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The socio-economic impacts of implementing the UK Biodiversity Action Plan for species-rich hedges in Devon

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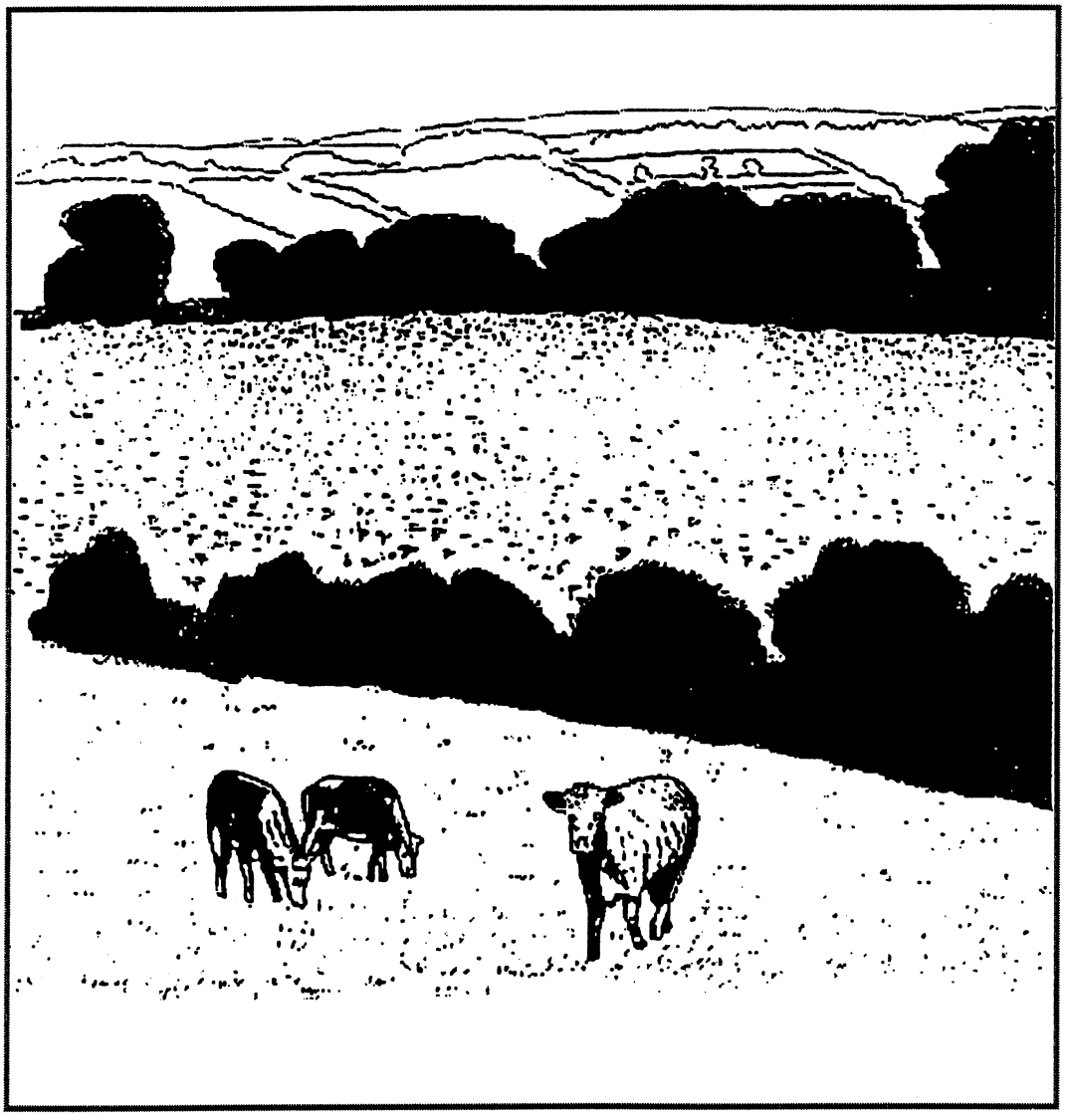

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The socio-economic impacts of implementing the UK Biodiversity Action Plan for species rich hedges in Devon

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Summary

Introduction

English Nature and other organisations from across all sectors are committed to achieving the UK Biodiversity Action Plan's nature conservation goals over the next 20 years and beyond. One of the costed Habitat Action Plans within the UK Biodiversity Action Plan is for ancient and/or species-rich hedges (UK Steering Group, 1995), with the following targets:

- Halt the net loss of species-rich hedgerows through neglect or removal by the year 2000, and all loss of hedgerows which are both ancient and species-rich by 2005;
- Achieve the favourable management of 25% (c. 47,500 km) of species-rich and ancient hedges by the year 2000, and of 50% (c. 95,000 km) by 2005; and
- Maintain overall numbers of hedgerow trees within each county or district at least at current levels, through ensuring a balanced age structure.

The additional cost of achieving the UK BAP targets on a country-wide level was estimated in 1995 to be £1.7M pa in the year 2000, rising to £3.0M pa by 2010 (Steering Group Report, 1995). Current public expenditure on hedges is about £2.5M pa, so the total UK public expenditure in the year 2000 will have to be about £4.2 M if the targets are to be met (EN project brief, 1999). It is estimated that the county now retains about 20% of species rich hedges in the country (Devon Biodiversity Partnership, 1998). For the purposes of this research, therefore, it was assumed that at least 20% of the £4.2M required to meet the targets should be directed to the county, that is some £840,000 per year. In fact, since Devon hedges are set upon banks, which are costly to maintain, Devon may expect to receive an even greater proportion of the money. Approximately £1 million per year was estimated to be the required expenditure.

