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Commissioned Report No. 304

The Economic Impact of Scotland's Natural Environment

(ROAME No. R07AA106)

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Commissioned Report No. 304 (ROAME No. R07AA106)

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Background

This analysis for the first time determines the extent to which sustainable use of the nation's natural environment supports Scotland's economy.

Main findings

- Scotland's natural environment is important to business location: of thirty factors of potential importance in determining regional location of businesses in Scotland, 'quality of landscape', 'low levels of pollution', and 'proximity to natural areas' were all identified within the top ten factors. Two-thirds of businesses believe that they benefit from Scotland's environment.
- Overall, one fifth of the industry sectors in our economy significantly depend upon the natural environment (although many other industry sectors have some linkage). This proportion would be even higher if extractive industries making use of non-renewable natural resources were included.
- The value to the economy of industry's sustainable use of the natural environment has been estimated at £17.2 billion (including all multiplier effects) for 2003. This output supports almost a quarter of a million full-time jobs (around 1 in 7 of all full-time jobs).
- There are also a number of wider benefits that the environment provides Scotland's economy, such as branding, attracting individuals to live and work, as well as provision of ecosystem services.
- The links between the environment and economy will continue to grow over time as sustainability issues become dominant, for example in addressing climate change. There are many sustainable economic activities that rely on the environment that have growth potential.

Conclusions

Scotland's natural environment underpins the economy. Sustainable use of the natural environment will help secure Scotland's prosperity over the coming years.

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EXECUTIVE SUMMARY

Headline Finding

The total impact of the natural environment on Scotland's economy, as measured by the economy-wide effect of removing its demand for inputs, was estimated to be £17.2 billion in 2003. This figure is equivalent to 11% of Scottish total output in that year¹. In addition, the environment was estimated to support some 242,000 jobs, or almost 14% of all full-time jobs in Scotland in 2003².

Background to the Study

Scottish Natural Heritage (SNH) has identified a need to quantify the benefit that the natural environment provides to Scotland's economy, where 'natural environment' is defined as 'the natural materials, processes, habitats and species, and topography that exist in Scotland'. 'Scotland' includes the coastal waters surrounding Scotland and not just terrestrial features. The aim of the study is to help ensure that this important role of the natural environment is recognised.

The objectives of the study are:

- to determine the current value of economic activity generated by the natural environment at all-Scotland level as well as a regional distribution;
- to gauge the level of environment-related employment in Scotland, including indirect employment, a regional distribution of this employment, and the relative importance of natural environment employment compared with other sectors;
- to conduct a credible analysis of the wider benefits that Scotland's natural environment provides to the economy;
- to conduct case studies based on the Cairngorms National Park and the Borders; and
- to make an assessment of the potential for the use of Scotland's natural environment to aid sustainable growth of the economy.

Economic Impacts

For each of the 128 industry groups³ (referred throughout as 'sectors') in the 2003 Standard Industrial Classification (SIC), an estimate has been made of the extent to which each sector relies on and/or utilises the natural environment. In particular, consideration has been given to the need for a high quality environment, rather than exploitation of the environment. Thus, industry sectors such as mining and quarrying, although they use the natural environment for their primary resource, are assigned a dependence/link of zero per cent, since they do not rely on, or contribute to (in the short-term at least), a high quality environment. The results indicate that there are 26 industry sectors that have significant links to the environment (where a significant link is defined as 20% or more of a sector's activities being environmentally-related). These sectors include food and drink production, water use, timber production and use, tourism and recreation. In full, these 26 sectors are:

¹ Values are given for 2003 as this is the year of the input-output tables used, being the most current available at the time. Total output at basic prices was £158.8 billion in 2003 according to Scottish government statistics. The Type II output multipliers have been used to calculate the headline figure.

² The estimate of jobs is based on the Type II employment multiplier estimated for the environment.

³ Broken down to the three-digit level.

- agricultural/forestry machinery;
- agriculture and hunting;
- beers and ales;
- bread, rusks and biscuits;
- construction;
- fish and fish products;
- fishing and fish farming;
- footwear;
- forestry harvesting;
- forestry planting;
- fruit and vegetables;
- grain mill products;
- hotels and restaurants;
- meat and meat products;
- membership organisations;
- other food products;
- prepared animal feeds;
- recreational activities;
- sewage and refuse disposal;
- soft drinks and mineral water;
- spirits and wines;
- tanning and leather;
- tour operators, travel agents;
- vegetable/animal oils and fats;
- water supply; and
- wood and wood products.

The impact of the natural environment on the Scottish economy has been estimated using an input-output framework. Input-output tables are a representation of the sectoral structure, including the inter-relationships, of an economy at a given point in time (typically a year) and describe the flows of money between industries in the purchase of inputs to production. Within this framework, it is possible to estimate the overall economic effect of a change (or 'shock') to one or more sectors in the economy. By incorporating an explicit 'environment' sector into this structure, the environment can be considered as another economic sector and analysed as such. This is achieved by allocating a proportion of the flows between the existing industries to the new environment sector, according to the survey-data percentages, to form a new input-output table.

The approach used in this study uses the newly-created input-output table to define the environment in terms of the value of its demand for inputs. This information is used in conjunction with the multipliers calculated from the table to estimate the economy-wide effect of setting the environment's demands to zero (effectively removing it from the economy). The multipliers used capture both the direct and knock-on economic effects.

Summary of Results

Having formed the new input-output table, the environment sector's 'value' for the Scottish economy can be interpreted as the sum of its purchases of inputs from the other sectors in the economy (termed intermediate demand). If there were no environment sector, these demands would all equal zero. The total value of a shock of sufficient size to remove the environment sector is thus the total value of these demands. This initial impact on the environment sector can be thought of as the 'direct' effect. In the input-output framework, a shock will have various knock-on effects on other industries' output through the reduction in environmental demand. These are known as 'indirect effects'. Moreover, it is likely that the shock will impact the demand for labour and, in turn, total wages. A reduction in wages will reduce household expenditure on final goods and services produced in the economy. This effect is called an 'induced' effect. Type II multipliers capture the combined direct, indirect and induced effects. Using these multipliers and the values of the environment's intermediate demands, the economy-wide reduction in demand from a shock such that the environment's demands for inputs are set to zero was estimated to be £17.2 billion.

The number of Scottish jobs (in the entire economy) supported by the environment was estimated to be 242,000. This was calculated as the number of jobs in the entire Scottish economy that would be lost if employment in the environment sector were zero (the figure of 154,000 calculated from the survey-data percentages multiplied by the Type II employment multiplier for the environment of 1.57). Like the estimated value of £17.2 billion, this employment figure captures the direct, indirect and induced effects on employment.

In the absence of input-output tables at the regional level, quantifying the value of the environment by region involves the allocation of the figures calculated for Scotland as a whole to the different regions. This can be done by apportioning the results of the input-output modelling by the Gross Value Added (GVA⁴) of the industry sectors. Table 1 compares the results for each region against the average for Scotland as a whole. The table also shows the number of jobs per region estimated as being supported by the environment (direct and non-direct).

Table 1: GVA per head and Jobs by HIE/SEn and SEARS Areas (Type II, direct + indirect + induced)

Region	GVA per Head	Direct Jobs	Direct + Indirect + Induced Jobs
Scotland	£3,400 per head	154,000	242,000
HIE/SEn	GVA per head	Direct Jobs	Direct + Indirect+ Induced Jobs
East and Central Scotland	£3,400	41,000	64,500
Grampian	£4,000	13,000	20,500
Highland and Islands	£5,100	22,000	34,500
South Scotland	£5,200	11,000	17,000
Tayside	£3,900	13,000	20,500
West and Central Scotland	£2,700	53,000	83,000
SEARS	GVA per head	Direct Jobs	Direct + Indirect +Induced Jobs
Argyll	£4,200	3,000	5,000
Ayrshire	£3,200	11,000	17,000
Borders	£4,800	4,000	6,000
Clyde Valley	£2,600	42,000	66,000
Dumfries and Galloway	£5,200	7,000	11,000
Forth	£3,400	41,000	64,500
Grampian and Moray	£4,000	18,000	28,000
Highlands	£5,900	11,000	17,000
Northern Isles	£5,500	2,000	3,000
Tayside	£3,900	13,000	20,500
Western Isles	£3,700	1,000	1,500

Source: based on Census 2001 data downloaded from www.scrol.gov.uk.
Totals may not sum due to rounding

Table 1 shows that it is the South Scotland Scottish Enterprise region that is identified as having the strongest links to the environment when expressed as GVA per head, closely followed by the Highlands and Islands. For the SEARS (Scotland's Environment and Rural Services) areas, it is Highlands that has the highest value, followed by the Northern Isles and Dumfries and Galloway. Locations with a low value, e.g. Ayrshire, are likely to reflect the large number of jobs in public services, aerospace, biotechnology and transport within that region (which are not assumed to have significant dependence on or links to the natural environment).

⁴ GVA (Gross Value Added) is the Gross Domestic Product at basic prices and is a measure of income generated by businesses after the subtraction of input costs, but before costs such as wages and capital investment are paid (Scottish Executive, 2007).

Wider Benefits

There are six different types of benefits being considered:

- *The relative value of Scotland's natural environment in attracting businesses and individuals to Scotland, and how this may change in the future.* Here the environment is seen as a marketing asset that can encourage businesses and individuals to invest in Scotland, promising a high quality of life as well as economic and recreational opportunities. Two-thirds of business surveyed believe Scotland's natural environment to be a benefit to their company. Location was not found to be an initial motivation for individuals moving to Scotland; more important initially were the opportunities that were available. However, of thirty factors of potential importance in determining regional location of businesses in Scotland, 'quality of landscape', 'low levels of pollution', and 'proximity to natural areas' were all identified within the top ten factors. These environmental factors are seen as being even more important by businesses in the Highlands. For visitors, 89% identified that the natural environment was an important factor in their choice of Scotland as their destination. Overall, therefore, the environment is a key factor in attracting business and visitors. While it may be less of a factor initially for relocating individuals, the significant role that the environment plays in the Scottish economy will help to provide the opportunities that encourage migration to Scotland.
- *Areas of economic opportunity in relation to the natural environment and an assessment of the enablers and barriers to exploiting these opportunities, and how this may change in the future.* There are numerous targets already in place to increase the productivity and performance of industry sectors with strong links to the environment. In addition, there are many strategies and policies focused on improving the sustainability of economic growth, such that those sectors not currently strongly associated with the environment may become increasingly linked to it in time. Sectors such as forestry are identified as providing opportunities for regeneration in rural areas, not just through timber production but also through linkages with tourism and recreation. Food and drink manufacturing is expanding considerably, outperforming other manufacturing industries in Scotland. Growing demand for locally produced and/or organic produce should provide opportunities for growth in sustainable production of food and drink products. Wildlife tourism is a potential key growth area, but this could be limited without significant protection of the environment and the species it supports. There is also a need to improve the skills base in the land management, conservation and tourism sectors, and encourage strategic and joined-up approaches to bring different industry sectors together. Key growth sectors such as renewable energy generation may potentially be limited in Scotland due to the need to expand transmission capacity. Although tourism may potentially be adversely affected by wind farms in some instances, more significant impacts could be felt as a result of the need for pylons transmitting the energy to where it is needed. This could be overcome by locating transmission cables underground or on the seabed to avoid impacting sensitive landscapes.
- *The importance of the natural environment hinterland for a city economy in Scotland.* A city's hinterland provides greenspace and access to the countryside for recreation, as well as providing alternative attractions for visitors to the city. The city provides benefits as an economic hub, supporting the rural economy, while the hinterland provides a source of materials and production inputs. Thus, the hinterland can act to attract business to the city, to attract individuals to the city hinterland and to provide those individuals with health, landscape and well-being benefits. There are opportunities to create greater linkages between cities and their hinterlands to take further advantage of the potential benefits.

- *The value of Scotland's natural environment for branding.* The natural environment is valuable as a brand as it reflects positive, memorable qualities linked to attractiveness, uniqueness and sustainability. The use of the natural environment as part of the brand can also benefit future economic development by becoming self-fulfilling in that it can influence decision making when developing policies and plans. This can arise where a brand portrays an iconic image or landscape which can help to protect that landscape and/or provide a vision of what the future should look like. The identity of Scotland is already heavily used, particularly by food and drink manufacturers, who also make use of the location of production to help differentiate their products. The use of Scotland's reputation to brand products already draws on perceptions of Scotland's environment and traditions. This reputation could be protected and enhanced through marketing of Scotland for tourism, but will only provide economic benefits as long as the product (i.e. the environment of Scotland) continues to meet or exceed the expectations of visitors.
- *The value to the economy of health benefits that the natural environment of Scotland provides.* The natural environment offers health benefits from pollution reduction, encouraging exercise and positive impacts on mental and physical health. If the number of inactive people in Scotland could be cut by 1% annually, £85.2 million in economic benefits could be gained in five years (SEPA, 2008). While this does not necessarily depend on the environment, there is general agreement that access to green spaces and woodland has a positive effect on mental wellbeing as well as encouraging physical activity. Other benefits can also be provided from the impact that trees have on reducing pollution levels, the increased use of views of nature to reduce sickness recovery times, as well as helping to reduce blood pressure and stress. Providing continued or increased access to green areas is likely to result in significant benefits to health, potentially revealed through health cost reductions but also in quality of life and well-being.
- *The ecosystem services that benefit the economy.* The benefits provided by ecosystem services are effectively the life support for Scotland and have been estimated at a minimum of £17 billion per year in 2001 prices (Williams *et al*, 2003) (£21 billion per year when up-rated to 2008 prices). Ecosystem services relate to indirect use of the environment and include carbon storage, filtering of pollutants, water storage and water purification. This value is very similar to the £17.2 billion per year estimate for the Type I and Type II effects (including wages), although it is not possible to directly link the total value for the ecosystem services to the Scottish economy (because many of these benefits will fall wholly outside the economy).

Conclusions

Using the multipliers from the input-output modelling, which capture the non-direct as well as the direct effects, the estimated fall in output in the Scottish economy resulting from the removal of the environment sector, as defined by its intermediate demands in 2003, is £17.2bn, or 11% of total output in Scotland, defined as total output at basic prices (in 2003). The environment was estimated to support some 242,000 jobs in the Scottish economy, (around 11% of all full-time jobs).

After taking methodological differences into consideration, the output and employment estimates are consistent with those in other regions of the UK for which similar studies have been undertaken. For example, a study in Wales (Bilsborough & Hill, 2003) (for year 2000) found that the environment contributed £9 billion of gross output (15%) and supported around 169,000 jobs (around 17%). Studies for three regions in England showed that the environmental economy generated 6% of total output (£7.8 billion) in the South East in 2003 (Land Use Consultants & SQW Ltd, 2007), 2% of GVA (£2.6 billion) in the North West

(Natural Economy Northwest, 2007), and 2% of GDP (£1.6 billion) in the South West (1999)⁵ (South West Observatory Internet Site, nd). In terms of jobs, the environment supported 4% of total jobs (109,000) in the North West, 5% (100,000) in the South West and 5.5% (230,000) in the South East. It is difficult to make direct comparisons with the figures as quoted above, however, as the industry sectors included/excluded vary between studies as do the percentages assigned to industry sectors to estimate their reliance on the environment. For example, the Welsh study included use of the environment by the mining and defence sectors.

