. The total annual value of aesthetic enjoyment of the landscape on the Isle of Man is estimated to be just over £3.5 million, with a 95% prediction interval of £2.8–4.3 million. It is noteworthy that coastal habitats (dunes, cliffs, coastal grasslands etc.) cover a relatively small area but have relatively high aesthetic values associated with them, particularly in comparison to forests. The average values per unit of area for each habitat type are also presented in Table 3. The average estimated value of aesthetic enjoyment from a hectare of coastal habitat is almost £600 compared with £29 for forest and woodland.

Table 3. Aesthetic enjoyment values by habitat type

Habitat type	Area (ha)	Average unit value (£/ha/year)	Total annual value (£ millions)	95% Lower CI	95% Upper CI
Grassland	25,773	46	0.93	0.65	1.20
Arable	13,044	80	0.81	0.73	0.89
Heath	6,864	133	0.71	0.62	0.81
Bracken and ruderal	2,276	322	0.57	0.45	0.69
Coastal habitats	876	595	0.41	0.26	0.56
Forest and woodland	5,122	29	0.12	0.10	0.14
Wetland and mire	639	80	0.04	0.02	0.06
Swamp	20	129	0.00	0.00	0.00
Total	54,614		3.58	2.83	4.34

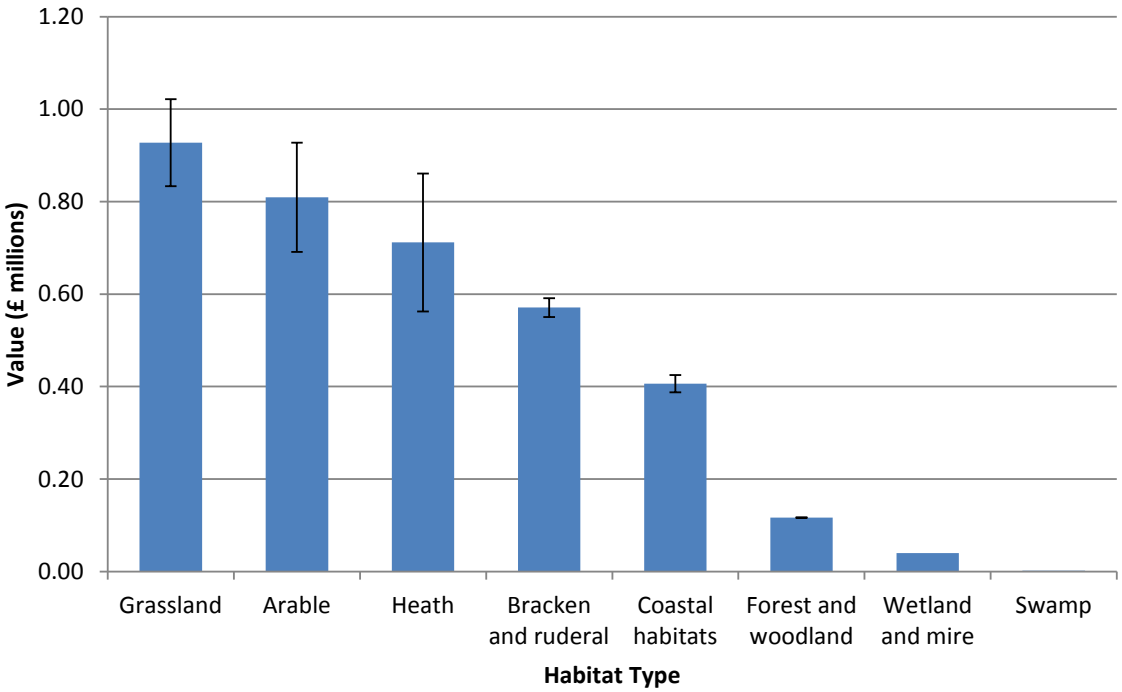

Figure 4. Annual values for aesthetic enjoyment (£ millions)

4.3 Flood control

Natural ecosystems can play an important role in flood control. For example, wetlands in the upper reaches of river basins can act like sponges (saturated peat is typically up to 98% water by mass), absorbing rainfall and thereby reducing the speed and volume of runoff entering streams and rivers. This means that water levels further downstream rise more slowly and the potential for destructive flooding is reduced.