Aims and objectives of study

This study set out to identify the potential socio-economic impacts of achieving these targets. English Nature believes that the socio-economic benefits may prove a powerful argument for further agri-environment monies being made available for hedge conservation. The overall aim of this research was to estimate the socio-economic impacts to the Devon economy of reaching the targets of the UK Biodiversity Action Plan for species-rich hedges, based on the assumption that this requires expenditure of £1 million per year within the county over the period 2000 to 2005.

A secondary aim of this research was to develop a methodology that can be used to estimate the socio-economic impacts on local economies of implementing further Biodiversity Action Plan targets.

The objectives of this study were to identify:

- the employment and wages of hedge maintenance and restoration labour, and associated training staff;

- local purchases of goods and services relating to hedge management and restoration, as required to meet BAP targets;
- supply of goods and services to local communities (e.g. firewood, hurdles etc.);
- expenditure by visitors and tourists induced to visit Devon as a result of hedge BAP implementation; and
- multiplier impacts associated with landowner, contractor, supplier and visitor expenditures.

Methodology

Following a literature review, a sample of hedge contractors were interviewed over the telephone using a structured questionnaire. Additional information on funding, training, tourism and agricultural suppliers was derived from semi-structured interviews with key informants. This information was fed into a spreadsheet and multipliers applied to obtain the total socio-economic impacts of implementing £1 million of hedge restoration and management work in Devon.

A simple spreadsheet model was developed in Excel, comprised of the main socio-economic impacts of hedge restoration work. The aim of the analysis was to estimate the *additional* income and employment impacts to the local economy arising from an injection of £1 million per year for 5 years for hedge restoration to meet the BAP targets for species-rich hedges. This analysis included an assessment of the multiplier effects to the Devon economy.

Analysis

In conducting the analysis two key assumptions were made:

- the £1 million of expenditure will meet 60% of the costs of hedge restoration. This assumption was based on the current level of funding of actual costs for work under agri-environment schemes. For example, under ESAs grants between 30% and 80% of actual cost are available to assist in the funding capital works; and
- it was assumed that no funds will be provided for hedge trimming. Its inclusion in the analysis would significantly reduce the total length of hedge that could be restored for £1million.

The research showed that implementing the BAP targets for species-rich hedges in Devon, assuming an expenditure of £1 million per year over a 5 year period, would have a positive socio-economic impact on the local economy.

The research estimated that approximately 177 km of hedge could be restored for £1 million, assuming these funds cover 60% of the costs of hedge restoration work. Hedge laying was the main operation undertaken.

The analysis estimated that approximately 27 actual hedge contractor jobs (including part-time and casual jobs) would be created from implementation of the BAP species-hedge targets.

This assumes that 50% of the work would be absorbed by existing businesses before additional employees are recruited. An additional 5.6 actual jobs would be created for farm labour. The total income for contractors from implementation of the BAP hedge targets was estimated as £677,534.

It was estimated that the local expenditure by contractors and farmers on supplies, to implement the BAP hedge targets, such as tools, materials, machinery and fuel, amounted to £439,293. The contractor survey revealed that direct local linkages were strong as most contractors buy their supplies locally. Five actual jobs will be created in the supply industry due to an increase in demand for supplies.

The research showed that a large number of organisations in Devon provide training in traditional hedge management practices. A survey of these organisations suggests that around 300 people in Devon in 1998 were trained in hedging skills. Expenditure on training by contractors and farmers in order to implement the hedge BAP targets was estimated as £7,031, with 0.9 actual jobs created.

The research revealed that a number of hedge products were produced from the by-products of hedge restoration work. The potential value of these products produced from work undertaken to implement the hedge BAP targets could range from £4,050 for walking sticks to £25,313 for hurdles.

The research showed the extent to which hedge implementation will increase expenditure by visitors induced to visit Devon due to landscape enhancement. It was estimated that £28,000 of visitor expenditure would be generated, assuming 100 visitor groups were attracted to the county due to landscape enhancement from hedge restoration work. The FTE jobs directly supported by the 100 visitor group's expenditure in the local economy was estimated as 0.62 FTE job.

Using farm models, the research showed that the cost of managing and retaining species-rich hedges in Devon, are significantly greater than the benefits attached to such features. The annual on-farm benefits of well managed species rich hedges for typical Devon farms range from between £230 to £412 depending on the enterprises on the farm and the length of species-rich hedges present, whilst the annual on-farm costs for the same hedges range from between £1,305 to £1,661.

The final multiplier analysis identified that expenditure on hedge restoration work in Devon contributes both directly and indirectly to income generation within the local economy, producing an output of £2,176,266. The greatest income impact was on wages to contractors and farmers who implement the work. The spending of these wages in the local economy also has a significant induced impact, generating a further £222,663 of expenditure in the local economy. An overall expenditure multiplier of 1.3 was calculated for hedge restoration work in Devon in order to implement the BAP targets for species rich hedges. This compares favourably with multipliers calculated for other land-based industries. The South West Economic Research Centre at the University of Plymouth suggests that the output multiplier for the agricultural industry in Devon and Cornwall is 1.272, taking into account both indirect and induced impacts. Table 1 shows that there was a strong linkage between expenditure on hedge restoration and contractors and local suppliers, and that other linkages were weak.