The impact of the environment cuts across many different industry sectors such that the total of £17.2 billion exceeds any individual sector in terms of total output (based on 2003 figures as this is the year of the input-output tables). For example, extraction of crude petroleum and natural gas and services to oil and gas (which was not included in the impact analysis) resulted in total output in 2003 of £15.1 billion⁶. These figures highlight the importance of the environment generally to the economy of Scotland and that it is sustainable (i.e. not based on a finite non-renewable resource). As an illustration, a sectoral comparison of jobs can also be provided. This study estimates that the number of jobs supported by the environment is similar to that supported by all manufacturing.

The results provided above have been derived using input-output analysis. One of the key uncertainties in the results is associated with the percentages used to highlight the reliance of different industry sectors on the environment and it is important that the analysis does not overstate the environmental impact. Other approaches exist that could have been adopted and which may have provided different results. However, this approach is considered to be the most appropriate for this study. It is important though to consider that the global natural environment ultimately supports all economic activity since without the ecosystem services provided (e.g. purification of water and air, photosynthesis producing crops and trees), human activities would not be possible.

The results presented above show that there are strong links between the natural environment and the Scottish economy. Many existing Government strategies and policies are already focusing on building more sustainable communities and economies. Where the growth of the sectors linked to the environment exceeds that of sectors that have fewer dependencies on the environment, the relative importance of the natural environment to the Scottish economy will increase. Similarly, the number of jobs related to the environment will also increase as a proportion of total jobs. Encouraging sustainability would develop stronger links to the environment in those industry sectors where these are weak at present. Combined with work to address the barriers such as lack of skills, this should provide the basis for continued growth of the importance of the environment for Scotland's economy into the future.

⁵ Data on proportion of total output generated by the environment are not available.

⁶ Data on total output are taken from Scottish Executive (2005b)

GLOSSARY OF ECONOMIC TERMS

Term	Definition
Basic price	The amount received by the producer from the purchaser of a unit of a good or service produced as output, minus taxes plus subsidies.
Direct effects	The initial effect of a change or shock, in the sector from which the change originated.
Direct and indirect effects	The direct effect plus the wider, knock-on effects to other, related sectors (that could also potentially feed back into the sector from which the change originated).
Direct, indirect and induced effects	The direct and indirect effects plus the additional effect on wages that will affect household spending on final goods and services produced in the economy.
Full-Time Equivalent (FTE)	The number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs.
Goods	Physical objects for which a demand exists. They may be used in the production of other goods and services.
Gross Value Added (GVA)	Gross value added is a measure of the contribution of an industry to economic activity and approximates to total turnover minus inputs purchased.
Industry	A group of establishments engaged in the same or similar types of economic activity.
Input-output analysis	A type of applied economic analysis that aims to account for how changes in one sector of the economy affect other sectors.
Input-output table	A representation of the relationships between industries and producers through their demands for goods and services at a particular point in time.
Multiplier	A multiplier is used to assess the dynamic impact of an industry. For example, a Type I output multiplier measures the direct effect of expenditure on an industry and the indirect effects on suppliers of inputs to that industry. The Type II multiplier also captures the additional induced effects from changes in incomes and spending. In a similar way, employment multipliers measure the impact of a change in employment.
Standard Industrial Classification (SIC)	System for grouping economic activities using the operating establishment as the basic production unit. The SIC system assigns each establishment an industry code on the basis of its primary activity, which is the establishment's principal product or

Term**Definition**

group of products produced or distributed or services rendered.

Sources:

United Nations (1999)

European Commission (nd)

Implan (2008)

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY	i
GLOSSARY	viii
1. Introduction	1
1.1 Background to the Study	1
1.2 Aim and Objectives of the Study	1
1.3 The Study Tasks	1
1.4 Overview of the Approach	2
1.5 Organisation of this Report	3
2. Estimating the Impact of the Natural Environment on the Economy of Scotland	4
2.1 Data Collection	5
2.2 Estimating Links to the Environment	5
2.3 Key Industry Sectors	7
2.4 Input-Output Modelling	10
2.5 Results: Scotland	12
3. The Impact of the Natural Environment to the Regions	22
3.1 Impacts of the Environments in the Regions	22
3.2 Case Study Areas	23
3.3 Comparison of Results	24
4. Wider Benefits	26
4.1 Overview	26
4.2 Attraction of Businesses, Individuals and Businesses	26
4.3 Hinterland	31
4.4 Branding	32
4.5 Health and Well-Being	34
4.6 Ecosystem Services	35
4.7 Summary of Key Barriers and Opportunities	36
5. Summary and Conclusions	39
5.1 Summary of the Impact of the Natural Environment	39
5.2 Potential for Future Development	42
6. References	46

1. INTRODUCTION

1.1 Background to the Study

Scottish Natural Heritage (SNH) and its project partners have identified a need to quantify the benefits that the natural environment provides to Scotland's economy, where 'natural environment' is defined as 'the natural materials, processes, habitats and species, and topography that exist in Scotland'. 'Scotland' includes the coastal waters surrounding Scotland and not just terrestrial features.

There are four general types of sustained 'benefit' to the economy that are brought by the environment:

1. income from activities concerned with the protection, restoration and enhancement of the environment;
2. income from activities that make sustainable use⁷ of one or more elements of the environment as a primary resource;
3. income from activities which are dependent upon the quality of the environment, in particular tourism and recreation and supporting industries; and
4. income from activities indirectly dependent on each of the above.

1.2 Aim and Objectives of the Study

The aim of the study is to help ensure that the importance of the natural environment is recognised.

The objectives of the study are:

- to determine the current value of economic input/output activity generated by the natural environment at all-Scotland level as well as a regional distribution;
- to gauge the level of environment-related employment in Scotland, including indirect employment, a regional distribution of this employment, and the relative importance of natural environment employment compared with other sectors;
- to conduct a credible analysis of the wider benefits that Scotland's natural environment provides the economy;
- to conduct case studies based on the Cairngorms National Park and the Borders; and
- to make a substantiated assessment of the potential for the use of Scotland's natural environment to aid sustainable growth of the economy.

1.3 The Study Tasks

The study was sub-divided into nine tasks in order to meet the aims and objectives of the study. The Tasks were:

- Task 1: Start-up meeting;
- Task 2: Data gathering;
- Task 3: Analysis of data;
- Task 4: Input-output modelling;
- Task 5: Analysis of outputs of modelling;
- Task 6: Analysis of wider benefits of the natural environment;

⁷ Where sustainable use is defined as the economic use of natural resources and/or processes over time in a manner that does not have negative impacts on the quality of the environment.

- Task 7: Case studies;
- Task 8: Analysis of potential for future development; and
- Task 9: Reporting and dissemination of findings.

1.4 Overview of the Approach

The impact of the natural environment on the Scottish economy has been estimated using an input-output framework. Input-output tables are a representation of the sectoral structure, including the inter-relationships, of an economy at a given point in time (typically a year) and describe the flows of money between industries in the purchase of inputs to production. Within this framework, it is possible to estimate the overall economic effect of a change (or 'shock') to one or more sectors in the economy. By incorporating an explicit 'environment' sector into this structure, the environment can be considered as another economic sector and analysed as such. This is achieved by allocating a proportion of the flows between the existing industries to the new environment sector, according to the survey-data percentages, to form a new input-output table.

The approach used in this study uses the newly-created input-output table to define the environment in terms of the value of its demand for inputs. This information was used in conjunction with the multipliers calculated from the table to estimate the economy-wide effect of setting the environment sector's demands to zero (effectively removing it from the economy). The multipliers used capture both the direct economic effect of the reduction in environmental demand (setting all the demands to zero) and the wider, non-direct effects, on the other sectors.

One of the key uncertainties in the results is associated with the percentages used to highlight the reliance of different industry sectors on the environment. This study assumes conservative percentages across industry sectors, such that the overall estimate of impact of the natural environment may be an under-estimate. To ensure transparency, justification is given for all the percentages used.

Input-output tables are generally limited to estimating effects on demand, rather than supply. As a result they are unable to take effects on productive potential into account. This means that changes such as creation of new production capacity, improvement in training and education, construction of new infrastructure, productivity gains throughout the economy and the spread and intensity of technological progress cannot be estimated (European Commission, nd). The implications are that rapidly changing and developing sectors may not be adequately represented over time. This is unlikely to have a significant effect on the results of this study, although the use of input-output tables for 2003 does mean that recent developments in those industry sectors most reliant on the environment may not be taken into account.

It is also important to note that input-output tables assume that all of the output from a particular sector is homogeneous and cannot fully capture the diversity of products available in the economy. This also applies to the environment sector and implies that the output allocated to the new sector is identical e.g. the nature of the environmental product that flows to and from agriculture is identical to, say, sources of renewable energy.

Input-output tables are available for Scotland as a whole, but not for the regions. As a result, it has been necessary to apportion the impacts for the whole of Scotland across the regions to enable a regional distribution to be determined. For the case studies, the national input-output tables have been used in conjunction with region-

specific survey data. This is likely to introduce considerable uncertainty as the approach relies on the simplifying assumption that the case study economies are very similar to the economy for Scotland as a whole (but at a smaller scale). The result of this assumption is that the input-output tables will be stylised and not an accurate representation of the case study economies: both the Cairngorms NP and the Borders, for example, have a greater emphasis on agriculture and forestry than Scotland as a whole (but exclude marine activity). Moreover, the Cairngorms NP economy receives substantial income from tourism, and the Borders from textile manufacturing. The implications of these differences are that the results of the input-output modelling are provided only to give an indication of the impact on the economy of the case study areas resulting from the effective elimination of their environment sectors, rather than accurate estimates of the impacts.

The use of input-output tables means that the impact of the natural environment on the economy can be quantified, in monetary terms. However, the natural environment also provides other economic benefits, most of which cannot be easily measured in terms of money values. These include benefits in terms of attracting businesses and individuals to Scotland, providing a basis for branding of Scottish products, and supporting quality of life and well-being as well as improved health. This study also considers these 'wider' benefits and assesses the extent to which such benefits are not captured within the results of the input-output modelling.

There are other approaches available that attempt to capture the value of the environment. For example, there is the ecosystem services approach which provides 'a framework for analysing the linkages between the environment and people, which in turn enables a better understanding of the trade-offs involved in decisions concerning the environment' (eftec, 2006). The approach is most useful where a project includes either creation or loss of entire habitats, or changes to habitat quality and quantity and, as such, was not considered relevant to the study being undertaken here since this project does not attempt to quantify the impacts on the *environment* (habitats and/or ecosystems) but to assess the impacts on the *economy* of the environment.

1.5 Organisation of this Report

This report covers the final phase of the study and provides an overall summary of the study as a whole, combining the results of all the tasks. A key output is to identify the estimated value of the natural environment to Scotland's economy, bringing together the results of the input-output modelling and the assessment of wider benefits. The report is organised as follows:

- Section 2 describes how the importance of the environment to Scotland's economy has been estimated;
- Section 3 sets out the results of the regional analysis and Cairngorms and Borders case studies, and summarises differences between the results;
- Section 4 summarises key findings on the wider benefits that the natural environment provides and how these may benefit the economy; and
- Section 5 identifies where there may be potential for future development.

2. ESTIMATING THE IMPACT OF THE NATURAL ENVIRONMENT ON THE ECONOMY OF SCOTLAND

2.1 Data Collection

In order to assess the benefits to the economy of the environment, it is necessary to identify which industry/product groups are:

- activities concerned with the protection, restoration and enhancement of the environment;
- activities that make sustainable use of one or more elements of the environment as a primary resource;
- activities which are dependent upon the quality of the environment, in particular tourism and recreation and supporting industries; and
- activities indirectly dependent on each of the above.

For each of these groups, the following information has then been collected:

- for activities concerned with the protection, restoration and enhancement of the environment:
 - number of full-time equivalent employees in environmental protection;
 - expenditure on environmental research and development (including funding/grant schemes and agri-environment schemes); and
 - type of economic activity.
- for activities that make sustainable use of one or more elements of the environment as a primary resource:
 - data regarding use of the environment and environmental resources;
 - significance of environmental quality; and
 - turnover/Gross Value Added (GVA⁸) and employment data.
- for activities which are dependent upon the quality of the environment:
 - number of full-time equivalent employees in tourism and recreation, and supporting industries;
 - expenditure on development of tourism and recreation opportunities, and supporting industries; and
 - type of economic activity.
- for activities indirectly dependent on each of the above:
 - turnover/Gross Value Added (GVA) and employment data;
 - percentage of activity related to the environment; and
 - multipliers for activities directly related to the environment to take into account indirect benefits.

Data has been collected for all the above across the 128 industry sectors included in the Standard Industrial Classification (SIC) codes for 2003⁹. The information has been collected through a detailed literature review, interrogation of statistical data sets and consultation with the project Steering Group.

⁸ GVA (Gross Value Added) is the Gross Domestic Product at basic prices and is a measure of income generated by businesses after the subtraction of input costs, but before costs such as wages and capital investment are paid (Scottish Executive, 2007).

⁹ The 2003 codes have been used as input-output tables, since the 2007 codes are not expected to be available until 2010.

2.2 Estimating Links to the Environment

For each of the 128 industry sectors included in the SIC 2003 codes, an estimate has been made of the extent to which each sector relies on and/or utilises the natural environment. In particular, consideration has been given to the need for sustainable use of the environment, which in practice means that activities do not degrade the quality of the environment¹⁰, rather than exploitation of the environment. Thus, industry sectors such as mining and quarrying, which although they use the natural environment for their primary resource are assigned a dependence/link of 0%, since they do not rely on, or contribute to (in the short-term at least), a high quality environment. The results highlight that there are 26 industry sectors that are identified as having significant links (where significant is identified as greater than 20% of activities being related to the environment). These 'key' industry sectors (in terms of this study) are shown in Table 2.1, together with justification for the percentage link assigned to the sector. A full list of all 128 industry sectors together with their dependence/links to the environment was also estimated as an initial stage of this work.

Table 2.1: Industry Sectors with the Greatest Links to the Environment

Sector	Link to Environment	Justification
<i>Activities Concerned with the Protection, Restoration and Enhancement of the Environment</i>		
Sewage and refuse disposal, sanitation and similar activities	90%	90% of Scottish sewerage treatment works compliant
Activities of membership organisations not elsewhere classified	31%	31% are organisations with an interest in the natural environment
<i>Activities that make Sustainable Use of one or more Elements of the Environment as a Primary Resource</i>		
Collection, purification and distribution of water	100%	100% (all water from natural sources)
Fishing and service activities incidental to fishing	96%	96% of Scottish fish stocks included (4% cod, which is over-fished, is not included)
Agriculture, hunting and related service activities	80%	80% of farms are members of assurance schemes/compliant with pollution regs.
Forestry planting and related service activities	70%	55% of Scottish forests certified under UKWAS, but all forests receiving Forestry Commission grant-aid must meet the UK Forest Standard, therefore assumed to be 70%
Forestry logging and related service activities	70%	55% of Scottish forests certified under UKWAS, but all forests receiving Forestry Commission grant-aid must meet the UK Forest Standard, therefore assumed to be 70%
Fish farming and related service activities	68.4%	68.4% were meeting environmental impact standards

¹⁰ Where environmental quality is defined as where there is an absence of significant pollution accumulation, habitat destruction, or soil erosion so that local biodiversity and ecosystems are being sustained.