The value of flood control provided by ecosystems on the Isle of Man is assessed for forests and inland wetlands. The role of ecosystems in mitigating coastal flooding has not been assessed. Again two separate value functions for wetlands[11] and forests[12] from the economic literature are used to estimate a flood control value per hectare for each habitat type that is multiplied by the area of each habitat.

The annual values for flood control provided by each habitat type, together with the 95% prediction interval, are presented in Table 4 and Figure 5. The total annual value of flood control provided by wetlands and forests is estimated to be just almost £11 million, with a 95% prediction interval of £8.4–10.4 million. The value of flood control provided by forests is substantially larger than from wetlands due to the much larger area covered by forests. In terms of flood control per unit of area, however, wetlands are assessed to provide a more valuable service.

Table 4. Flood control values by habitat type (£ millions)

Habitat type	Area (ha)	Average unit value (£/ha/year)	Total annual value (£ millions)	95% Lower CI	95% Upper CI
Plantation forests	3,308	2,213	5.16	4.81	5.51
Woodlands - semi natural	1,813	2,297	2.93	1.64	1.56
Wetland - bog	280	5,739	1.13	0.83	1.44
Wetland - fen	30	5,739	0.12	0.09	0.15
Wetland - swamp	20	5,739	0.08	0.06	0.10
Total	5,779		10.75	8.40	10.44

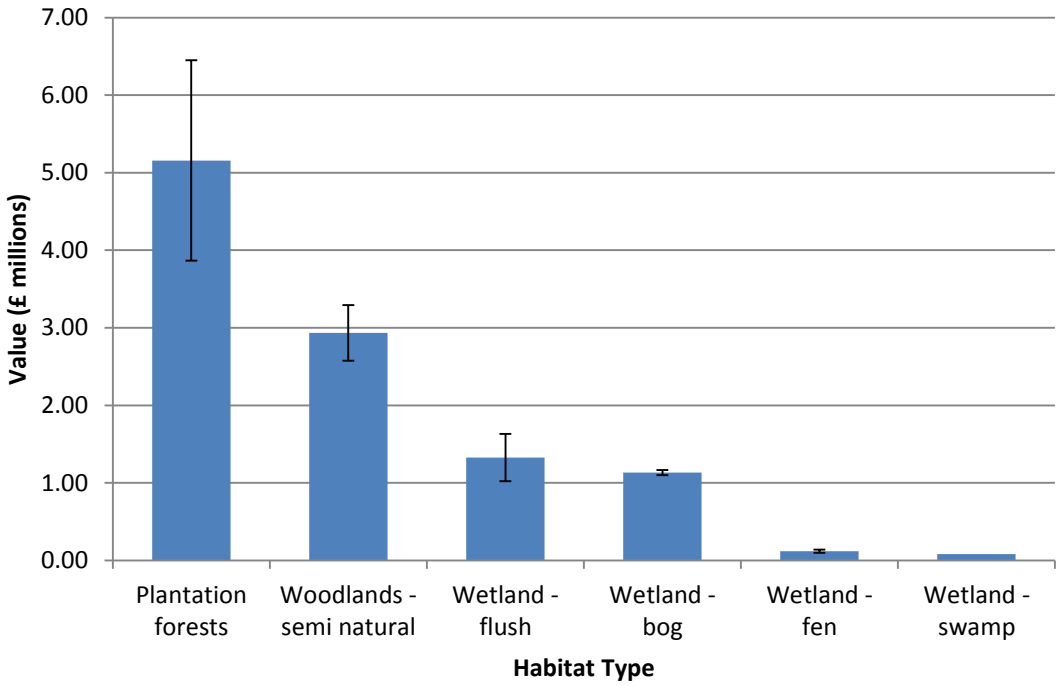

Figure 5. Annual values for flood control by habitat type (£ millions)

4.4 Water supply

Many ecosystems play a role in directly or indirectly regulating the flow of water that is used for drinking water and irrigation for crops.

The valuation of the role of ecosystems in the supply of water on the Isle of Man is valued using the same value functions that are used in the assessment of flood control. These value functions are used to estimate water supply values per hectare for wetlands and forest that

are multiplied by the area of each habitat. Since natural woodlands are not located in catchments of water supplies, water supply values are not estimated for this habitat type.