Table 1 Potential income impact on Devon economy from £1 million expenditure on hedge restoration

	Potential direct impact (£)	Potential indirect impact (£) *	Potential induced impact ** (£)	Total (£)
Hedge restoration	1113315	0	222663	1335978
Supplies	439293	131788	114216	685297
Training	7031	879	1582	9492
Tourism	28000	8400	7280	43680
Hedge products	73000	11849	16970	101819
Total	1,660,639	152,916	362,711	2,176,266

* Assumes supply chain coefficient of 0.3 for local suppliers and tourism, assuming one third of second round spending on supplies occurs within Devon
** Assumes induced coefficient of 0.2

The employment impact on the Devon economy of £1 million expenditure on hedge restoration work amounts to 27 FTE jobs or 32 jobs once indirect and induced impacts were taken into account. From these figures it was possible to identify the employment multiplier for hedge restoration work in Devon as 1.2. A similar employment multiplier has been calculated for agriculture in Devon and Cornwall and forestry in Scotland.

Table 2 shows that the direct links between hedge restoration work and employment for hedge contractors was strong, as most of the jobs will go to local contractors, who work within a small radius. The indirect links were weaker as, unlike forestry and agriculture, which support significant timber and food processing industries, there was minimal processing of hedge by-products.

Table 2 Potential employment impact on Devon economy from £1 million expenditure on hedge restoration

	Direct FTE jobs	Indirect FTE jobs *	Induced jobs **	Total FTE jobs
Hedge restoration	19.4	0	3.55	22.9
Supplies	4.4	1.2	0.56	6.2
Training	0.7	0.01	0.07	0.8
Tourism	0.6	0.08	0.07	0.8
Hedge products	1.5	0.12	0.16	1.7
Total	26.6	1.41	4.40	32.4

*Assumes 1 FTE job created for every £100,000 expenditure on second round supplies and service
** Assumes induced employment coefficient of 0.1

The analysis assumed that £1 million expenditure on hedge restoration covers 60% of the costs and the rest is met by the farmers. Table 3 shows the impact on the Devon economy if the £1 million expenditure covers either 100% or 40% of the costs. The distribution of labour between contractors and farm labour remains the same for each scenario, although in reality if

only 40% of the hedge restoration is grant-aided it is likely that more work will be undertaken by farm labour.

Table 3 Total income and employment impact on Devon economy under different funding scenarios

% of hedge restoration work funded	100%	60%	40%
Total hedge length restored for £1 million	106	177	266
Hedge restoration labour			
Total output from contractor work	580,743	813,040	929,189
Total output from farm labour work	373,527	522,938	597,643
Total no. of jobs created from contracting	11.6	19.3	28.9
Total no. jobs created from farm labour work	2.2	3.6	5.4
Local supplies			
Total output from expenditure on local supplies	411,178	685,297	1,027,945
Total no. of local jobs created from expenditure on local supplies	3.7	6.2	9.2
Training			
Total output from expenditure on training	5,695	9,492	14,465
Total no. of local jobs created from expenditure on training	0.5	0.8	1.2
Hedge products			
Total output from producing hedge products	61,092	101,819	152,729
Total no. of local jobs created from producing hedge products	1.0	1.7	2.6
Total output into Devon economy	1,475,915	2,176,266	2,765,650
Total no. of FTE jobs created in Devon	19.7	32.4	48.2
Direct expenditure by farmers/landowners	0	605,232	1,123,205

Conclusions

The research concluded that implementing the BAP targets for species-rich hedges in Devon, assuming an expenditure of £1 million per year over a 5 year period, will have a positive socio-economic impact on the local economy. It demonstrated that any expenditure on hedge restoration can generate additional spending by farmers and contractors in the local economy over and above the money provided by a capital grant, multiplying the impact of the grant payments. In fact local linkages were strong as most hedge contractors and farmers purchase their supplies locally.

Expenditure on hedge restoration work also results in high direct employment impacts. The research has shown that expenditure on hedge restoration can both generate and maintain employment on the farm and for contractor businesses. The labour-intensive nature of this work seems to offer potential for enhancing economic activity in the county. Any grant scheme providing funds for hedge restoration can generate and maintain employment in the local economy and provide the confidence for the establishment of new small businesses supplying contractor services. While the direct employment impacts of hedge restoration in the local economy were high, the indirect employment impacts were minimal.

The objective of the Biodiversity Action Plans is to promote sustainable management of wildlife and natural landscapes and thereby improve wildlife diversity. Wildlife can give added value to much of the county's economy and wealth creation. This research revealed that the implementation of BAP targets can have socio-economic benefits to the local economy in terms of wealth and employment creation. Implementation of other Habitat BAPs in Devon, such as the Oak Woodland, Alder/Willow Wet Woodlands and Parkland and Wood Pasture BAPS, could also result in significant socio-economic benefits to the Devon economy,

Hedge restoration will make a significant contribution to the local economy in terms of both income and employment opportunities. The mechanism for delivering these funds are already available in the form of agri-environment schemes. However, comments from a number of hedge contractors interviewed suggest that farmers were often deterred from applying for these grants because they were too cumbersome and complex for their needs, particularly if they just wish to restore a few hedges. Most schemes require a whole farm plan involving a number of features on the farm. A number of contractors lamented the demise of the County Council grants to hedges, which were directed specifically at hedges and were favoured by farmers.

The research has shown that approximately 180 km of hedge can be restored for £1 million expenditure, assuming these funds cover 60% of the costs of hedge restoration work. The BAP target for species rich hedges in Devon is to achieve the favourable management of 50% (c. 19,000 km) of species-rich and ancient hedges by the year 2005. It was estimated that the total UK public expenditure in the year 2000 will have to be about £4.2 M if the targets are to be met and that approximately £1 million of this expenditure should be directed to the Devon to meet the county targets. However, the research suggested that these estimates of expenditure required to meet BAP targets are unrealistic. An expenditure of £5 million over five years would achieve the favourable management of 5% (c. 900 km) of species-rich and ancient hedges in Devon by the year 2005 and not the 50% proposed in the BAP targets.