Table 2.1: Industry Sectors with the Greatest Links to the Environment

Sector	Link to Environment	Justification
<i>Activities which are Dependent upon the Quality of the Environment, in Particular Tourism and Recreation and Supporting Industries</i>		
Hotels and restaurants	30%	30% (60% of hotel nights booked by holiday makers, half of these visiting due to environment)
Recreational, cultural and sporting activities	23.5%	23.5% spend by Scottish councils on culture, recreation and sport that is associated with greenspace and country parks
Supporting and auxiliary transport activities, activities of travel agencies	20%	20% (40% tourists from within Scotland, half to see the natural environment)
<i>Activities Indirectly Dependent on Above Product/Industry Groups</i>		
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness	99%	99% (based on 20:1 water use to hide use in production, with 80% of hides included as assured/compliant)
Footwear	99%	99% (based on 20:1 water use to hide use in production, with 80% of hides included as assured/compliant)
Production of mineral waters and soft drinks	97%	97% (bottled water production (100% water) : soft drink production (65% water) / ratio of bottled water to soft drink production in Scotland of 10:1)
Beers and ales	95%	95% (water makes up circa 93% of the beverage by weight plus 29% of other third based on 36% of inputs from Scottish agriculture to Scottish food industry and 80% of this is assured/ compliant with pollution controls)
Grain mill products, starches and starch products	80%	80% agricultural output assured/ compliant with pollution controls
Agricultural and forestry machinery	78%	78% (80% of agriculture and 70% of forestry assured, based on relative proportions)
Spirits and wines	76%	76% (2/3rds of input to product is water - Scotch Whisky Distilling Industry Sector Report plus 29% of other third based on 36% of inputs from Scottish agriculture to Scottish food industry and 80% of this is assured/compliant with pollution)
Wood and wood products, except furniture	37%	37% sawing and planing of wood (Net imports = 63% of hard and soft woods in UK; certified wood used)
Bread, rusks and biscuits; manufacture of pastry goods and cakes	29%	29% (36% of inputs from Scottish agriculture to Scottish food industry and 80% of this is assured
Other food products	29%	/compliant with pollution controls)

Table 2.1: Industry Sectors with the Greatest Links to the Environment

Sector	Link to Environment	Justification
Production, processing and preserving of meat and meat products	28%	
Processing and preserving of fish and fish products; fruit and vegetables	28%	28% (based on relative turnover)
Vegetable and animal oils and fats	28%	
Prepared animal feeds	26.4%	26.4% (two-thirds of feed is imported, one third is sourced from Scotland of which 80% is assured/compliant with pollution controls)
Construction	22.2%	22.2% (60% timber frame buildings in Scotland, 37% of which Scottish timber, certified wood used)

2.3 Key Industry Sectors

For all 128 industry sectors, information has been collected on number of employees, expenditure and Gross Value Added of that sector. Table 2.2 provides a summary of these data for the 26 key industry sectors, by type of activity. Data are given for 2003, where available. Data from other years is used where detailed information was not available for 2003.

Table 2.2: Employment, Expenditure and Gross Value Added for Key Industry Sectors

Sector	Employees	Expenditure/GVA
<i>Activities Concerned with the Protection, Restoration and Enhancement of the Environment</i>		
Sewage and refuse disposal, sanitation and similar activities	6,000 or 0.3% of total for Scotland (2003)	£3 million net capital expenditure, £31 million Gross Value Added (2003) (recycling) £296 million net capital expenditure, £513 million Gross Value Added (2003) (sewage and refuse disposal)
Activities of membership organisations not elsewhere classified	13,000 or 0.6% of total for Scotland (2003)	£30 million net capital expenditure, £193 million Gross Value Added (2003)
<i>Activities that make Sustainable Use of one or more Elements of the Environment as a Primary Resource</i>		
Collection, purification and distribution of water	6,000 (water, 90% full-time) or 0.3% of total for Scotland	No data for 2003; £367 million net capital expenditure, £386 million Gross Value Added (2001)
Fishing and service activities incidental to fishing	4,000 or 0.2% of total for Scotland (2003, for fishing)	£9 million net capital expenditure, £151 million Gross Value Added (2003) (fishing)
Agriculture, hunting and related service activities	25,772 or 1.2% of total for Scotland (2003)	£7 million net capital expenditure, £1,021 million Gross Value Added (2003)

Table 2.2: Employment, Expenditure and Gross Value Added for Key Industry Sectors

Sector	Employees	Expenditure/GVA
Forestry planting and related service activities	3,000 or 0.1% of total for Scotland (2003)	£6 million net capital expenditure, £72 million Gross Value Added (2003) (forestry, logging and related activities)
Forestry logging and related service activities	3,000 or 0.1% of total for Scotland (2003)	£6 million net capital expenditure, £72 million Gross Value Added (2003) (forestry, logging and related activities)
Fish farming and related service activities	4,000 or 0.2% of total for Scotland (2003, for fishing)	£9 million net capital expenditure, £151 million Gross Value Added (2003) (fishing)
<i>Activities which are Dependent upon the Quality of the Environment, in Particular Tourism and Recreation and Supporting Industries</i>		
Hotels and restaurants	160,000 (2003 data) or 7.9% of total for Scotland (includes hotels, camping sites, restaurants and bars)	£256 million net capital expenditure, £2,211 million Gross Value Added (2003)
Recreational, cultural and sporting activities	55,000 (recreational and cultural activities, 2003) or 2.7% of total for Scotland 32,000 (activities of travel agencies and tour operators;	£215 million net capital expenditure, £2,305 million Gross Value Added (2003)
Supporting and auxiliary transport activities, activities of travel agencies	tourist assistance activities not elsewhere classified, 2003) or 1.6% of total for Scotland	£419 million net capital expenditure, £1,187 million Gross Value Added (2003)
<i>Activities Indirectly Dependent on Above Product/Industry Groups</i>		
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness	1,000 (2003) or 0.05% of total for Scotland	£3 million net capital expenditure, £29 million Gross Value Added (2003) (manufacture of leather and leather products)
Footwear	No specific data found for footwear, but likely to be small % of total for Scotland	£3 million net capital expenditure, £29 million Gross Value Added (2003) (manufacture of leather and leather products)
Production of mineral waters and soft drinks	1,939 (2005) or 0.1% of total for Scotland	£11 million net capital expenditure, £94 million Gross Value Added (2003) (manufacture of beverages excluding spirits is 4% of total for food products and beverages)
Beers and ales	1,229 (malt and beer, 2005) or 0.06% of total for Scotland	£11 million net capital expenditure, £94 million Gross Value Added (2003) (manufacture of beverages excluding spirits is 4% of total for food products and beverages)

Table 2.2: Employment, Expenditure and Gross Value Added for Key Industry Sectors

Sector	Employees	Expenditure/GVA
Grain mill products, starches and starch products	582 (grain mill products, starches and starch products, 2005) or 0.03% of total for Scotland	£125 million net capital expenditure, £1,060 million Gross Value Added (2003) (manufacture of food products is 45% of total for food products and beverages)
Agricultural and forestry machinery	No specific data found, but likely to be small % of total for Scotland	£62 million net capital expenditure, £789 million Gross Value Added (2003) (machinery and equipment)
Spirits and wines	8,700 (Scottish spirits including whisky, 2003) or 0.4% of total for Scotland	£127 million net capital expenditure, £1,050 million Gross Value Added (2003) (spirits)
Wood and wood products, except furniture	8,000 (2003) or 0.4% of total for Scotland	No data for 2003; £47 million net capital expenditure, £234 million Gross Value Added (2000)
Bread, rusks and biscuits; manufacture of pastry goods and cakes	10,632 (manufacture of bread, fresh pastry goods and cakes, rusks and biscuits, preserved pastry goods and cakes, 2005) or 0.5% of total for Scotland	£125 million net capital expenditure, £1,060 million Gross Value Added (2003) (manufacture of food products is 45% of total for food products and beverages)
Other food products	2,258 (other food products, 2005) or 0.1% of total for Scotland	£125 million net capital expenditure, £1,060 million Gross Value Added (2003) (manufacture of food products is 45% of total for food products and beverages)
Production, processing and preserving of meat and meat products	7,701 (production and preserving of meat, poultry meat and meat and poultry meat products, 2005) or 0.4% of total for Scotland	£125 million net capital expenditure, £1,060 million Gross Value Added (2003) (manufacture of food products is 45% of total for food products and beverages)
Processing and preserving of fish and fish products; fruit and vegetables	11,426 (production and preserving of fish and fish products, processing and preserving of potatoes, processing and preserving of fruit and vegetables, 2005) or 0.6% of total for Scotland	£125 million net capital expenditure, £1,060 million Gross Value Added (2003) (manufacture of food products is 45% of total for food products and beverages)
Vegetable and animal oils and fats	0% of total for Scotland (no manufacturers in Scotland in 2005)	£125 million net capital expenditure, £1,060 million Gross Value Added (2003) (manufacture of food products is 45% of total for food products and beverages)

Table 2.2: Employment, Expenditure and Gross Value Added for Key Industry Sectors

Sector	Employees	Expenditure/GVA
Prepared animal feeds	1,085 (manufacture of prepared feeds for farm animals, pet feeds, 2005) or 0.05% of total for Scotland	£125 million net capital expenditure, £1,060 million Gross Value Added (2003) (manufacture of food products is 45% of total for food products and beverages)
Construction	118,000 or 5.8% of total for Scotland (2003)	£233 million net capital expenditure, £4,403 million Gross Value Added (2003)

2.4 Input-Output Modelling

2.4.1 Overview

This section presents the results from the input-output modelling carried out by Cambridge Econometrics (CE). This follows the procedure outlined below. An explicit 'natural environment' sector is modelled using an input-output framework aimed at quantifying the contribution of the environment to Scotland's economy.

The analysis combines data published by the Scottish Government¹¹; the Annual Business Inquiry¹²; the survey results collected by RPA; and the feedback from the Steering Group.

2.4.2 Input-Output Tables and Multiplier Analysis

An input-output (IO) table is a matrix that depicts the sectoral structure and inter-relationships of an economy. It does this by breaking down the commodity inputs to an industry's final output by the sectors from which these inputs originate for a given time period, typically a single year. Each column denotes an industry and each element in that column the monetary value of the inputs purchased. The flows between industries constitute what is known as intermediate demand. The matrix also captures flows of other productive factors such as imports, taxes and wages as well as the breakdown of final demand by different consumer groups such as households, government and exports to consumers abroad (see Figure 2.1). Thus, an IO table is a comprehensive representation of an economy in terms of its industrial linkages. Furthermore, an IO table forms part of a much wider accounting framework that is recorded in a social accounting matrix (SAM). While IO tables only depict monetary flows for commodities with a market value (purchases of inputs made by industry sectors and final demand for output by expenditure group), SAMs also track non-market monetary flows such as those between households and government.

¹¹ <http://www.scotland.gov.uk/Topics/Statistics/>

¹² Accessed via nomis: <https://www.nomisweb.co.uk/Default.asp>

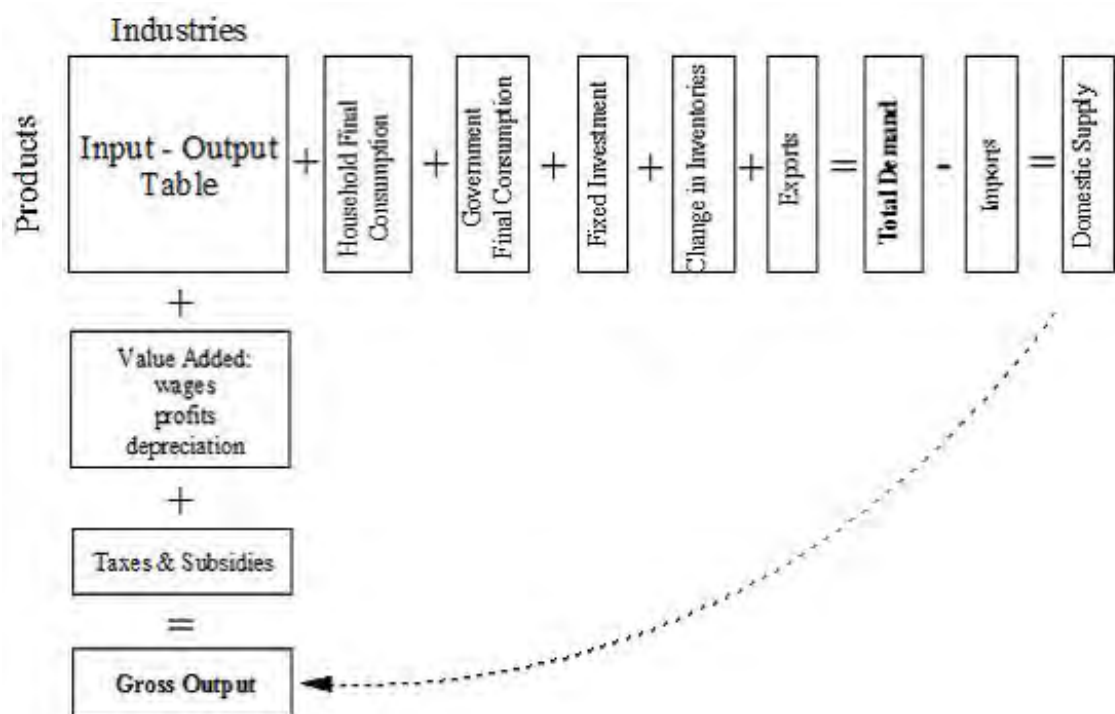


Figure 2.1: The Structure of an Input-Output Table

The tables are typically used in the calculation and analysis of ‘multipliers’, an estimate of the economy-wide effects of a shock to a sector as it permeates through the economy via its linkages with other industries. The modelling of the environment as another economic sector permits an analysis of how the environment is related to an economy and, in turn, facilitates the calculation of a new set of multipliers. The work discussed here focuses on the derivation of ‘output’ and ‘employment’ multipliers.

An output multiplier is defined as the value of all of the additional domestically-produced commodities required to generate sufficient economic activity to increase output in a particular sector by one unit. Similarly, an employment multiplier is the economy-wide increase in employment necessary to create one additional job in a sector. The multiplier relationship can also be viewed in reverse: as the amount of economy-wide output (employment) generated from a one-unit increase in a sector’s output (employment).

We consider two ‘types’ of multiplier to capture the linkage effects, Type I and Type II. Type I multipliers not only account for the direct effect (the value of the shock itself, which will be sector-specific) but also the indirect effect (how the sectoral shock affects the other economic sectors). Type II multipliers not only capture the direct and indirect effects, but also the ‘induced’ effect. This induced effect arises from an additional economic linkage, that of households. A sectoral shock will affect wages and thus household income, which will in turn lead to a change in expenditure on final goods and services produced in the economy. The additional flow means that Type II multipliers can, by definition, never be smaller than their corresponding Type I multiplier.

2.4.3 Method

Expanding an IO table to incorporate the environment involves the addition of an extra row and column to the matrix to represent monetary flows of some conceptual

environment ‘product’ to and from the economy’s other sectors. The environment sector thus becomes both a supplier and purchaser of inputs. The individual elements of the original matrix are separated first by the extent to which the industry inputs are considered to be environmental (how much of an industry’s inputs are drawn from the environment), and then by how much of the remaining intermediate outputs are then ‘purchased’ by the environment. It has been assumed that the environment does not use its own output – the environment-to-environment flow has been assumed to be zero.