The annual values for role of wetlands and forests in regulating water supply, together with the 95% prediction interval, are presented in Table 5 and Figure 6. The total annual value of water supply regulation by wetlands and forests is estimated to be just £1.3 million, with a 95% prediction interval of £1.1–1.6 million.

Table 5. Water supply values by habitat type (£ millions)

Habitat type	Area (ha)	Average unit value (£/ha/year)	Total annual value (£ millions)	95% Lower CI	95% Upper CI
Plantation forests	3,308	322	0.64	0.59	0.70
Wetland - flush	329	1,565	0.36	0.26	0.46
Wetland - bog	280	1,191	0.24	0.17	0.30
Wetland - fen	30	3,676	0.08	0.06	0.10
Wetland - swamp	20	42	0.00	0.00	0.00
Total	5,779		1.32	1.08	1.56

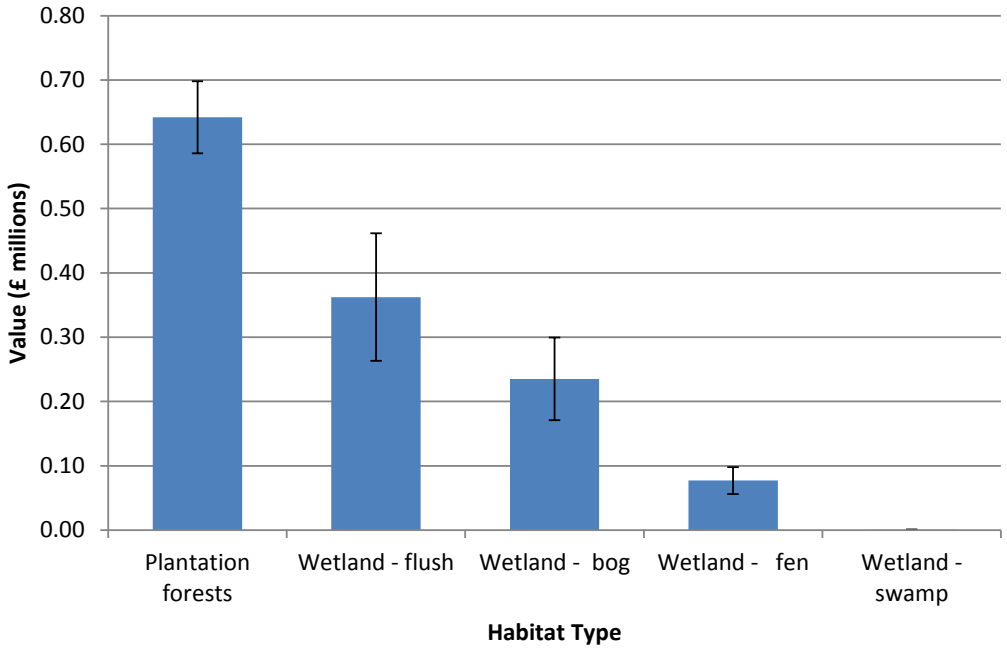

Figure 6. Annual values for water supply by habitat type (£ millions)

4.5 Water quality

Ecosystems can play an important role in purifying water by retaining pollutants in their sediments, soils and vegetation. In particular, high levels of nutrients such as phosphorous and nitrogen, commonly associated with agricultural runoff and sewage effluent, can be significantly reduced by wetlands. This helps to reduce the costs of processing water when it enters the municipal water supply. It lessens the risk of eutrophication in surface-water, a process that occurs when high nutrient levels cause algal growth, which in turn depletes oxygen and blocks out the light that other aquatic plants and animals need to survive.

The valuation of the water quality service provided by ecosystems on the Isle of Man is valued using the same value functions that are used in the assessment of flood control and water supply. These value functions are used to estimate water quality values per hectare for wetlands and forest that are multiplied by the area of each habitat.

The annual values for the role of wetlands and forests in regulating water quantity, together with the 95% prediction interval, are presented in Table 6 and Figure 7. The total annual value of water quality regulation by wetlands and forests is estimated to be almost £1.2 million.