Recommendations

A key assumption in this research was that Devon contains 20% of the country's species-rich, although no data was available to quantify the condition of the county's hedges. Further research should be directed at quantifying the current condition of hedges.

The research findings indicated that visitors value the presence of hedges in the landscape, suggesting that substantial economic benefits can be derived from positive management of these features. However, it was difficult within the scope of this study to estimate the exact economic benefit of these features. It was, therefore, recommended that a valuation survey is undertaken.

The analysis identified a significant potential value for hedge products provided there was a market for these goods. The economic benefit from these products was important for the local economy and it was, therefore, recommended that a marketing study for hedge products is conducted to identify the demand for such products.

The analysis makes a number of assumptions and it may be useful to examine the sensitivity of these results by varying the main assumptions and identifying the percentage change.

The use of primary data obtained from a telephone survey proved invaluable in identifying the key factors involved in implementing the hedge BAP targets in Devon. It was recommended that any further studies looking at the socio-economic impacts of implementing BAP targets also incorporate some primary research.

1. Introduction

1.1 Background

1.1.1 In 1994, the UK government published "Biodiversity: the UK Action Plan", which identified principles and guidelines for conserving and enhancing plants, animals and habitats within the UK. The Action Plan was closely followed by the Steering Group's Report (1995), which outlined in more detail how action might be undertaken and for the first time published costed habitat and species action plans for key habitats and species to achieve 10-15 year objectives and targets. English Nature and other organisations from across all sectors are committed to achieving the Plan's nature conservation goals over the next 20 years and beyond. One of the costed Habitat Action Plans within the UK Biodiversity Action Plan is for ancient and/or species-rich hedges (UK Steering Group, 1995), with the following targets:

- halt the net loss of species-rich hedgerows through neglect or removal by the year 2000, and all loss of hedgerows which are both ancient and species-rich by 2005;
- achieve the favourable management of 25% (c. 47,500 km) of species-rich and ancient hedges by the year 2000, and of 50% (c. 95,000 km) by 2005; and
- maintain overall numbers of hedgerow trees within each county or district at least at current levels, through ensuring a balanced age structure.

1.1.2 The additional cost of achieving these UK BAP targets on a country-wide level was estimated in 1995 to be £1.7M pa in the year 2000, rising to £3.0M pa by 2010 (Steering Group Report, 1995). It is assumed that most of this extra expenditure will come from public sources. Current public expenditure on hedges is about £2.5M pa, so the total UK public expenditure in the year 2000 will have to be about £4.2 M if the targets are to be met (EN project brief, 1999),

1.1.3 According to the Devon's Hedges guide produced by Devon County Council and Devon Hedge Group (1997) the county's hedges have escaped some of the more extreme forms of landscape changes experienced in other parts of lowland Britain. Consequently the county now retains about 20% of species rich hedges in the country (Devon Biodiversity Partnership, 1998). For the purposes of this research, therefore, it is assumed that at least 20% of the £4.2M required to meet the targets should be directed to the county, that is some £840,000 per year. In fact, since Devon hedges are set upon banks, which are costly to maintain, Devon may expect to receive an even greater proportion of the money. Approximately £1 million a year is estimated to be the required expenditure.

1.1.4 The wildlife benefits of introducing the management practices required to meet the targets for species rich hedges are well documented (Barr *et al*, 1995). Other environmental benefits such as carbon sequestration are also well researched (Falloon *et al*, 1998). What is less well known are the potential socio-economic impacts of achieving these targets. English Nature believe that the socio-economic benefits may prove a powerful argument for further agri-environment monies being made available for hedge conservation.

1.2 Aims and objectives

1.2.1 In light of the above, the overall aim of this research is to estimate the socio-economic impacts to the Devon economy of reaching the targets of the UK Biodiversity Action Plan for species-rich hedges, based on the assumption that this requires expenditure of £1 million per year within the county over the period 2000 to 2005.

1.2.2 A secondary aim of this research is to develop a methodology that can be used to estimate the socio-economic impacts to the local economy of implementing further Biodiversity Action Plan targets.