In accordance with the project-agreed definition of ‘natural environment’, only domestic flows are considered. In practice, this means that the contribution of imports has been excluded from intermediate demand.

In moving from monetary flows, such as GVA, to coefficients, which are necessary for the multiplier analysis, other purchases and costs that do not take place between industries are adjusted to reflect the change in the composition of inputs to each industry as a result of modelling the environment.

It should be noted that the method described, and the analysis that follows, makes the (unavoidable) assumption that all of the output that has been reallocated to environment from the various industrial sectors is homogeneous. Clearly, the single environment sector cannot capture fully the diversity of products that are sourced from the environment, and that feed into production in a variety of ways.

2.4.4 Data

The new table incorporating the natural environment is created by reallocating the flows from the existing Scottish IO table for 2003. The figures in this table are expressed in 2003 prices and follow the 2003 Standard Industrial Classification (SIC) at the 128-industry level. CE has enquired about the availability of IO tables that conform to the 2007 SIC standard. However, given the way in which the Scottish tables are reliant on data supplied by the UK Office for National Statistics, we understand that it is unlikely that tables with the new classification will be available before 2010.

In order to calculate the employment multipliers, the IO table must be supplemented with employment data. The data used come from the Annual Business Inquiry (ABI) and have been aggregated to match the 128 sectors of the IO table. The figures used are for full-time employment.

2.5 Results: Scotland

2.5.1 Results

The results of the input-output modelling are shown for selected sectors in the tables below. The multipliers are shown alongside those calculated from the existing, unmodified tables. Type I and Type II output multipliers are shown in Tables 2.3 and 2.4, respectively. Type I and Type II employment multipliers are shown in Tables 2.5 and 2.6 respectively.

Table 2.3: Type I Output Multipliers for the Scottish Economy

Sector	Existing	New
Agriculture	1.59	1.56
Forestry Planting	1.22	1.22

Table 2.3: Type I Output Multipliers for the Scottish Economy

Sector	Existing	New
Forestry Harvesting	1.78	1.87
Sea Fishing	1.30	1.29
Fish Farming	1.43	1.43
Meat Processing	1.77	1.72
Fish and Fruit Processing	1.71	1.72
Oils and Fats	1.38	1.38
Grain Milling and Starch	1.60	1.56
Animal Feeding Stuffs	1.43	1.42
Bread, Biscuits, etc	1.32	1.31
Miscellaneous Foods	1.46	1.45
Spirits and Wines, etc	1.27	1.27
Beer Brewing	1.44	1.43
Soft Drinks	1.28	1.28
Leather Tanning	1.43	1.38
Footwear	1.27	1.30
Timber and Wood Products	1.54	1.52
Agricultural Machinery	1.25	1.25
Electric Motors and Generators	1.15	1.15
Electricity Production and Distribution	2.16	2.05
Water Supply	1.19	1.18
Construction	1.53	1.52
Hotels, Catering, Pubs, etc	1.16	1.16
Transport Services	1.73	1.71
Sanitary Services	1.13	1.15
Membership Organisations	1.17	1.17
Recreational Services	1.44	1.44
<i>Environment</i>	<i>N/A</i>	<i>1.45</i>

Notes: 'Existing' denotes multipliers calculated from the original IO table.

'New' denotes multipliers calculated from the new table, incorporating environment.

Table 2.4: Type II Output Multipliers for the Scottish Economy

Sector	Existing	New
Agriculture	2.08	1.97
Forestry Planting	2.14	2.00
Forestry Harvesting	2.95	2.66
Sea Fishing	1.60	1.50
Fish Farming	1.83	1.79
Meat Processing	2.38	2.37
Fish and Fruit Processing	2.36	2.44
Oils and Fats	1.74	1.75
Grain Milling and Starch	2.25	2.02
Animal Feeding Stuffs	1.86	1.85

Table 2.4: Type II Output Multipliers for the Scottish Economy

Sector	Existing	New
Bread, Biscuits, etc	1.99	1.97
Miscellaneous Foods	2.09	2.07
Spirits and Wines, etc	1.90	1.73
Beer Brewing	2.15	1.79
Soft Drinks	1.83	1.57
Leather Tanning	1.91	1.62
Footwear	1.87	1.49
Timber and Wood Products	2.20	2.13
Agricultural Machinery	2.04	1.89
Electric Motors and Generators	2.08	2.06
Electricity Production and Distribution	2.66	2.60
Water Supply	1.69	1.29
Construction	2.38	2.35
Hotels, Catering, Pubs, etc	2.16	2.08
Transport Services	2.53	2.50
Sanitary Services	1.71	1.32
Membership Organisations	2.41	2.33
Recreational Services	2.28	2.25
<i>Environment</i>	<i>N/A</i>	<i>2.30</i>
Wages	1.79	1.79

Notes: 'Existing' denotes multipliers calculated from the original IO table.
'New' denotes multipliers calculated from the new table, incorporating environment.

Table 2.5: Type I Employment Multipliers for the Scottish Economy

Sector	Existing	New
Agriculture	1.75	3.48
Forestry Planting	1.06	1.08
Forestry Harvesting	2.30	10.44
Sea Fishing	1.40	2.43
Fish Farming	1.46	1.88
Meat Processing	1.73	2.02
Fish and Fruit Processing	1.52	1.79
Oils and Fats	2.21	2.64
Grain Milling and Starch	1.74	3.65
Animal Feeding Stuffs	1.89	2.11
Bread, Biscuits, etc	1.24	1.27
Miscellaneous Foods	1.38	1.46
Spirits and Wines, etc	1.58	2.08
Beer Brewing	1.93	5.88
Soft Drinks	1.48	2.54
Leather Tanning	1.54	14.17
Footwear	1.17	17.79

Table 2.5: Type I Employment Multipliers for the Scottish Economy

Sector	Existing	New
Timber and Wood Products	1.65	1.71
Agricultural Machinery	1.20	1.27
Electric Motors and Generators	1.12	1.12
Electricity Production and Distribution	3.51	4.41
Water Supply	1.20	*
Construction	1.51	1.52
Hotels, Catering, Pubs, etc	1.08	1.10
Transport Services	1.94	2.00
Sanitary Services	1.13	1.98
Membership Organisations	1.09	1.10
Recreational Services	1.53	1.55
<i>Environment</i>	<i>N/A</i>	<i>1.34</i>

Notes: 'Existing' denotes multipliers calculated from the original IO table.
'New' denotes multipliers calculated from the new table, incorporating environment.
* indicates that all employment has been allocated to environment - there is no multiplier effect.

Table 2.6: Type II Employment Multipliers for the Scottish Economy

Sector	Existing	New
Agriculture	1.98	4.03
Forestry Planting	1.14	1.16
Forestry Harvesting	2.73	12.77
Sea Fishing	1.53	2.75
Fish Farming	1.63	2.14
Meat Processing	1.96	2.32
Fish and Fruit Processing	1.70	2.04
Oils and Fats	2.76	3.28
Grain Milling and Starch	2.07	4.34
Animal Feeding Stuffs	2.26	2.52
Bread, Biscuits, etc	1.42	1.46
Miscellaneous Foods	1.56	1.66
Spirits and Wines, etc	2.11	2.68
Beer Brewing	2.47	7.12
Soft Drinks	1.79	3.03
Leather Tanning	1.77	16.65
Footwear	1.31	20.87
Timber and Wood Products	1.89	1.96
Agricultural Machinery	1.41	1.49
Electric Motors and Generators	1.36	1.37
Electricity Production and Distribution	4.42	5.43
Water Supply	1.38	*
Construction	1.77	1.79

Table 2.6: Type II Employment Multipliers for the Scottish Economy

Sector	Existing	New
Hotels, Catering, Pubs, etc	1.25	1.27
Transport Services	2.35	2.42
Sanitary Services	1.30	2.30
Membership Organisations	1.27	1.28
Recreational Services	1.83	1.86
<i>Environment</i>	<i>N/A</i>	<i>1.57</i>

Notes: 'Existing' denotes multipliers calculated from the original IO table.
'New' denotes multipliers calculated from the new table, incorporating environment.
* indicates that all employment has been allocated to environment - there is no multiplier effect.

Where the entirety of a sector's output/employment is considered environment-related (such as water supply), an employment multiplier is not given. The absence of any employment prevents us from analysing the effect of an additional job in that sector. The effect is now captured in the environment multiplier.

The Type I and Type II output multipliers for environment were estimated to be 1.45 and 2.30, respectively. A £1 increase in the output of the environment will lead to an increase in economy-wide output of £1.45 in the Type I case (the direct effect, £1, plus the indirect effect, £0.45). In the case of the Type II multiplier, economy-wide output will increase by £2.30 (a direct effect of £1 and combined indirect and induced effect of £1.30). For the most part, the non-environment-sector multipliers that have been calculated using the new IO table (incorporating environment) are smaller than the corresponding multipliers calculated from the old table. In general, new multipliers that are larger than the old ones arise because of a particularly large environment output effect (from a one-unit shock). The size of this effect is positively related to the extent to which the sector purchases environmental output as an input to production which is determined by the allocation process.

The Type I and Type II employment multipliers for environment were estimated to be 1.34 and 1.57, respectively – the total number of jobs created in the economy from increasing environmental employment by one job (including the job created directly). Large employment multipliers (e.g. for Forestry Harvesting) are the result of large output-to-job ratios, relative to those of the other sectors. These result from sectors with high value output and relatively low employment. Because of this, there will always be a few large employment multipliers. Cases where the new employment multiplier is substantially larger than the old are, in general, confined to those sectors that have been considered to have a high dependency on the environment. This is amplified for the Type II multipliers due to the reallocation of wages, which constitute a high proportion of production costs.

2.5.2 Decomposing the Multipliers

The sectoral decompositions of the Type I and Type II environment output multipliers are shown in descending order for the sectors most closely linked to the environment (according to the IO analysis) in Tables 2.7 and 2.8, respectively. Only the breakdown of the indirect (and, in the case of Type II, induced) effects are shown – the value of the direct effect of an output multiplier will always be equal to the value of the shock applied, in this case, equal to one. The values are shown for a one-unit increase in environment output by fractions of a unit and by the proportion of the total effect.

Table 2.7: Breakdown of the Type I Environment Output Multiplier

Sector	Effect	%
Electricity Production and Distribution	0.05	11.0
Construction	0.04	9.7
Banking	0.04	9.3
Transport Services	0.03	6.2
<i>Environment</i>	<i>0.02</i>	<i>4.6</i>
Wholesale Distribution	0.02	4.2
Other Land Transport	0.02	3.8
Owning and Dealing in Real Estate	0.02	3.6
Other Business Services	0.01	3.2
Recreational Services	0.01	2.8
Insurance and Pension Funds	0.01	2.5
Architectural, etc. Activities	0.01	2.5
Telecommunications	0.01	2.2
Agriculture	0.01	2.2
Computing Services	0.01	1.9
Legal Activities	0.01	1.8
Distribution and Motor Repair, etc	0.01	1.7
Renting of Machinery	0.01	1.7
Oil Process, Nuclear Fuel	0.01	1.4
Glass and Glass Products	0.01	1.4
Market Research	0.01	1.3
Accountancy Services	0.01	1.2
Other Financial Institutions	0.01	1.1

Notes: Sectors are ranked in descending order by the non-direct change in environment output.
'Effect' is the sectoral change in output from a one-unit increase in environment output.
'%' is the percentage of the total non-direct effect (for Type I this is calculated as 1.45 - 1.00 = 0.45).
The remaining 106 sectors have indirect effects of less than 0.005.

Table 2.8: Breakdown of the Type II Environment Output Multiplier

Sector	Effect	%
Wages	0.56	43.3
Electricity Production and Distribution	0.06	4.4
<i>Environment</i>	<i>0.05</i>	<i>4.2</i>
Construction	0.05	4.0
Banking	0.05	3.8
Letting of Dwellings	0.04	3.4
Retail Distribution	0.04	3.3
Transport Services	0.03	2.5
Wholesale Distribution	0.03	2.5
Other Land Transport	0.02	1.9

Table 2.8: Breakdown of the Type II Environment Output Multiplier

Sector	Effect	%
Insurance and Pension Funds	0.02	1.8
Recreational Services	0.02	1.7
Owning and Dealing in Real Estate	0.02	1.7
Telecommunications	0.02	1.4
Distribution and Motor Repair, etc	0.02	1.4
Other Business Services	0.02	1.3
Hotels, Catering, Pubs, etc	0.01	1.0
Architectural, etc. Activities	0.01	1.0
Agriculture	0.01	0.9
Computing Services	0.01	0.8
Renting of Machinery	0.01	0.8
Oil Process, Nuclear Fuel	0.01	0.8
Legal Activities	0.01	0.7
Market Research	0.01	0.6
Extraction - Oil and Gas	0.01	0.5
Education	0.01	0.5
Glass and Glass Products	0.01	0.5
Accountancy Services	0.01	0.5
Auxiliary to Insurance	0.01	0.5
Public Administration	0.01	0.5
Other Service Activities	0.01	0.5
Other Financial Institutions	0.01	0.5
Postal Services	0.01	0.4

Notes: Sectors are ranked in descending order by the non-direct change in environment output.

'Effect' is the sectoral change in output from a one-unit increase in environment output.

'%' is the percentage of the total non-direct effect (for Type II this is calculated as $2.30 - 1.00 = 1.30$).

The remaining 97 sectors have indirect/induced effects of less than 0.005.

In both the Type I and Type II cases, excluding environment and wages, Electricity, Construction and Banking are the sectors most affected by a change in environmental output. This is because these are the sectors from which the environment makes the largest purchases from – the most direct linkage under IO modelling. This relationship arises because, while the percentages used for these sectors are not the necessarily the largest, these sectors are among the largest in terms of output – even a small reallocation in percentage terms can lead to a large reallocation of output to environment. The conversion to coefficients preserves these ratios and the result is a strong environmental linkage. The importance of wages is not surprising as it often accounts for a considerable proportion of the overall costs of production.

Breakdowns of the Type I and Type II employment multipliers are presented in Tables 2.9 and 2.10, respectively. For a given increase in environmental output (arising from an additional job), the sectors that benefit most are those most closely linked to the environment i.e. the sectors reported in Tables 2.7 and 2.8. However, because the output-to-job ratio differs between sectors, the increase in employment

from a given increase in output will differ. Sectors with higher output-to-job ratios will see a smaller increase in employment than those with smaller ratios. Hence, Electricity Production and Distribution benefits greatly from an increase in environmental output, but this translates into relatively few additional jobs created because the sector's output-to-job ratio is comparatively high. Construction, on the other hand, also sees a relatively large increase in output from an increase in environmental output, which translates into a comparatively large number of jobs due to a low output-to-job ratio.

Table 2.9: Breakdown of the Type I Environment Employment Multiplier

Sector	Effect	%
Construction	0.04	10.8
Other Business Services	0.03	7.9
Banking	0.03	7.4
<i>Environment</i>	<i>0.02</i>	<i>6.0</i>
Wholesale Distribution	0.02	5.7
Other Land Transport	0.02	5.6
Transport Services	0.01	4.3
Distribution and Motor Repair, etc	0.01	3.7
Legal Activities	0.01	2.8
Architectural, etc. Activities	0.01	2.8
Recreational Services	0.01	2.8
Postal Services	0.01	2.2
Market Research	0.01	2.2
Electricity Production and Distribution	0.01	2.1
Computing Services	0.01	2.1
Accountancy Services	0.01	1.8
Renting of Machinery	0.01	1.7
Education	0.01	1.6
Glass and Glass Products	0.01	1.6
TOTAL	0.29	75.1

Note(s): Sectors are ranked in descending order by the non-direct change in environment employment.