Table 6. Water quality values by habitat type (£ millions)

Habitat type	Area (ha)	Average unit value (£/ha/year)	Total annual value (£ millions)	95% Lower CI	95% Upper CI
Woodlands - semi natural	1,813	22	0.03	0.01	0.01
Wetland - flush	328.62	2,588	0.60	0.44	0.76
Wetland - bog	280	2,588	0.51	0.37	0.65
Wetland - fen	30	2,588	0.05	0.04	0.07
Wetland - swamp	20	2,670	0.04	0.03	0.05
Total	2,452		1.19	0.85	1.49

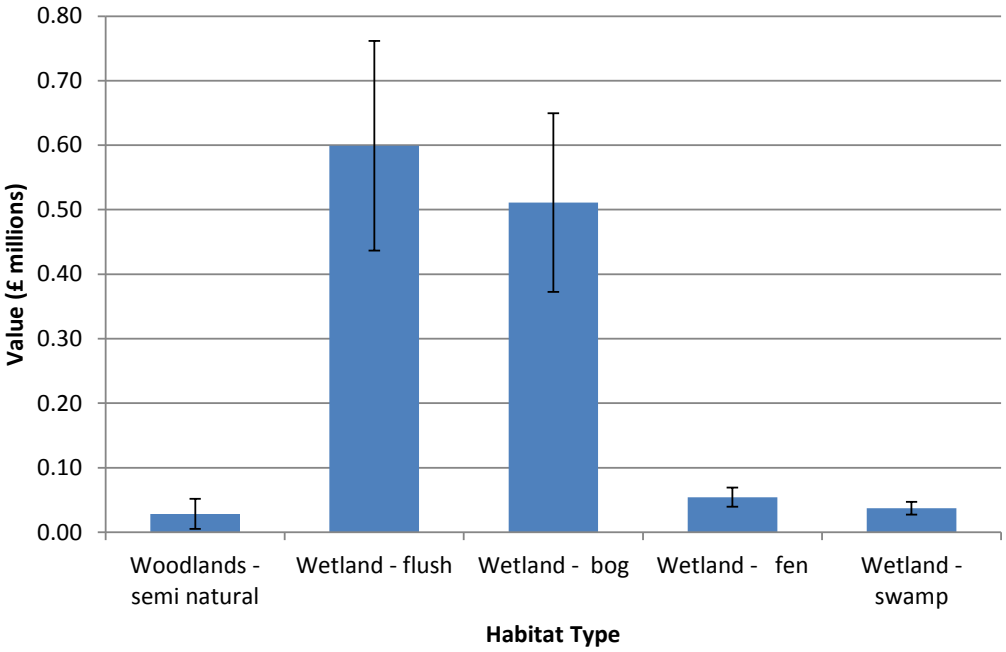

Figure 7. Annual values for water quality by habitat type (£ millions)

4.6 Nature related tourism

The natural environment and scenic beauty of the Isle of Man is a significant draw for tourists visiting the island. The results of the Isle of Man visitor survey conducted in 2010 show that 77% of tourists are interested in visiting the coast and 53% in nature areas.[13] These are the two most commonly stated interests for tourists to the Isle of Man.

The economic value of nature related tourism to the Isle of Man is assessed as the profit (i.e., producer surplus) created by the tourist industry. As such, this value is additional to the welfare (i.e., consumer surplus) derived from nature based recreation by tourists, which is a component of the recreation value estimate.

Producer surplus derived from nature related tourism is calculated as revenue minus costs. Average expenditure by stayover tourists is obtained from the Isle of Man passenger survey conducted in 2010.[14] The average total expenditure on transport, accommodation and other expenses is £393 per trip. The total number of visits by stayover tourists in 2010 is 103,000. This number is for all stayover tourists and so includes visitors with interests other than experiencing the natural environment of the island. To identify the proportion of tourists that visit the Isle of Man with the primary purpose of experiencing the natural environment, we use information from the visitor survey report. We standardise the data on the interests of visitors to sum to one and use these numbers as the proportions of visits attributable to each interest category. We consider interests in the coast and nature to represent nature related tourism, which accounts for 47% or tourists or 48,550 visits. This number is

multiplied by the average expenditure per visit to obtain an estimate of nature related tourism revenue. Costs of providing tourist services are assumed to be 50% of revenues based on a review of the literature.