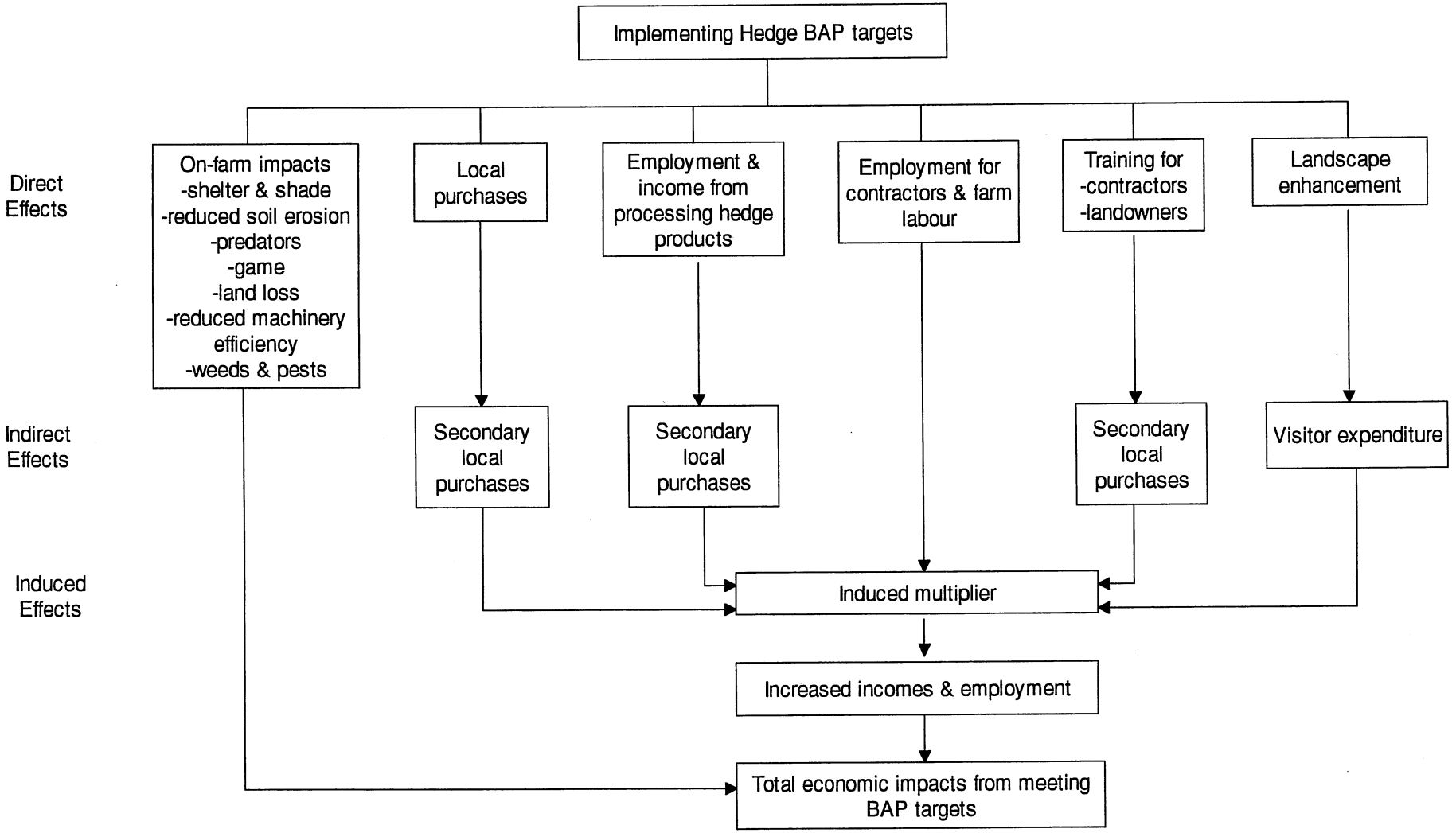
1.2.3 The objectives of this study are to identify:

- the employment and wages of hedge maintenance and restoration labour, and associated training staff;
- local purchases of goods and services relating to hedge management and restoration, as required to meet BAP targets;
- supply of goods and services to local communities (e.g. firewood, hurdles etc.);
- expenditure by visitors and tourists induced to visit Devon as a result of hedge BAP implementation; and
- multiplier effects associated with landowner, contractor, supplier and visitor expenditures.

1.2.4 Figure 1.1 summarises the main socio-economic elements that will be assessed in relation to the implementation of the Hedge BAP targets. It identifies both the direct and indirect impacts that were examined in order to identify the total socio-economic impacts from meeting the BAP targets.

1.3 Report structure

1.3.1 Chapter 2 describes the research methodology and provides details of the sample and characteristics of the telephone survey. Chapter 3 describes the characteristics of hedges in Devon and identifies current expenditure on hedge restoration work in the county. In Chapters 4 and 5 the socio-economic impact of £1 million expenditure per year on hedge restoration work in Devon is estimated. Chapter 6 identified the on-farm benefits and costs of hedge restoration. Finally, in Chapter 7 the conclusions and recommendations of the research project are presented.



This figure presents only those impacts analysed in the research

Figure 1.1 Socio-economic impacts of implementing the BAP targets for species rich hedges in Devon

2. Research methodology

2.1 Introduction

2.1.1 In accordance with the terms of reference, the methodology used in this research has been developed from previous studies. The flow diagram presented in Figure 2.1 provides an illustration of all stages of the research work. Following a literature review, a sample of hedge contractors were interviewed over the telephone using a structured questionnaire. Additional information on funding, training, tourism and agricultural suppliers was derived from semi-structured interviews with key informants. This information was fed into a spreadsheet and multipliers applied to obtain the total socio-economic impacts of implementing £1 million of hedge restoration and management work in Devon