'Effect' is the sectoral change in employment from a one-unit increase in environment employment.

'%' is the percentage of the total non-direct effect (for Type I this is calculated as $1.34 - 1.00 = 0.34$).

The remaining 110 sectors have indirect effects of less than 0.005.

Table 2.10: Breakdown of the Type II Environment Employment Multiplier

Sector	Effect	%
<i>Environment</i>	<i>0.05</i>	<i>9.6</i>
Retail Distribution	0.05	8.8
Construction	0.04	7.8
Wholesale Distribution	0.03	5.9

Table 2.10: Breakdown of the Type II Environment Employment Multiplier

Sector	Effect	%
<i>Environment</i>	0.05	9.6
Other Business Services	0.03	5.7
Banking	0.03	5.3
Distribution and Motor Repair, etc	0.03	5.1
Other Land Transport	0.03	4.9
Hotels, Catering, Pubs, etc	0.02	3.4
Transport Services	0.02	3.1
Recreational Services	0.02	3
Architectural, etc. Activities	0.01	2
Legal Activities	0.01	2
Postal Services	0.01	1.8
Education	0.01	1.8
Market Research	0.01	1.6
Telecommunications	0.01	1.6
Other Service Activities	0.01	1.6
Computing Services	0.01	1.5
Electricity Production and Distribution	0.01	1.5
Renting of Machinery	0.01	1.4
Accountancy Services	0.01	1.3
Insurance and Pension Funds	0.01	1.3
Glass and Glass Products	0.01	1
Public Administration	0.01	0.9
Estate Agent Activities	0.01	0.9
Cutlery and Tools	0.01	0.9
TOTAL	0.51	85.7

Note(s): Sectors are ranked in descending order by the non-direct change in environment employment.

'Effect' is the sectoral change in employment from a one-unit increase in environment employment.

'%' is the percentage of the total non-direct effect (for Type II this is calculated as $1.57 - 1.00 = 0.57$).

The remaining 103 sectors have indirect effects of less than 0.005.

2.5.3 Estimating the Impacts of Scotland's Natural Environment

Multiplier analysis allows us to examine the economic effect of a particular sector by estimating the value of the environment in terms of the economic activity 'lost' if there were a negative shock to the environment sufficient to set its demand to zero, effectively eliminating the sector from the economy.

The impact of Scotland's environment, in terms of intermediate demand (industry to industry), can be calculated as the total of the environment column in the new, reallocated, IO table. This figure captures the environment's relationship to the economy in terms of its purchases of inputs and was estimated to be £3.9bn excluding wages and £8.6bn including wages. This can be interpreted as the direct 'value' of the environment – the direct fall in Scotland's output resulting from a negative environmental shock sufficient to set the sector's output to zero. The value is obviously equal to the required shock, in this case.

Using the Type I and Type II multipliers, we can also measure the additional indirect and induced effects i.e. the knock-on economic effects. These will arise because the environment sector's demand will have been reduced. The non-environment sectors will, in turn, reduce their own demand and economic activity will fall. Allowing for the indirect effects (in addition to the direct effect) - the Type I effect - the fall in economy-wide output from the effective removal of the environment sector is estimated to be £5.9bn. Also accounting for the reduction in wages and the subsequent fall in household expenditure – the Type II effect – the fall in output is estimated to be £17.2bn. These results are shown in Table 2.11.

Table 2.11: Calculating the Value of the Scottish Environment

Total domestic demand (direct effect)		Type I (direct and indirect effect)	Type II (direct, indirect and induced effect)
excl. wages	incl. wages		
£3.9 billion	£8.6 billion	£5.9 billion	£17.2 billion

Note(s): Figures are given as the effect on the economy of a shock to the environment sector equal to the value of its intermediate domestic demand. This is derived from the new input-output table and the resulting multipliers. Source: RPA and Cambridge Econometrics.

A total value of £17.2 billion equates to an overall value for Scotland of £3,400 per head (to two significant figures), based on a population of almost five million.

The number of Scottish jobs (in the entire economy) supported by the environment was estimated to be 242,000. This was calculated as the number of jobs in the entire Scottish economy that would be lost if employment in the environment sector were zero (the figure of 154,000 calculated from the survey-data percentages multiplied by the Type II employment multiplier for the environment of 1.57). Like the estimated value of £17.2 billion, this employment figure captures the direct, indirect and induced effects on employment.

3. THE IMPACT OF THE NATURAL ENVIRONMENT TO THE REGIONS

3.1 Impacts of the Environment in the Regions

In the absence of input-output tables at the regional level, quantifying the value of the environment by region involves the allocation of the figures calculated for Scotland as a whole to the different regions. The regional values are calculated by apportioning the total value estimated in Section 2.5 (£17.2 billion) using number of employees in key sectors considered most reliant on the environment. Number of employees is used rather than GVA to avoid biasing the results in favour of more urbanised areas. The GVA per head for the Highlands and Islands Enterprise (HIE)/Scottish Enterprise (SEn) regions and 'Scotland's Environmental and Rural Services' (SEARS) areas are shown in Table 3.1.

Table 3.1: GVA per head by HIE/SEn and SEARS Areas (Type II, direct + indirect + induced)

Scotland	£3,400 per head	-	
HIE/SEn	GVA per head	Difference from Scotland	
South Scotland	£5,200	+£1,800 per head	+53%
Highland and Islands	£5,100	+£1,700 per head	+50%
Grampian	£4,000	+£600 per head	+18%
Tayside	£3,900	+£500 per head	+15%
East and Central Scotland	£3,400	Same	±0%
West and Central Scotland	£2,700	-£700 per head	-21%
SEARS	GVA per head	Difference from Scotland	
Highlands	£5,900	+£2,500 per head	+74%
Northern Isles	£5,500	+£2,100 per head	+62%
Dumfries and Galloway	£5,200	+£1,800 per head	+53%
Borders	£4,800	+£1,400 per head	+41%
Argyll	£4,200	£800 per head	+24%
Grampian and Moray	£4,000	+£600 per head	+18%
Tayside	£3,900	+£500 per head	+15%
Western Isles	£3,700	+£300 per head	+9%
Forth	£3,400	Same	±0%
Ayrshire	£3,200	-£200 per head	-6%
Clyde Valley	£2,600	-£800 per head	-24%

Source: based on Census 2001 data downloaded from www.scrol.gov.uk.

Table 3.1 shows that the greatest increase is +53% for South Scotland for the HIE/SEn areas, while the greatest decrease is -21% for West and Central Scotland. There is considerable variation, generated in part by use of the dataset that includes only employees associated with food and drink manufacturing (excluding all other manufacturing) and excluding transport. For the SEARS areas, the greatest increase is +74% for Highlands with the greatest decrease at -24% for the Clyde Valley. Ayrshire also has a GVA per head less than that for Scotland as a whole.

3.2 Case Study Areas

3.2.1 Cairngorms National Park

Input-output modelling undertaken for the Cairngorms estimated an impact of the natural environment to the Cairngorms economy of £71 million per year, compared with £17,200 million for Scotland as a whole. This includes the direct, indirect and induced (Type II) effects and represents the amount by which the region's output would fall if the Cairngorms environment sector were to disappear, given the assumptions on the reliance of the different industry sectors on the environment. This is equivalent to around £4,400 per resident of the National Park (NP) per year¹³. The value for Scotland as a whole is equivalent to £3,400 per resident per year¹⁴. Thus, the natural environment of the Cairngorms may be worth around 26% more per resident than the average for all of Scotland.

The value for the Cairngorms was based on an estimate of the GVA of the National Park using information on employees and GVA per head for three regions (corrected for the GVA of the cities, where possible):

- GVA per head for Aberdeenshire: £12,376;
- GVA per head for Angus: £10,567;
- GVA per head for Inverness & Nairn and West Moray, Badenoch & Strathspey (no separate values have been found): £14,004.

The total GVA calculated was £200 million. If, however, the upper estimate of £290 million as the GVA for the Cairngorms NP is taken (which takes account of GVA per head for food and drink, manufacturing etc, and so could be considered comparable to the assumptions made for the HIE/SEn and SEARS regions), the GVA related to the environment increases to £103 million. This means that the GVA per head (based on a population of 16,000) increases to £6,400 per head; equivalent to an increase of 88% over that of the average for Scotland.

It is likely that the value of £71 million estimated through input-output modelling under-estimates the 'real' impact of the natural environment on the economy of the NP. This is because the approach is based on the national input-output tables. This requires the assumption that the economy of the NP is similar to the economy of Scotland as a whole. In fact, tourism, agriculture and forestry are much more important to the NP than to Scotland. This means that the impact of these sectors is likely to be under-estimated. Since these sectors are also identified as being heavily reliant on the environment in the NP (again more so than in Scotland generally), the overall impact of the environment on the economy of the NP is likely to be under-estimated. An indication of the degree of possible under-estimation can be determined by considering that around 80% of the GVA for the Cairngorms is derived from tourism. Taking GVA of the NP as £200 million and the reliance of the tourism sector on the environment of 80% (see Table 2.4) would give a direct impact on the economy of £128 million. Thus, the estimate provided by input-output modelling may under-estimate the 'real' impact of the natural environment on the Cairngorms economy by a significant amount.

¹³ £71 million ÷ population of the Cairngorms National Park, 16,000.

¹⁴ £17,200 million ÷ 5.1 million (approximate population of Scotland).

3.2.2 Borders

Input-output modelling has estimated an impact of the natural environment to the economy of the Borders case study area of £245 million per year¹⁵, compared with £17,200 million for Scotland as a whole and £71 million for the Cairngorms National Park. This includes the direct, indirect and induced (Type II) effects and represents the amount by which the region's output would fall if the environment sector within the case study area were to disappear, given our assumptions on the reliance of the different industry sectors on the environment. This is equivalent to around £4,300 per resident of the case study area per year¹⁶. The value for Scotland as a whole is equivalent to £3,400 per resident per year¹⁷ and for the Cairngorms National Park is £4,400 per resident per year (upper estimate of £6,400 per head)¹⁸. Thus, the natural environment of the case study area may be worth around 27% more per resident than the average for all of Scotland but 4% less per resident than for the Cairngorms National Park (or 33% less of the upper estimate for the Cairngorms case study is used).

As with the Cairngorms National Park, the estimated impact of the natural environment on the economy of Borders case study area is expected to be uncertain due to the assumption that the Borders economy is a scaled-down version of the Scottish economy. The overall effect on the reliability of the results may be less significant than for the Cairngorms since the population covered by the Borders case study is larger (57,000 compared with 16,000) such that the potential is that more of the economic linkages seen at the Scotland level are also present in the Borders. However, the case study area is mainly rural, with sectors such as agriculture, public administration and defence and hotels and restaurants (for example) being significantly more important in the case study area than in Scotland generally. Again, sectors such as hotels and restaurants are associated with 80% reliance on the environment in the Borders case study (compared with 30% for Scotland) such that the 'real' impact of the natural environment on the economy of the Borders case study area is likely to be an under-estimate.

3.3 Comparison of Results

The comparison of results for the different regions is best undertaken using GVA per head of population and the Type II (direct, indirect and induced) input-output modelling results. If the upper estimate of GVA for the Cairngorms National Park case study area is used, the top five results are (in descending order):

- Cairngorms NP: £6,400 per head of population;
- Highlands SEARS area: £5,900 per head (this will include part of the Cairngorms NP);
- Northern Isles SEARS area: £5,500 per head;
- Dumfries and Galloway SEARS area: £5,200 per head; and
- South Scotland SEn area: £5,200 per head.

¹⁵ This is likely to be a minimum value due to assumptions made about the relative size of the industry sectors compared with Scotland as a whole, for example, textiles manufacturing is much more important in the case study area than for Scotland as a whole, but this is not fully reflecting in the results from input-output modelling because regional (case study area-specific) input-output tables are not available.

¹⁶ £245 million ÷ population of the Borders case study area, 57,259.

¹⁷ £17,200 million ÷ 5.1 million (approximate population of Scotland).

¹⁸ £71 million ÷ 16,000.

The areas with the highest results are generally the more rural regions, reliant more on those industries that have been identified in this study as being most strongly linked to the environment. The Borders case study result of £4,300 per head is lower than the regional estimate for the Scottish Borders SEARS area of £4,800 per head. Since the SEARS area includes the urban areas omitted from the case study area, it could be expected that the use of regional data collected during the case study site visits combined with the national input-output tables is under-estimating the 'real' value of the environment by much more than 10% (since it could be expected that the rural areas have greater links to the environment than the urban areas).

The lowest result was Clyde Valley SEARS area at £2,600 per head, i.e. an area of greater urbanisation where there may be greater concentrations of industries that have weaker links to the environment.

4. WIDER BENEFITS

4.1 Overview

This section provides a summary of the potential wider benefits that may accrue because of the high quality of Scotland's natural environment. There are six different types of benefits being considered:

- the relative value of Scotland's natural environment in attracting businesses and individuals to Scotland, and how this may change in the future;
- the importance of the natural environment hinterland for a city economy in Scotland;
- the value of Scotland's natural environment for branding;
- the value to the economy of health benefits that the natural environment of Scotland provides;
- the ecosystem services that benefit the economy; and
- the existence values of Scottish landscapes and biodiversity that benefit the quality of life of Scotland's people.

The analysis of wider benefits has been based on an extensive literature review. This Section also provides a summary of the areas of economic opportunity in relation to the natural environment and an assessment of the enablers and barriers to exploiting these opportunities, and how this may change in the future.

4.2 Attraction of Businesses and Individuals

4.2.1 Attracting Businesses

The high quality of Scotland's environment has been used to market Scotland as a place to do business (Scottish Executive, 2004). Two-thirds of business surveyed for this current study (between December 2007 and January 2008) believed Scotland's natural environment to be a benefit to their company. In addition, factors such as quality of life for employees and freedom from pollution are measures included in the 'European Cities Monitor' and 'UK Cities Monitor' that rank cities according to their attractiveness to businesses (Cushman & Wakefield, 2007; 2007a). Glasgow is the only Scottish city included in the European Cities Monitor, having an overall rank of 26th (out of 33). The UK Cities Monitor also includes Edinburgh, which is ranked 8th, while Glasgow is ranked 6th (out of 15), though in terms of quality of life for employees Edinburgh is ranked 1st. Edinburgh is also ranked best in terms of freedom from pollution, but Glasgow is ranked 9th (although this is an improvement from 10th in 2006) (Cushman & Wakefield, 2007a).

The UK Cities Monitor identifies the three most essential factors for locating a business as (Cushman & Wakefield, 2007a):

- ease of recruiting qualified staff (46%);
- easy access to markets, customers or clients (43%); and
- value for money of office space (41%).

These factors agree well with the findings of the survey undertaken for this study, where value for money was ranked one of the most important factors. However, the survey also found that Scotland's natural environment is important to business location: of thirty factors of potential importance in determining regional location of businesses in Scotland, 'quality of landscape', 'low levels of pollution', and 'proximity to natural areas' were all identified within the top ten factors. These environmental factors are seen as being even more important by businesses in the Highlands.