The annual values for coast and other nature related tourism, together with a prediction interval based on 20% variation in the assumed costs, are presented in Table 7 and Figure 8. The total annual value of nature related tourism is estimated to be almost £10 million.

Table 7. Nature related tourism values by habitat type (£ millions)

Habitat type	Number of visitors	Average unit value (£/visit)	Total annual value (£ millions)	Lower CI	Upper CI
Coast	28,784	197	5.66	4.52	6.79
Other Nature	19,766	197	3.88	3.11	4.66
Total	48,550	197	9.54	7.63	11.45

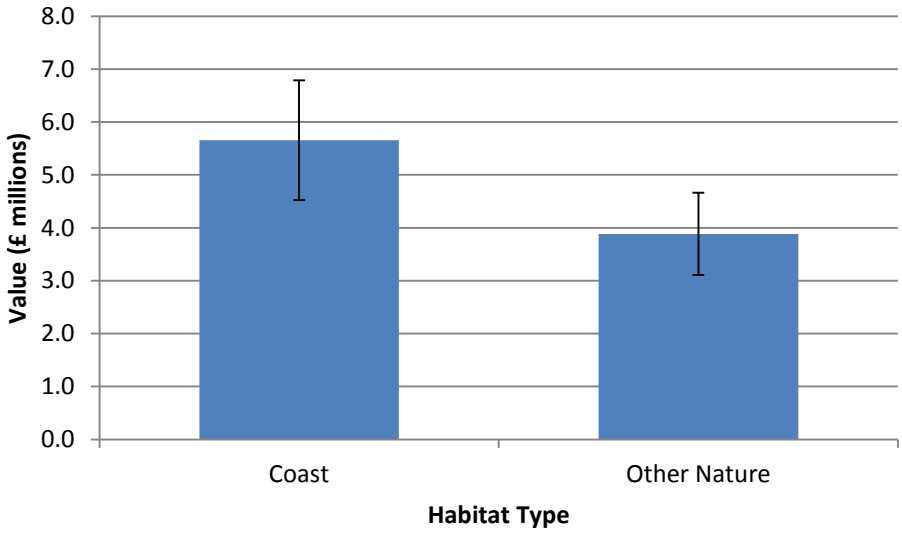

Figure 8. Annual values for nature related tourism by habitat type (£ millions)

4.7 Summary of values by ecosystem service

To give an overview of the total and relative values of the ecosystem services that are assessed in this report, Figures 9 and 10 present a summary of the values estimated. The opportunities provided by natural areas for recreation activities have the highest value (£15.8 million p.a.), followed flood control (£10.6 million p.a.) and nature related tourism (£9.5 million p.a.). Values for aesthetic enjoyment of the landscape, water supply and water

quality regulation are relatively low but not economically insignificant. The total annual value of the assessed ecosystem services for the Isle of Man is just over £42 million.