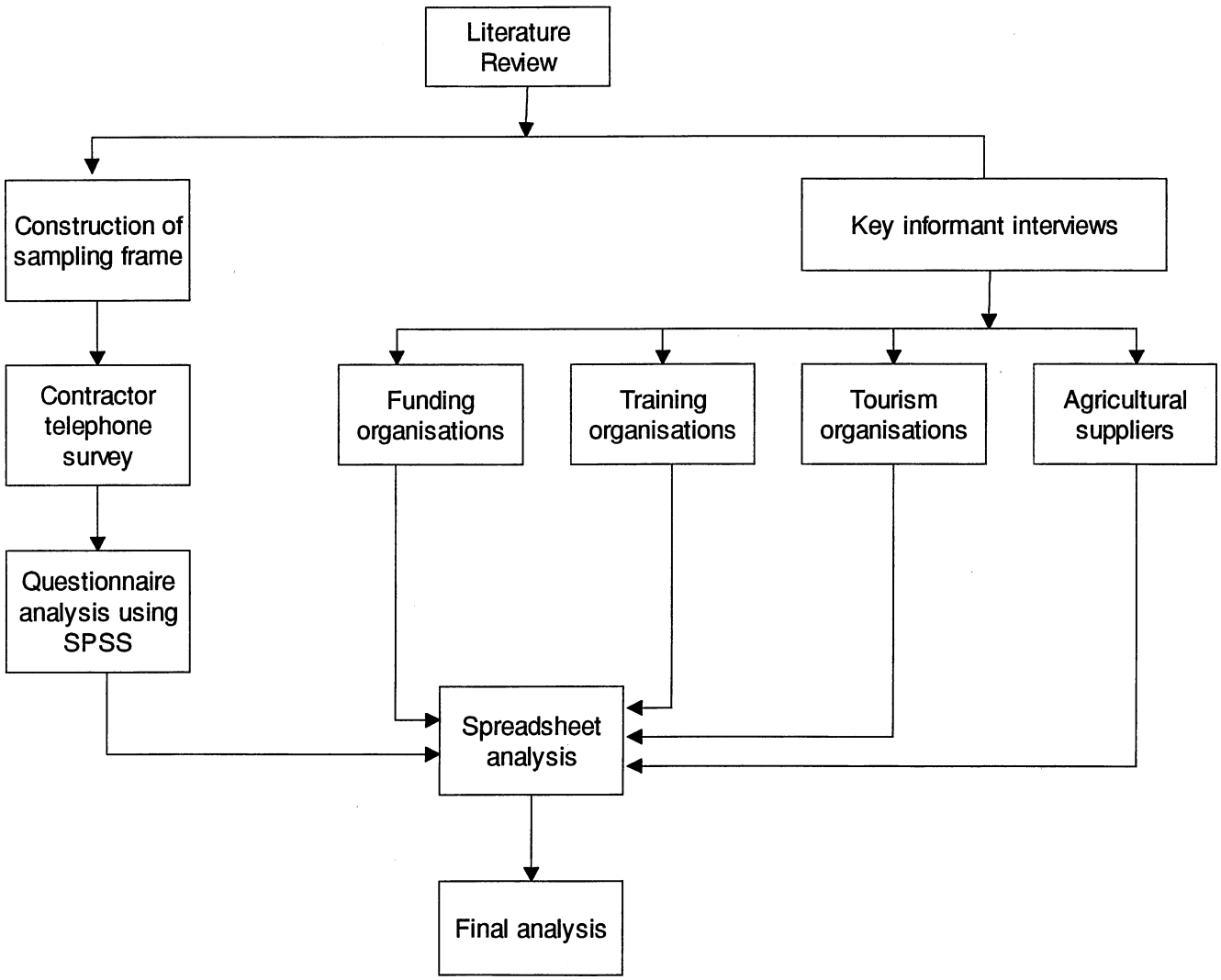


Figure 2.1 Summary of research methodology used in study

2.2 Literature review

2.2.1 A literature review was conducted to identify the impact of expenditure on hedge restoration and management work on the local economy. Data was also extracted from a number of secondary sources to obtain information on:

- existing capacity for employment in hedge restoration/maintenance;
- existing capacity for training in hedge restoration/maintenance;
- visitor numbers and tourist expenditure;
- influence of landscape on visitor enjoyment; and
- existing businesses processing hedge-cutting products.

2.3 Hedge contractor telephone survey

2.3.1 The study drew on a telephone survey of hedge contractors throughout Devon. A structured questionnaire was used to obtain the following information:

- fees charged by contractors;
- length of time taken to complete a task;
- extent to which contracting business has increased as result of hedges work in agri-environment schemes;
- number of employees;
- extent to which demand for work would increase before further recruitment;
- local purchases for hedgerow work; and
- products and any associated income from hedge work.

2.3.2 The telephone interviews were conducted in the evenings and took on average 15 minutes to complete. A copy of the questionnaire is provided in Appendix 1.

2.3.3 As a directory of hedge contractors was at the time unavailable in Devon, a list of contractors was drawn up from a variety of sources, including the Devon Hedge Group, 'Green Pages', Devon Rural Skills Trust, Exmoor National Park and South Hams Woodland Campaign. The sample was selected with a view to interviewing contractors undertaking hedge laying, rather than solely hedge trimming, as part of their hedge work. Each contractor was categorised according to the area of Devon in which their business was based. These records were entered into a database, which was used to construct a sampling frame for the survey. The database contained 40 names, addresses and telephone numbers of contractors. The sampling frame was stratified to identify whether there were differences in hedge activity between:

- designated areas where there are a concentration of funds for hedge management work, such as Environmentally Sensitive Areas in Dartmoor, Exmoor and Blackdown Hills and Objective 5b projects, such as the Lower Tamar Valley; and

- the wider countryside outside of designated areas where the Countryside Stewardship scheme offers hedge management grants.

Table 2.1 Location of hedge contractors who responded to the survey by area

Area	No. of respondents	Environmentally designated area	Wider countryside
North Devon	5	3	2
Mid Devon	2	0	2
Torridge	3	0	3
West Devon	7	7	0
Teignbridge	8	5	3
South Hams	5	1	4
Total	30	16	14

2.3.4 A 100% response rate was achieved for the telephone survey. Out of a sample of 40 hedge contractors, six were no longer working as hedge contractors or were retired, and four others were unavailable for reasons such as 'no longer lives at the address' or 'wrong telephone number'. Of the remaining 30 currently active contractors, none refused to participated in the survey. The main reason for the high response rate is that the contractors recognised that the research could be of benefit to their businesses. Table 2.1 provides a breakdown of the sample of hedge contractors interviewed by area.