Scotland is perceived as having 'tremendous assets' through its natural and cultural heritage. However, these are also considered to carry 'necessary but challenging management and stewardship obligations' (Scottish Executive, 2007a). Perceptions of the natural environment may also be putting a barrier in the way of investment in Scotland in some instances. For example, the opinion of one respondent in the US business survey appears to be that Scotland has a wonderful landscape, but it is not an area for business (Scottish Government, 2007). Another respondent felt that some American companies were actively looking to relocate where the legal structure was less strict (ibid, 2007). This implies they would be less keen to move to Scotland since they assumed the presence of a high quality natural environment protected by an extensive legal system. However, these views are not universally found in all such surveys.

The perceptions that legislation is adding to the costs can be countered by the findings of Le Roux *et al* (2008), which found that Scotland has a high quality regulatory process but imposes relatively low costs of compliance on its industry and has an environment that is of high (i.e. moderate to excellent) quality. The costs of compliance with environmental regulation are shown to be of good value in Scotland.

Overall, therefore, Scotland is recognised as an attractive location but there are concerns over the level of bureaucracy associated with investing in an area of natural beauty. Such concerns for those looking to invest from outside of Scotland may be inaccurate perceptions, although respondents to the survey did suggest that there may be some issues with bureaucracy which may be disproportionate to development size. There may also be issues in terms of the extent to which Scotland is known (internationally) as a place for business, with the advantages offered by Scotland's cities not always well recognised.

The Framework for the Economic Development of Scotland (FEDS) produced by the Scottish Executive (2004b) identified that economic growth was to be secured through increasing competitiveness both domestically and internationally. The environment helped with this aim through its impact on some of the factors that drive competitiveness (based on Scottish Executive, 2004b): education and skills: environmental resources provide opportunities for education as well as the focus for research and development; and entrepreneurial drive and competitiveness of enterprises: through the development of confidence within Scotland and attitudes to the cities and regions within it, but also through identifying better resource efficiency and adoption of 'greener' working practices. The current administration's Economic Strategy aims to provide opportunities for all of Scotland to flourish through increasing sustainable economic growth. The Government's strategy identifies five Strategic Priorities that are most critical to economic growth:

1. Learning, Skills and Well-being
2. Supportive Business Environment
3. Infrastructure Development and Place
4. Effective Government
5. Equity

For the future, enabling learning and skills enhancement should help to attract investment from businesses and retain the individuals needed to provide the knowledge that forms the basis of improving competitiveness. Combining this with promotion of the relatively low compliance costs in what is a high quality regulatory regime could also help to redress some of the misconceptions concerning the costs to businesses associated with a high quality environment.

4.2.2 Attracting Individuals to Live and Work in Scotland

The National Planning Framework for Scotland 2 (Scottish Government, 2008) highlights the importance of place to a modern knowledge economy. It identifies that 'businesses choose to locate where they can recruit well-educated, talented people'. The people that businesses wish to recruit tend to be attracted to cities and regions that offer 'a variety of economic opportunities, a stimulating environment, amenities for a wide range of lifestyles, and good connections to other high quality places' (ibid, 2008). The Framework concludes that the environmental quality, built heritage and cultural life of Scotland's cities and towns are strong economic assets.

Demographic projection trends for Scotland suggest that fewer young people are expected to enter the labour force, resulting in a potential reduction in terms of supply of skills. To help address this, the Scottish Executive announced a 'Fresh Talent Initiative' in 2003 to encourage people to stay in and/or migrate to Scotland. The findings of a survey of in-migrants in Scottish Executive (2006), however, found that the Fresh Talent Initiative lacked clarity in terms of who it was trying to attract. There was also concern that the Initiative existed to only encourage in-migration of intelligent, young people or was only aimed at those coming from overseas (Scottish Executive, 2006). Despite this, the Initiative had (by January 2007) resulted in 4000 people from more than 150 countries coming to live and work in Scotland (Scottish Executive, 2007b).

Scottish Executive (2006) examines the motivations of people who relocated to Scotland. The study found that the key reasons for relocation were (ibid, 2006):

- employment and economic opportunities;
- higher education;
- proximity of family;
- lifestyle; and
- return to roots.

For many of those relocating, location had a relatively low weight in the decision making process, particularly at the outset. For many in-migrants, it was the location of opportunities that was the driving force behind where they moved to. Exceptions to this were those with family ties or roots in Scotland (Harrison *et al*, 2003 in Scottish Executive, 2006).

Prior to moving to Scotland, many in-migrants expected to gain an improved quality of life. Once they had moved, many in-migrants had trouble settling in while many highly skilled people found it difficult to find suitable employment. However the main barriers tended to be associated with people's preconceptions and expectations, with those who were motivated for economic reasons facing fewer difficulties (Scottish Executive, 2006).

Hope *et al* (2004) assessed the main motivations for individuals moving to the Highlands and Islands, finding that the three main reasons were tranquillity, environment, and scenery. Other important factors included work, to retire, and

safety. People deciding to move to the Highlands and Islands tended to take very frequent holidays in the region before making the decision to move with 61% stating that they visited 'very regularly, around once a year or more often'. However, the majority of these people did also have family or historical links with the area (Hope *et al*, 2004). Having made the decision to move, 97% stated that they were very or fairly satisfied with their decision and only around 10% were unsure if they would make the same decision again. The reasons for being unsure included lack of job opportunities, the area being too remote or not suitable for young people, and not being made welcome (Hope *et al*, 2004).

Many of the growth sectors in rural Scotland, such as finance, high technology manufacturing, information communication technologies (ICT) services, and research and development, are less likely to require direct access to large markets. The development of modern communications technologies and emphasis on knowledge-based outputs (rather than more tangible products) mean that businesses are increasingly detached from the location in which they are based (SAC *et al*, 2005). There are also advantages in rural areas in terms of tourism opportunities, food and drink manufacturing, and teleworking (Scottish Executive, 2001). Growth in these sectors could help to attract and retain individuals by providing the depth and range of opportunities required by the local population (including young people).

The development of new firms is identified as one of the prime drivers of growth in the Scottish economy, with a high rate of business start-ups predicted to increase levels of competitiveness and productivity. Scotland had a relatively low level of business start-ups in 2004 at 29 per 10,000 resident adults (compared with the UK average figure of 38). One of the key priorities is to increase the number and rate of business start-ups. Many rural businesses tend to be smaller businesses or self-employed individuals. Rural areas tend to have much higher proportions of self-employed people (17% for Highland rural compared with 14% in upland and lowland rural and 10% urban (RSK ERA, 2001)). Self-employed people are also more likely to stay in their current location since they value their quality of life more than their career (agreed with by 86% of self-employed people in natural heritage jobs asked by RKS ERA, 2001, compared with 81% of employees) and have a greater degree of job satisfaction (97% stating that their job was satisfying, compared with 82% of employees) (ibid, 2001).

4.2.3 Attracting Individuals to Visit Scotland

Scotland is already an important visitor destination, with income from tourism in 2006 estimated at £4.2 billion, or around 5% of the GDP. An assessment of why visitors are attracted to Scotland can be undertaken through a review of visitor surveys, which attempt to identify key factors and reasons why visitors chose to come to Scotland. The most important factors in determining the choice of Scotland as a holiday according to the Visitor Attitudes Survey 2004 are (in Future Foundation, 2006):

- the scenery: 89% considering very or quite important;
- the natural environment: 89%; and
- the number of things to see and do: 83%.

A survey of European (French, Italian, Spanish, and German) visitors showed that landscape/countryside/scenery was by far the main attraction that influenced their decision to holiday in Scotland (VisitScotland, 2002). Durie *et al* (2005) highlight beautiful scenery, friendly people, a good place to relax, and interesting culture and history are the most important attributes of Scotland identified by visitors.

Visitors can undertake a wide range of activities while visiting Scotland, many of which are reliant on, or linked to, the natural environment. These include bird and wildlife watching, angling/fishing, shooting, stalking, activity holidays, mountain biking, snow-sports, hill walking, outdoor culture and heritage, golf, visits to attractions such as distilleries, photography, archaeology and genealogy. All of these activities are reasons why people visit Scotland, along with the attractiveness of the landscapes, scenery, and peace and quiet.

The outlook for the adventure tourism is good in the medium term (the next 15 years) based on optimistic projections for the Scottish and world economy more generally. In particular, the overseas market is predicted as growing due to Scotland gaining an increasing international reputation for many activity sports due to the numerous high-profile competitions returning year after year. Currently, 70% of the market is domestic, but the main growth area will be from overseas markets which may require new language skills, translation of safety instructions and hire contracts, etc (VisitScotland, 2007b). Future Foundation (2006) notes though that it is those countries whose economies are expected to grow the fastest and which may generally be expected to lead to increases in tourism where tourism is expected to increase by the greatest amount (Brazil, Russia, India and China).

In terms of Scotland as a Short Break Destination, there is a need to focus on increased numbers of high-spending visitors who are likely to be more environmentally aware. Although these visitors are likely to visit cities rather than rural areas (due to the fact that they are coming only for a short stay), tranquillity, open spaces and authenticity mean that rural destinations could concentrate on niche markets, such as sports, well-being breaks, and cultural events (Future Foundation, 2006).

In the longer term, VisitScotland (2006) indicates that Scottish tourism may need to position itself as a sustainable brand in order to meet the negative impacts of a risk averse society. In other words, Scottish tourism will need to move more toward a 'citizen's brand' which promotes community and concern for the environment. Threats to these opportunities include rising insurance premiums and threats of litigation (e.g. related to the school tourism market). A scenario of 'Dynamic Scotland 2025' portrays Scotland as a combination of New Zealand and San Francisco – a destination that is both vibrant and tranquil. This scenario focuses on people coming from further afield and, thus, visiting more remote rural areas as well as cities. It is also dependent on the success of the Short Break Destination scenario. Impacts on the environment are potentially a key constraint to realising the Dynamic Scotland scenario, in that it poses significant challenges in relation to visitor congestion (and the impacts of this on both the built and natural environment), increased air flights to Scotland, and the potential marginalization of disadvantaged local communities. However, Future Foundation (2006) also indicates that there should be increased opportunities for those marketing outdoor recreation based on the high quality of Scotland's natural environment.

Obstacles to visiting an area are lack of knowledge (and mistaken perceptions of an area), limited time (which leads customers to a 'stick to what they know best' attitude), and limited resources, which becomes most prominent when discussing the islands as destinations. Although highly aspirational, the islands are perceived as difficult (and expensive) to get to, and sometimes too far for a short break (Nunwood, 2005). Respondents to a survey of visitors to the Cairngorms National Park identified that they would like more opportunities to experience the area's cultural and historic heritage, including being able to buy local crafts more easily and taste more local produce (CNPA, 2005).

4.3 Hinterland

4.3.1 Benefits for those Living or Working in Scottish Cities

The benefits to the city and its hinterland are effectively a sub-set of the benefits across all of the wider benefits for Scotland as a whole. The hinterland provides greenspace and access to the countryside for recreation, with physical and mental health benefits. It also provides alternative attractions for visitors to the cities. The city provides benefits as an economic hub, giving support to the rural economy, while the hinterland provides a source of materials and production inputs.

Cities and towns are economically linked to their surrounding areas. The urban areas provide population clusters and concentrate economic development opportunities, which may act as the focus for future rural development initiatives. This conserves the environment of the hinterland whilst enabling the benefits of employment and income to spread. The main flows from a town or city are related to (SAC *et al*, 2005): education, recreation, cultural activities, shopping, and work.

Movement of benefits may be restricted by the commuting distance. The city region is important as a provider of a highly qualified workforce, with the potential to earn more by commuting to the city itself. However, areas within the city region can suffer from weak growth of the business base, indicating that proximity to a large city is not always positive. A study by Contract Marketers Scotland in 2001 (reported in Angus Council, 2002) found rural businesses, although rarely relying on local markets, were generally unwilling to move to urban locations. Such businesses identified their competitive advantage as being derived from their immediate environment through access to property, labour and sustainable resources (Angus Council, 2002). A city's success therefore depends on linkages to the wider area in addition to having a strong core.

Linkages between rural and urban areas are complex. Greenspace around a city has a range of environmental benefits, including (based on Land Use Consultants, 2004; Edinburgh and Lothians Greenspace Trust, 2007):

- reduction in risk of flooding through interception of rainfall;
- reduction in air pollution;
- benefits in terms of biodiversity, particularly where there is a greenspace network interspersed with remnants of old wildlife habitats;
- benefits for education and lifelong learning;
- opportunities for community cohesion through social interaction and promotion of social inclusion;
- increased community involvement and empowerment where a greenspace stimulates community involvement in planning and management;
- opportunities for recreation with direct benefits in terms of physical health;
- contributions to mental health and well-being;
- benefits in relation to land values and image, linked to quality of the greenspace;
- increased attraction of economic development - with subsequent regeneration and employment opportunities; and
- opportunities for training and employment through greenspace management.

Considerable benefit can be obtained from woodlands near to towns and cities. The impacts of those near cities are more important since more people can take advantage of the landscape and recreation benefits (Willis *et al*, 2000). Edwards & McPhillimy (2004) identify that woodland recreation opportunities provided near towns help make it easier to undertake recreation, reducing pressure on other sites

and creating links between health and education benefits. Scottish Executive (2007d) reports a Defra study that put a public benefit of up to £2.5 million per hectare on woodlands in and around urban areas. Garrod (2002) assessed the value of woodland views from houses and whilst travelling in the urban fringe to be £544 million. Households also estimated their willingness to pay for visual or recreational access to different arrangements of forest landscapes. The total value of urban fringe woodland (capitalised at 3.5% discount rate into perpetuity) was £7,860 per household, or approximately £240 per household per year (Garrod, 2002).

4.3.2 Benefits for Visitors to Scottish Cities

The marketing of cities (and towns) as places to visit often includes linkages and references to the surrounding hinterland. For example, Aberdeen is associated with beaches, coastline and opportunities for activities such as fishing, cycling and water-sports, whilst Inverness is identified as the 'gateway to the Highlands', with the renowned beauty of the surrounding area and opportunity to see dolphins in the Moray Firth (VisitScotland, 2007a). Visitors to Edinburgh also rated the beautiful/picturesque setting of the city as one of the aspects that had most impressed them on their visit (Lynn Jones Research, 2005). The Stirling Visitor Survey 2006 (Tourism Resources Company, 2007) found that overseas visitors, in particular, noted the scenery of the surrounding area. One of the main strengths included being 'close to the countryside'. Such visitor surveys highlight that people visiting the cities also value the surrounding countryside; hence there are direct benefits to city break tourism from the natural environment hinterland around the city.

Greenspace proposals show the benefits of providing recreation opportunities and corridors connecting the city, its open spaces and the wider countryside. A strategic action plan has been developed for Inverness to provide a framework for future investment in and management of greenspaces in the city. It is also anticipated that the action plan will identify the full potential that greenspace has, as well as its positive impacts on health, the economy, the environment, education and tourism (City of Inverness, 2007).

4.4 Branding

4.4.1 Branding Using the Natural Environment

The use of Scotland's natural environment for branding needs to reflect positive, memorable qualities linked to attractiveness, uniqueness, and sustainability. These qualities need to be relevant and provide value added to people both within and outside Scotland. A place brand is most valuable where it is realistic, competitive and provides a compelling strategic vision (Allen, 2005).