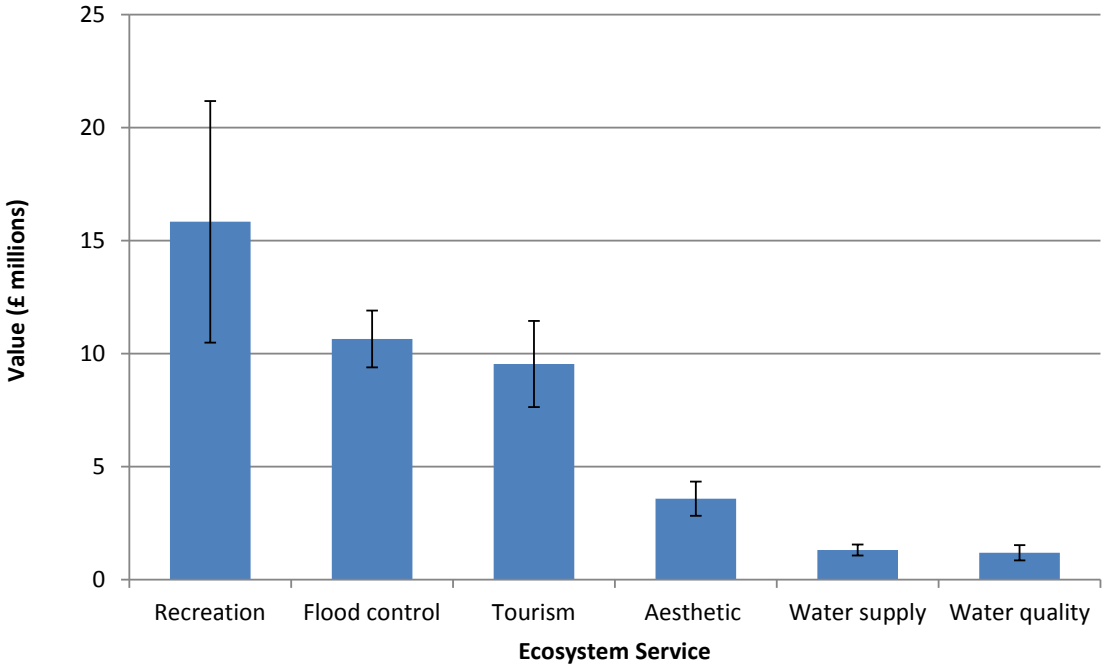

Figure 9. Summary of total annual values for ecosystem services (£ millions)

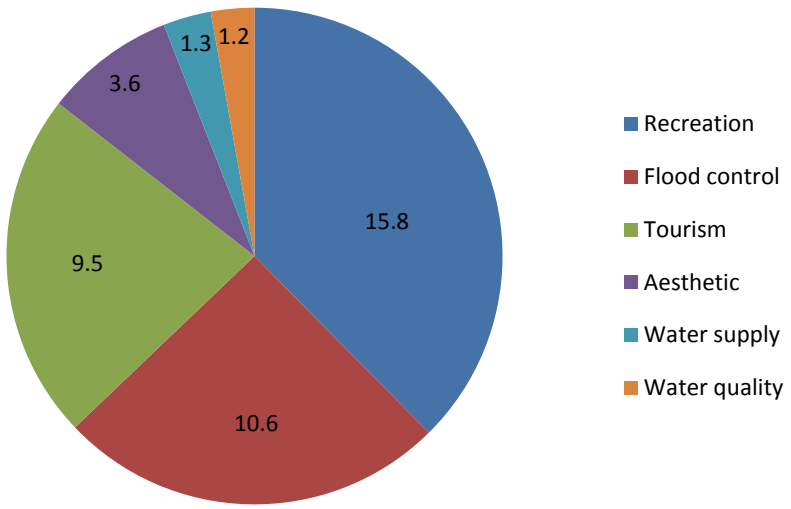

Figure 10. Summary of total annual values for ecosystem services (£ millions)

5. Conclusions and recommendations

The annual values of six important ecosystem services have been assessed for the Isle of Man using available data and value transfer methods. The sum of these annual values is approximately £42 million.

These estimated values highlight the economic importance of ecosystem services but are in themselves not readily useful for evaluating alternative policies related to management of the natural environment. For this purpose we would need to know how the current provision and value of ecosystem services will change under alternative policies. In economics terminology, this requires a 'marginal analysis'. This is also the case for the assessment of alternative future scenarios for the natural environment, for example the assessment of the impacts of climate change on ecosystems. It is unlikely under any policy or scenario that the flow of ecosystem services will be stopped entirely, and so it is more informative to consider relatively small marginal changes rather than total values. Future assessments should take this up.

It is very important to note that the present assessment includes only a subset of ecosystem services produced by natural capital on the Isle of Man. Table 1 provides an overview of where the gaps in the data lie. Future work should target filling the gaps that are potentially of greatest importance. These might be the flood control service provided by habitats other than forests and inland wetlands, particularly coastal ecosystems; and the non-use value of biodiversity. The non-use value of biodiversity is the value that people place on the existence and preservation of biodiversity, unrelated to any direct or indirect use. It is associated with people's preferences to maintain biodiversity for its own sake and as a bequest to future generations. Non-use values for biodiversity that have been estimated in previous studies are often found to be a large component of total economic value. One of the aims of the next phase of UK NEA is to address this issue for the UK. For ecosystem services that are likely to have highly specific values for the Isle of Man (e.g. biodiversity), the transfer of values from other contexts might not be sufficiently reliable. In this case, future work should include primary valuation studies.

6. Notes and references

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