2.4 Characteristics of the sample

2.4.1 In order to fully assess the impact of grants on hedge contractors' businesses, it was important to consider the characteristics of the sample of contractors surveyed.

2.4.2 Twenty-five out of the thirty respondents (83%) were full-time contractors. The remaining 5 were either part-time farmers, teachers or semi-retired. However, only 8% of the contractors interviewed concentrated solely on hedge work as part of their contracting businesses. This is not surprising as hedge work is seasonal, taking place during the winter months. Other contractor activities involved agricultural work, building construction, dry-stone walling, forestry and garden services. On average hedge work contributed to 45% of total contracting work carried out by each contractor.

2.4.3 The sample was biased towards contractors undertaking hedge restoration work. Therefore, only 7 out of the 30 contractors interviewed solely concentrated on hedge trimming. The remaining 23 undertook either hedge laying, bank restoration or coppicing as part of their hedge work.

Table 2.2 Hedge operation undertaken by contractors surveyed

Operation	No of contractors
Trimming	9
Laying	19
Coppicing	7
Planting	4
Bank restoration	20
Protective fencing	10
Total	69
Sample size (N).	30

Note: some contractors performed more than one operation

2.5 Key informant interviews

2.5.1 In addition to the telephone interviews with hedge contractors, the various organisation listed below were contacted by telephone to obtain more specific information to feed into the spreadsheet analysis:

- Funding organisations for information on present expenditure in Devon on environmental grants for hedge work, including the Ministry of Agriculture Fisheries and Food, the Devon County Council, particularly in relation to EU funded projects and National Parks.

- Organisations offering training, including Devon Rural Skills Trust, British Trust for Conservation Volunteers (BTCV), National Trust, Bicton College of Agriculture to obtain information on who is providing training in hedging skills in Devon, how many people attend the courses and evidence of any increase in the demand for training due to environmental grants.

- Organisations dealing with tourism in Devon, including the West Country Regional Tourist Board, Devon County Council and the Devonshire Heartland Tourism Association to obtain information on the importance of hedges in the landscape in attracting visitors.

- Suppliers of materials, tools and machinery for hedge work in Devon, to identify whether demand for supplies has increased as a result agri-environment schemes.

2.6 Spreadsheet analysis

2.6.1 A simple spreadsheet model was developed in Excel, comprised of the main socio-economic impacts of hedge restoration work. The aim of the analysis was to estimate the *additional* income and employment impacts to the local economy arising from an injection of £1 million per year for 5 years for hedge restoration to meet the BAP targets for species-rich hedges. This analysis also included an assessment of the multiplier effects to the Devon economy.