The value of the natural environment as a brand is linked to the 'purpose of Scotland', i.e. what is it specifically known for. It is whether the Scottish environment is clearly identifiable that determines its potential value as a brand (Allen, 2005). Bianchini & Ghilardi (2007) identify the importance of a 'mindscape', i.e. the linkages between the physical landscape of a place and people's visual and cultural perceptions of it.

Durie *et al* (2005) consider that tourist destinations search for their history and culture when they are constructing a brand. There are four aspects to generating a sense of place, with these identified as (Durie *et al*, 2005):

- iconic images generated through literature, food, landscape, music and film;

- the ability to mean different things to different people at different times making it possible to offer and promote a wide range of activities thus meeting the requirements of many different groups without compromising the perceptions or requirements of others;
- changing perception over time such that authenticity is maintained as seen by contemporary visitors; and
- a careful balance between authenticity and a romanticised view of the past.

As well as encouraging investments and development through promotion of its strengths, such as history and sense of place, a brand can be self fulfilling in that it can influence decision making in terms of policy and plans. Thus, as well as representing the place at present, the brand can also express a vision for the future for which there is a strategy and purpose to achieve (Allen, 2005). It is the ability to differentiate what Scotland has to offer in terms of its natural heritage that will determine the value of the environment as a brand, either for Scotland as a whole, for particular regions or for specific products or companies.

4.4.2 Branding of Products Using the Natural Environment

Environmental differentiation is usually based on three elements (KPMG, 2001):

- a willingness among likely consumers to pay for added environmental qualities;
- establishment of credible information about the environmental attributes; and
- potential to defend the environmental attributes against imitation by competitors.

Scotland Food & Drink is using the distinctive identity of Scotland to increase global branding of the Scottish industry through working with other relevant sectors such as tourism. This draws on the global reputation of Scottish food and drink products and traditions, such as Hogmanay celebrations and Scotch whisky (Scotland Food & Drink, 2007). Scottish salmon is often differentiated using production practices, including organic production and Label Rouge (for the French market). Differentiation of products also arises from the use of named geographical areas of origin, e.g. Orkney and Shetland, referred to on the product packaging. Differentiation by geographical origin offers an opportunity for smaller producers in these regions to enter the market (Ernst & Young, 2005).

Branding by private companies to promote their products can also be linked directly (or indirectly) to the environment (e.g. Highland Spring Water and Findlays). There are also opportunities to utilise company brands to raise awareness of conservation issues and even to raise funds, for example, linked to product promotions.

Accreditation programmes have the potential to act as a brand by providing customers with assurance of product and service quality. An important issue is how to convert the standards required by the accreditation schemes with those required by consumers, particularly in the context of the natural environment (Land Use Consultants, 2005). Product based accreditation schemes are common, existing in almost all sectors of industry and commerce in the UK. The schemes provide an opportunity for business to demonstrate to their customers that they meet certain standards expected by the market.

A key issue in using accreditation to promote product and place is to avoid providing too much information that could overwhelm or confuse customers, or could dilute the overall brand message. The most successful schemes tend to provide a hierarchy such as good, better, best showing a progression of enhancement (Land Use Consultants, 2005). The promotion and use of the Green Tourism Business Scheme (GTBS) has the potential to act as brand in this way. The scheme includes a label, a

ranking (gold, silver or bronze) that shows a progression of enhancement, and can be used for marketing as it provides an audited assessment of sustainable criteria such as energy and water efficiency, waste management and biodiversity. The Green Tourism Business Scheme Internet site also allows searching for accredited companies by location, such that there is a marketing advantage for those meeting the required standards.

4.5 Health and Well-Being

There is considerable research on the value of the natural environment in terms of the health benefits it can provide, e.g. through pollution reduction, encouraging exercise and from psychological benefits for those who are ill.

Research by the OECD has identified a direct relationship between a country's accomplishments in development and its population's health (Forward Scotland, 2007). If life expectancy is used as a proxy for health, there is a link between this and national productivity (ibid, 2007). Physical inactivity is thought to cost £8.2 billion per year, including costs to the NHS and absences from work (O'Brien, 2005). Survey research commissioned by the Scottish Executive suggested that 22% of Scottish people never do any exercise (Weldon and Bailey, 2007). If the number of inactive people in Scotland could be cut by 1% annually, £85.2 million in economic benefits could be gained in five years (SEPA, 2008).

The Sustainable Development Commission (2007) is promoting the value of the natural environment to the NHS, and suggesting how it may be used to improve health, for example through making sure new healthcare buildings have views of nature. As a result, NHS Scotland is including the 'physical environment' on its list of constructs which will be used to produce mental health and well being indicators (Forward Scotland *et al*, 2007). This is in response to findings that people tend to recover more quickly and with fewer drugs when they have access to green space while in hospital (Forward Scotland, 2007). Greenspace Scotland (2007, in Forward Scotland, 2007) found that blood pressure decreased when people were in a more natural environment, while simply viewing an outdoor space is identified as producing a short-term recovery from stress. There is also general agreement that access to greenspaces and woodlands has a positive impact on mental and physical health and wellbeing (Weldon and Bailey, 2007).

Exercise such as walking may also be prescribed by health professionals as a treatment option for certain conditions (CJC Consulting, 2005). However, some activities prescribed by health practitioners use indoor facilities or approaches based on behaviour, so are not necessarily dependent on greenspaces (ibid, 2005). Yet the general condition of the environment does appear to affect exercise levels and consequently, health. A European cross-sectional study has found that those living in environments with lots of greenery were more than three times more likely to undergo frequent physical activity than those in areas with the lowest amount of greenery (ibid, 2005).

The gentle type of physical activity associated with visits to woods are considered important contributors to good health, with particular benefits in terms of preventing and curing cardiovascular problems (Willis *et al*, 2000). MNT Associates (2007) found that health walks to National Nature Reserves (NNRs) were considered to provide a much more positive experience than was expected for those who had not previously walked an NNR route. Other types of green area can also bring benefits. The Greenspace Scotland Omnibus Survey concluded that green spaces were important parts of urban communities, and most people saw them as having a

positive impact on their quality of life, although satisfaction varied between the different socio-economic groups considered (Greenspace Scotland, 2007). The presence of greenery may also affect social wellbeing and neighbourhood cohesion. Research in the Netherlands has suggested that people living in greener areas feel that their health is better than those in less green environments (O'Brien, 2005).

Several pieces of research have identified a high learning potential to be gained from education outdoors (University of Edinburgh, 2007). There are already 2,000 schools in Scotland that are registered on the Eco Schools programme, which is an international scheme, relevant to natural heritage, to encourage sustainability and education about the environment (ibid, 2007). However, there is perceived to be a lack of policy on education outdoors (ibid, 2007). Opportunities do exist, through, for example, the John Muir Trust which runs an award scheme with the aim of getting people active in wilder areas, as well as conserving and promoting these places (McMorran *et al*, 2006). Wilderness was also found to have encouraged people to work together as a team and have more respect for the environment (ibid, 2006).

Benefits to health are also predicted as a result of the impact that trees have on pollution levels. Trees are able to absorb large quantities of pollution, in particular PM₁₀ and SO₂. The total benefits to Scotland per year are estimated at between £57,000 and £2.1 million. The range is large due to the assumptions used for reduction in deaths brought forward (the lower end of the range reflects death brought forward avoided by one month and the higher end as deaths brought forward avoided for one year) (Powe & Willis, 2002).

The overall health benefits of Scottish woodlands have been estimated at between £408 million and £540 million (equivalent to £14.1 million to £18.9 million per year in 2006 prices) and include (Forestry Commission, 2006):

- premature deaths avoided through increased physical exercise;
- morbidity avoided through increased physical exercise;
- premature death and morbidity avoided due to reduced air pollution; and
- savings in mental health treatment costs and reduced absence from employment.

4.6 Ecosystem Services

The ecosystem services approach is based on the Millennium Ecosystem Assessment, developed for the UK. The aim of the assessment of ecosystem services is to understand how the condition of environmental assets is enhanced or depleted by different levels of use. The Millennium Ecosystem Assessment identified four categories of ecosystem services (Millennium Ecosystem Assessment, 2005):

- provisioning services: including products obtained from ecosystems such as food, fibre, fuel, genetic resources, biochemicals, natural medicines, pharmaceuticals and freshwater;
- regulating services: including benefits obtained from the regulation of ecosystem processes including regulation of air quality, climate, water, erosion, diseases and pests and natural hazards; water purification and pollination;
- cultural services: including the non-material benefits obtained from ecosystems such as spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences (which also includes landscape values); and
- supporting services: including those services necessary for production of all the other ecosystem services such as soil formation, photosynthesis, primary production, nutrient cycling and water cycling.

The benefits provided by ecosystem services are, in effect, the life support for Scotland. SEPA funded a study by Williams *et al* (2003) that estimated the value of Scotland's ecosystem services at £17 billion per year in 2001 prices (or £21 billion in 2008 prices adjusting for inflation). The approach was based on that undertaken by Costanza in 1997 to value the ecosystem services for the world (estimated at \$33 trillion per year). The SEPA study used the same approach to provide an estimate of the annual value of the flow of benefits that the environment provides for Scotland. These benefits covered both terrestrial and marine habitats (to the 12 mile limit) and included ecosystem services such as clean air, water, rendering waste harmless, as well as the provision of refuges for biodiversity. Williams *et al* (2003) found that 88 of the 187 possible ecosystem services could not be valued and these were therefore assigned a zero value. This means that the £17 billion per year estimate (or £21 billion in 2008 prices adjusting for inflation) is expected to be an under-estimate.

Several studies have attempted to value a sub-set of the ecosystem services provided by Scotland's environment. Willis *et al* (2003) estimated the (capitalised) value of carbon sequestration by woodland to be between £1.2 billion and £2.6 billion (2002 prices, with the estimate depending on the values used for the external cost of carbon¹⁹).

4.7 Summary of Key Barriers and Opportunities

This Section summarises some of the main barriers and opportunities that exist in relation to growing the gains to the economy from sustainable use of Scotland's natural environment.

Investment

Although Scotland is already successful in attracting inward investment, there are misconceptions and misunderstandings over the level and complexity of legislation and bureaucracy (particularly from the USA) that may be influencing (or even discouraging) the choice of Scotland for foreign direct investment. Knowledge of Scotland and its cities is generally poor; although specific, targeted actions have produced positive results (e.g. 54% of respondents to a survey during Tartan Week agreed that Scotland is a competitive place for business). There are also concerns over levels of bureaucracy among Scotland's businesses, although the majority of businesses considered the environment to be a benefit. This suggests a need for promotion of Scotland as a location in which to invest.

In-migration appears to be dominated more by opportunities than location, with the nature of the job generally more important than place. However, many in-migrants did expect an improved quality of life upon moving to Scotland, including perceptions of beautiful countryside. Many in-migrants expected to stay in Scotland for a short period of time only (43% expecting to stay for three years or less). Many of the recent growth sectors (banking and finance, high technology manufacturing and information communication technologies) are also those that do not need local access to large markets such that they are less tied to city locations. The provision of broadband access to every Scottish community means that rural areas are well provisioned to attract such businesses. Despite, this Scotland had a relatively low level of business start-ups in 2004 (29 per 1,000 resident adults compared with the UK average of 38). A key priority (already identified) is to increase the number and rate of business start-ups.

¹⁹ The £1,182 million estimate is based on an external cost of carbon of £6.67 per tonne of carbon, while the £2,614 million value is based on an external cost of carbon of £14.67 per tonne of carbon.

Tourism and Recreation

Scotland has an established international reputation as a visitor destination with the scenery, natural environment, and number of things to see and do, important factors in Scotland's being chosen as an eventual holiday destination. Promotion of Scotland as a brand through the use of the natural environment in images can help to generate a sense of place that itself influences decision-making. In this way, the brand can represent a vision for the future (although it is essential that any brand represents an authentic picture of Scotland to ensure that visitor's expectations can be realised).

Scotland is also well-placed in niche and growth areas such as adventure tourism, wildlife tourism, mountain biking, angling and golf. Visitor numbers are forecast to grow at an average of 2.3% per annum from 2005 to 2015, with this level of growth not expected to create problems in terms of carrying capacity. Wildlife tourism, for example, is predicted to continue to grow due to increased interest and publicity, e.g. from wildlife television programmes often featuring Scotland's iconic species and habitats (e.g. golden eagles, pine martens, red deer).

Wildlife tourism is characterised by small businesses for which wildlife tourism is their sole source of income. Many rely on the summer season and few show signs of diversifying. There is a need for support for these small businesses (e.g. through funding) as they lack investment potential for staff training, information provision and marketing, and for maintenance and improvement of their facilities, as well as a need for investment in the infrastructure needed to support greater numbers of visitors.

Many wildlife tourism suppliers are concerned that the environment and wildlife habitats in particular may be declining in quality, with protection only being put into place at a slow rate. Other barriers are likely to include the volatile oil price and the potential implications of increasing fuel prices. This could potentially reduce visitors from overseas as well as domestic visitors using low cost airlines. Any reduction in the level of disposable income (e.g. due to recession) would also affect tourism spending. A key barrier for angling would arise if salmon parasites (currently not present in Scotland due to thorough disinfecting requirements) were to be introduced. This could seriously impact on the angling industry, e.g. in the River Tweed.

Food and Drink Products

Increased interest in healthy eating and local produce should provide opportunities for local farmers and manufacturers. However, opportunities for high value products could be affected by a reduction in disposable income. There are also barriers in terms of availability of such products and the need for investment in processing facilities to meet growing demand. Changes to funding have also led to concerns over the economic future of farming, forestry and land management (e.g. for hunting of grouse), with this also relevant to estates (which need to cross-subsidise loss making operations). The salmon industry in particular has benefited from a strengthening of links between retailers and processors. Increasing this to include partnering with salmon farmers could help improve loyalty to Scottish products and avoid moves to lower-priced imported produce. Scottish food and drink also relies heavily on its reputation, with opportunities for continued growth through promotions aiming to make Scotland known internationally as 'the land of food and drink'. Since, food and drink manufacturers tend to spend a high proportion of their total expenditure in the local area, they provide significant knock-on benefits to the local community.

Forest Products

Although global demand for wood is growing, it is expected that much of this demand will be met from fast-growing plantations outside the UK. The economic viability of UK forestry is not expected to be threatened, though, and long-term softwood prices are predicted to continue to increase. The opportunities offered by certification of wood from sustainable sources are expected to control illegal timber, helping to maintain prices for UK producers. Collection of non-timber products is not predicted to have significant economic opportunities, due mainly to established markets in other countries and concern over what is a sustainable harvest. There may be greater potential from biomass production particularly in contributing to rural business diversification. Substantial opportunities may exist from better alignment of woodlands and forestry with tourism and recreation, and also with education and health. Realisation of these benefits is likely to need co-ordinated approaches between forestry organisations and visitor/recreation organisations, including more sympathetic behaviour from harvesters. Furthermore, tailoring these opportunities to the hinterlands of cities could have significant benefits for urban as well as rural populations, as well as providing additional attractions to encourage visitors to explore wider and (potentially) stay longer.

Renewable Energy

Scotland is identified as having the highest projected growth of renewable energy generation in the UK (OECD, 2008). However, care is needed that this does not result in knock-on impacts to other sectors, e.g. tourism where electricity pylons are introduced to areas valued for their scenery, or where wind farms could harm wildlife (e.g. migratory/predatory birds).

5. SUMMARY AND CONCLUSIONS

5.1 Summary of the Impact of the Natural Environment

5.1.1 Results of Input-Output Modelling

Input-output modelling has estimated a value of the natural environment to the Scottish economy of:

- Total domestic demand, excluding wages: £3.9 billion per year;
- Type I effect (direct + indirect): £5.9 billion per year;
- Total domestic demand, including wages: £8.6 billion per year; and
- Type II effect (direct + indirect + induced): £17.2 billion per year.

These estimates represent the amount by which Scotland's output would fall if the benefits provided by Scotland's natural environment were no longer available, given our assumptions on the reliance of the different industry sectors on the environment. This is equivalent to around £3,400 per resident per year for the Type II effect (direct + indirect + induced)²⁰. The total for Scotland is based on the input-output tables for 2003 and thus represents the impact of the environment in 2003. The estimates provided are highly dependent on the percentage reliance on the environment assigned to each industry sector. This is the key source of uncertainty in the estimate of the impact of the natural environment due to the need to convert qualitative measures of reliance on the environment into quantitative data. The percentage reliance of each sector has been applied conservatively such that the total impact may be an under-estimate of the 'real' impact.

The regional analysis has shown that the value per resident per year varies considerably, as summarised in Table 5.1 for the HIE/SEn regions and Table 5.2 for the SEARS areas. Table 5.1 shows that South Scotland (£5,200 per head) has the strongest links to the environment when expressed as GVA per head. The Highlands and Islands (£5,100 per head) has a similar value, both of which are 50% greater than the estimate for Scotland overall. West and Central Scotland has the lowest value in GVA per head. These values can be compared with the result for the Cairngorms NP of £6,400 per head, when the upper estimate of the GVA for the NP (£290 million²¹) is used.

Table 5.1: GVA per head by SEARS Areas (Type II, direct + indirect + induced)

HIE/SEn	GVA per head	Difference from Scotland	
South Scotland	£5,200	+£1,800 per head	+53%
Highland and Islands	£5,100	+£1,700 per head	+50%
Grampian	£4,000	+£600 per head	+18%
Tayside	£3,900	+£500 per head	+15%
East and Central Scotland	£3,400	Same	±0%
West and Central Scotland	£2,700	-£700 per head	-21%

²⁰ £17,200 million ÷ 5.1 million (approximate population of Scotland).

²¹ It is considered appropriate to take an upper estimate for the GVA of the Cairngorms NP since this reflects more closely the assumptions made for the regional analysis in terms of using food and drink as the best indicator of those manufacturing sectors that have the strongest links to the environment.

Table 5.2: GVA per head by HIE/SEn (Type 1, direct + indirect, including wages)

SEARS	GVA per head	Difference from Scotland	
Highlands	£5,900	+£2,500 per head	+74%
Northern Isles	£5,500	+£2,100 per head	+62%
Dumfries and Galloway	£5,200	+£1,800 per head	+53%
Borders	£4,800	+£1,400 per head	+41%
Argyll	£4,200	£800 per head	+24%
Grampian and Moray	£4,000	+£600 per head	+18%
Tayside	£3,900	+£500 per head	+15%
Western Isles	£3,700	+£300 per head	+9%
Forth	£3,400	Same	±0%
Ayrshire	£3,200	-£200 per head	-6%
Clyde Valley	£2,600	-£800 per head	-24%

For the SEARS areas, it is the Highlands that has the highest value (£5,900 per head), followed by the Northern Isles (£5,500 per head) and Dumfries and Galloway (£5,200 per head). All three of these SEARS areas have a GVA per head at least 50% greater than that for Scotland overall. Clyde Valley is the lowest estimate and is 24% less than the average for Scotland. Ayrshire also has a low value, perhaps reflecting the large number of jobs in public administration/public services, aerospace, biotechnology and transport within that region (which are not assumed to have significant dependence on or links to the natural environment).

5.1.2 Employment

Table 5.3 gives an indication of the direct and indirect jobs that are related to the natural environment. The total number of jobs is around 154,000 directly supported and 242,000 (direct, indirect and induced).

Table 5.3: Direct and Indirect Jobs Supported by the Environment

SEARS	Direct Jobs	Direct + Indirect + Induced Jobs
Argyll	3,000	5,000
Ayrshire	11,000	17,000
Borders	4,000	6,000
Clyde Valley	42,000	66,000
Dumfries and Galloway	7,000	11,000
Forth	41,000	64,500
Grampian and Moray	18,000	28,000
Highlands	11,000	17,000
Northern Isles	2,000	3,000
Tayside	13,000	20,500
Western Isles	1,000	1,500
HIE/SEn	Direct Jobs	Direct + Indirect + Induced Jobs
East and Central Scotland	41,000	64,500
Grampian	13,000	20,500

Table 5.3: Direct and Indirect Jobs Supported by the Environment

Highland and Islands	22,000	34,500
South Scotland	11,000	17,000
Tayside	13,000	20,500
West and Central Scotland	53,000	83,000

A sectoral comparison of jobs can be provided in terms of jobs supported (i.e. 242,000). Of the 2.3 million jobs in 2003²², a total of 540,000 were associated with 'distribution, hotels and catering and repairs', while 413,000 were associated with 'banking, finance and insurance, etc.'. Around 243,000 jobs were in manufacturing (of which 8,700 were associated with spirit production), 120,000 in construction, 29,000 in 'agriculture, forestry and fishing' and 37,000 in 'energy and water supply'. This study estimates that the number of jobs supported by the environment is similar to that supported by all manufacturing.

5.1.3 Context of the Results

The impact of the environment cuts across many different industry sectors such that the total of £17.2 billion exceeds any individual sector in terms of total output (based on 2003 figures as this is the year of the input-output tables). For example, the construction sector provided £11.0 billion total output in 2003. Extraction of crude petroleum and natural gas and services to oil and gas resulted in total output in 2003 of £15.1 billion²³. These figures highlight the importance of the environment generally to the economy of Scotland.

There are also studies that have been undertaken in other regions of the UK, where the value of the environment to the economy has been estimated. These include:

- Wales: £9.0 billion of gross output (15%) and supports 169,000 jobs (around 17%). Data are for 2000 from Bilsborough & Hill (2003);
- South East of England: environmental economy generated £7.8 billion in terms of total output (6%) and supported 230,000 jobs (5.5%). Data are for 2000 from Land Use Consultants & SQW Ltd (2007);
- North West of England: environmental economy generated £2.6 billion (GVA) (2% of total GVA for the region) and 109,000 jobs (4% of total jobs), from Natural Economy Northwest (2007); and
- South West of England: environment related economic activity contributed at least £1.6 billion (2%) to GDP and 100,000 jobs (5%). Data are for 1999 and is considered to underestimate the value of the environment as an asset, in particular to tourism (information from the Regional Economic Strategy downloaded from the South West Observatory Internet site).

Overall, it does appear that the environment has a similar level of impact on the Scottish economy as the Welsh environment has on the Welsh economy. The English regions show a smaller impact from the environment on the economy. It is difficult to make direct comparisons, however, as the industry sectors included/excluded vary between studies as do the percentages assigned to industry sectors to estimate their reliance on the environment. For example, Bilsborough & Hill (2003) includes defence, mining and quarrying, all of which have been excluded from the results for Scotland as these industry sectors are not considered to rely on a high quality environment for their activities. Thus, the Scotland figures are likely to be an under-estimate of the total impact of the environment on the economy.

²² Data on jobs are taken from Scottish Executive (2007).

²³ Data on total output are taken from Scottish Executive (2005b).

5.1.4 Wider Economic Impact

The values presented in Tables 5.1 and 5.2 reflect only a part of the 'true' impact of the natural environment to the Scottish economy, with significant amounts of impact not being captured. This includes health and well-being, including activities that are not paid for directly (e.g. walking, cycling, general wildlife watching), although some payments may be made indirectly, e.g. through taxes and car parking fees. As a result, the additional benefits are difficult to disentangle from what has already been captured in the input-output modelling. It is also difficult to separate the different types of wider benefits from each other, such that it is not possible to quantify each individually. An indication of the importance of a number of identified ecosystem services can be given based on the value for Scotland of £17 billion per year estimated by Williams *et al* (2003). It should be noted that although this value is very similar to the £17.2 billion per year estimate for the Type I and Type II effects (including wages), it is not possible to directly link the value of ecosystem services to Scottish economic output (because many of these benefits will fall wholly outside the market economy).

In some instances the use of 'willingness to pay' provides an indication of the potential importance of the natural environment (although this can not always be directly linked to the Scottish economy). The F4P Omnibus Survey (in Forestry Commission, 2006) gives benefits of £24 million for the amenity benefit of woodland views on house prices and £15 million for the value of urban fringe broadleaved woodland on journeys. While some of the amenity benefit of woodland views may be reflected in the economy through house sales, there may be considerable benefits in terms of attracting people to live in the wooded areas. Furthermore, the benefits associated with woodland views on journeys could attract people to work in Scotland (when compared with less wooded areas of England, for example). Thus, there may be additional positive effects on Scotland's economy over and above the results of the input-output modelling.

5.2 Potential for Future Development

The results presented above show that there are already strong links between the natural environment and the Scottish economy. However, there are also areas where the links could be strengthened in the future. Many existing Government strategies and policies are already focusing on building more sustainable communities and economies. As well as building on existing dependence/links between the natural environment and the economy, this could encourage stronger links to develop in those industry sectors where links to the environment are weak at present.

Ongoing use of the environment as a marketing tool to attract businesses, individuals and visitors will mean that the links between the environment and economy will continue to grow over time. However, it is important that perceptions of costs and bureaucracy associated with legislation to protect and enhance the environment are addressed, without affecting the level of protection that is afforded.

Recently implemented policies such as the Supply Side Intervention for broadband²⁴ (George Street Research, 2007) are likely to help detach a significant number of businesses from location, so that people can live in areas with a high quality natural environment.

²⁴ This policy aimed to provide affordable broadband access to every Scottish community and this was achieved on 29 December 2007.

Increasing the capacity of local producers (e.g. farmers) to process their products on-site could help meet the demand for locally sourced and produced goods, creating linkages through the chain from producer and processor to manufacturer and consumer. As well as diversifying local economies, this may bring further opportunities for young people, encouraging them to stay and build their careers in their local community.

Continued (and enhanced) promotion of Scotland's green credentials in the tourism sector could extend the tourist season, reducing impacts in terms of carrying capacity, minimising the need to retrain staff at the start of each season and helping to maintain the quality of habitats. Growth of recreation in forests and enhanced connections with estates, alongside development of infrastructure, activities and services is also a key opportunity for reducing seasonality within the tourism industry.

It is essential that any branding of products presents an authentic image, to encourage word-of-mouth recommendations, but also to raise awareness of the products that Scotland offers: from the already established Scotch whisky through to the growing niche tourism markets for adventure activities and the potential for renewable energy generation. This requires a co-ordinated approach to marketing, bringing together the various industry sectors to emphasise what Scotland has to offer locally, regionally, nationally and globally.

In terms of specific sectors, the analysis identified a number with strong dependence on or links to the natural environment that have identified objectives for growth. Where growth to meet these targets involves greater sustainable use of the natural environment, there is significant potential to increase the impact of the environment on the economy. The growth objectives include:

- increasing the proportion of local produce in the Scottish food market. This may benefit from enhanced interest in sustainability and healthy eating but is likely to require investment in processing facilities and strengthening of links between retailers and processors;
- growth of production of wood raw material from 6.9 million m³ to 8.9 million m³ in the period 2017-2021, an increase of almost 30% (Forestry Commission, 2006). Global demand for wood is growing and increased certification of wood coming from sustainable sources should help control illegal timber and maintain wood prices;
- potential growth in game as a product of Scottish forests sold to UK markets, (Forestry Commission, 2006). Increasing interest and demand for Scottish produce is a key factor in increasing demand with Scotland already being promoted as the 'land of food and drink'. There are concerns that a lack of funding may affect the economic future of some land management activities, particularly on estates where there is a need to cross-subsidise loss making activities. This may need to be addressed to ensure that opportunities are not missed;
- growth in demand for specialist mushrooms collected from forests (Dyke & Primrose, 2002). Meeting growing demand requires work to be undertaken to establish sustainable levels of harvesting and to ensure that compliance with forestry/woodland certification schemes is not threatened;
- increased use of brash resulting from timber harvesting for biomass fuel, with an estimated 650,000 m³ maximum available (Scottish Executive, 2007d). Subject to

considerations about nutrients, soil stability, and long-term carbon budgets, there may be opportunities for the judicious removal of currently unused brush. This offers potential for rural business diversification, which may require education, training and funding;

- growth in forest-related tourism from GVA of £250 million per year (Forestry Commission, 2006). To meet this target there is a need for better alignment of forestry management (including harvesting) with the needs of tourism and recreation. This may require co-ordinated action between forestry and visitor organisations;
- growth in income from angling, which is currently £113 million per year, and where two-thirds is from visiting anglers (TNS, 2004). This requires on-going protection of fish stocks through maintenance of water quality (reducing pollution from agriculture, urban areas and fish farms), and, in particular, to avoid the introduction of salmon parasites;
- increased generation of energy from renewable sources, with a target to generate 50% of electricity used by 2020, an increase of more than 100% of current levels; with the potential to create 35,000 UK jobs (Scottish Government, 2008). The expansion of renewable energy sources, e.g. through wind farms, needs to be undertaken sympathetically to avoid impacts on recreation and tourism, in particular, where electricity pylons need to be installed to deliver electricity to where it is needed;
- increased tourism revenues by 50% to 2015, i.e. by £2 billion (Scottish Executive, 2000), with growing importance of niche and adventure tourism. Wildlife and adventure tourism are mainly associated with small businesses and are key growth sectors. For example, wildlife tourism in Scotland has grown by 14% year-on-year since 1996 (compared with growth internationally of 12% year-on-year (VisitScotland, nd)). Continued growth of these niche markets is likely to require help with training and marketing since such businesses typically have low investment potential, often being small, family businesses or associated with self-employed people. Such businesses also typically rely on seasonal income and may benefit from education and investment to assist with diversification. There are also concerns that some wildlife habitats are declining in quality and that in some instances protection is not being undertaken quickly enough;
- increased incomes from food and drink manufacturing by almost 33%, from £7.57 billion to £10 billion (Scotland Food & Drink, 2007), where this could also drive increases in production of the raw materials given the strong local links between food and drink manufacturers and their suppliers. Scotland already has a strong reputation for food and drink products and this needs to be maintained and enhanced; and
- increased recycling of waste from 30% currently to 40% by 2010 and 70% by 2025 (Scottish Government, 2008b), with the potential to create 45,000 jobs UK-wide (Murchison, 2003). This is likely to require on-going investment and funding at the community level.

As the growth of the above sectors exceeds that of sectors that have fewer dependencies on the environment, the relative importance of the natural environment to the Scottish economy will increase. Similarly, the number of jobs related to the environment will also increase as a proportion of total jobs. Obviously, growth in each of the sectors must take place in a sustainable, environmentally sensitive way

to ensure that the development of some sectors does not compromise activity in other sectors.

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