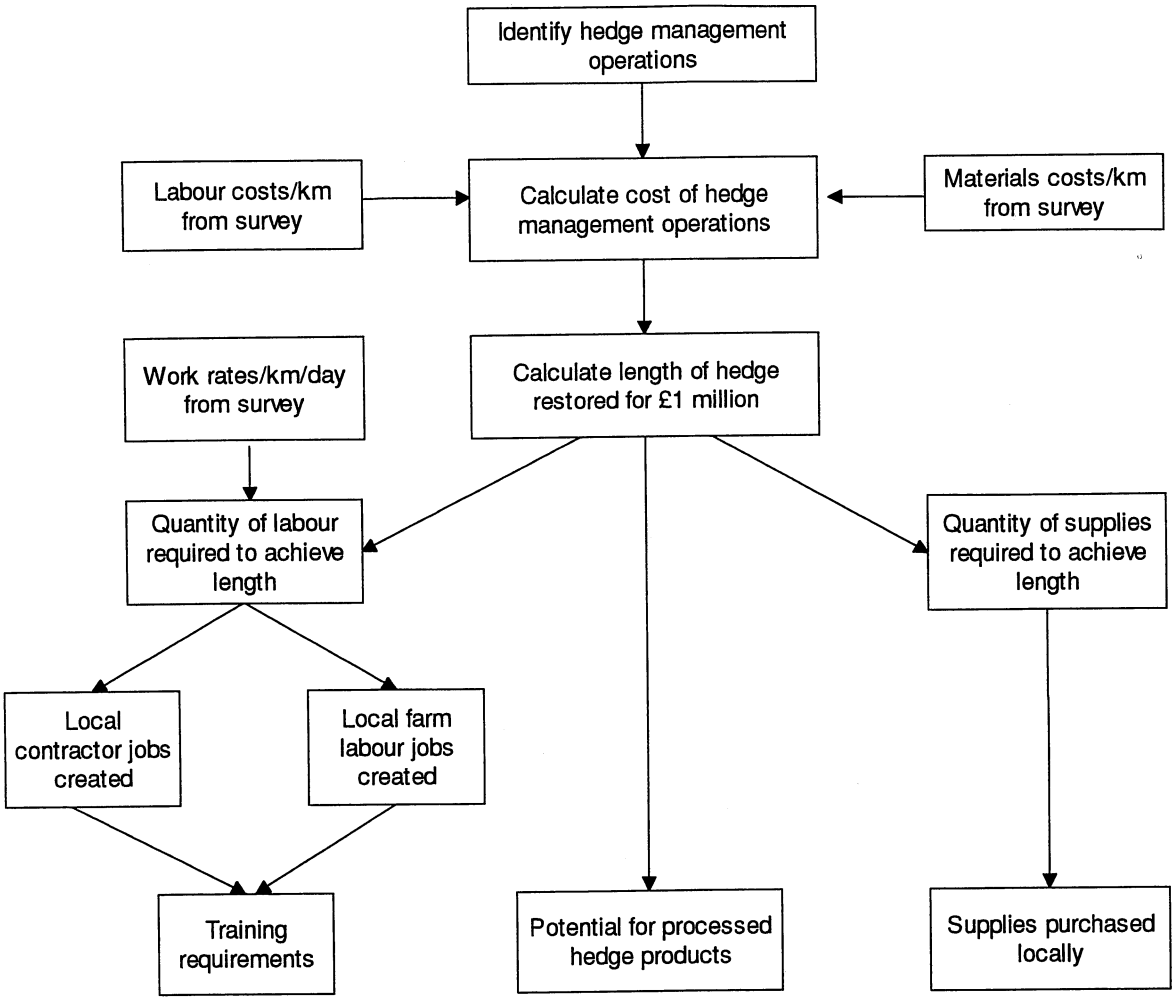


Figure 2.2 Approach to identifying direct effect of hedge restoration work

2.6.2 Figure 2.2 shows the approach taken in identifying he direct effects of hedge restoration work. Firstly, the main hedge management practices in Devon and the proportion in which they are practised were identified. Then the cost of the hedge management practices were identified based on information from the hedge contractors survey. Having identified the cost of hedge management per km it was possible to identify the length of hedge management that could be achieved for £1 million. Based on work rates for each task obtained from the survey it was possible to estimate how much labour would be required to complete length of hedge management for £1 million. This labour was then apportioned between tasks undertaken by contractors and those undertaken by farm labour. Having identified the number of additional jobs created it was possible to estimate the likely demand for training in hedge restoration skills. Knowing the length of hedge restored for £1 million is was also possible to calculate the quantity of materials and tools supplies required and to calculate the potential market value of by-products of the hedge management work, such as firewood, hurdles, walking sticks, thatching spars. This was based on information on the quantity and value of products derived from the survey of hedge contractors.

Having identified the direct effects of expenditure on hedge restoration work, a multiplier analysis was then conducted.

2.7 Multiplier analysis

2.7.1 Multiplier analysis is an economic technique that can be used to examine the overall impact of a specific expenditure in an economic system. In the context of the present study, such expenditure is grant aid for hedge restoration work. Economic theory suggests that the injection of this expenditure in the local economy will stimulate an increase in the level of economic activity that, in turn, will generate additional income and employment in the area.

2.7.2 In estimating the impact of projects on local employment and incomes, it has been traditional to use one of three methods: local Keynesian multipliers, local input-output analysis, or full-blown local econometric modelling procedures (Armstrong and Taylor, 1993). Resource constraints meant that input-output analysis or econometric modelling was not within the scope of the research, so the indirect and induced impacts of employment and expenditure were measured using existing local multiplier coefficients extracted from regional studies. According to Armstrong *et al* (1997) the overwhelming number of previous studies have employed variants of the Keynesian open-economy multipliers specifically adapted for use at a local level. These multipliers measure the marginal propensity to consume locally produced goods.

2.7.3 It was also recognised that not all expenditure on hedges will fully benefit the Devon economy. Some will 'leak' from the county as a proportion of spending will go on goods and services purchased outside the area, such as contractors and machinery, whilst further sums will be lost as taxation and exports. Every attempt was made to ensure that these leakages were accounted for at each level of assessment of the six impacts outlined in Figure 1.1.

3. Hedges in Devon

3.1 Introduction

3.1.1 The term "hedge" in Devon refers not only to lines of woody shrubs which almost always occurs on top of an earth or stone faced bank, but also to banks without, or with only sparse, woody shrubs on top, which are often found in exposed areas of Dartmoor and Exmoor (DETR, 1998). The Devon Biodiversity Action Plan (1998) defines a species rich hedge as:

- on average having 5 or more native woody species in a 30 m length, OR
- supporting, in whole or in part, the life cycle of one or more of the following key species: dormouse (*Muscardinus avellanarius*), greater horseshoe bat (*Rhinolophus ferrumequinum*), cirl bunting (*Emberiza cirlus*), small eggar moth (*Eriogaster lanestris L.*), Devon carpet moth (*Lampropteryx otregiata*), brown hairstreak butterfly (*Thecla betulae*), Plymouth pear (*Pyrus cordata Desv.*), Devon whitebeam (*Sorbus devonienis*), wild service tree (*Sorbus torminalis*), small-leaved lime (*Tilia cordata*), purple ramping fumitory (*Fumaria purpurea*), balm-leaved figwort (*Scrophularia scorodonia*), bastard balm (*Melittis melissophyllum*) or hay-scented fern (*Dryopteris aemula*), OR
- containing any species included within Section 6(3) of Schedule 1 of the Hedgerow Regulations 1997 effectively specially-protected birds, mammals and plants and Red Data Book insects, other invertebrates and vascular plants (see Appendix 3) OR
- having at least six herbaceous (non-woody) flowering plants or ferns which are typical of woodland.

3.1.2 According to the Devon BAP (1998) there are some 53,000 km of hedge in the county. It is estimated that perhaps 75 % of these hedges are species-rich, as defined above, suggesting that there may be at least 40,000 km of species-rich hedge in the county (Devon BAP, 1998). If each hedge is on average 2.5m wide, then it is estimated that they occupy approximately 10,000 ha or 1.5 % of the county area.

3.1.3 Although no data is available to quantify the condition of hedges in Devon, they are known to be declining both through outright hedge removal and through neglect or mis-management (Devon BAP, 1998). The traditional forms of hedge maintenance based on regular steeping (hedge laying), 'casting up' (repair of the bank) and hand trimming have declined due to high costs involved, particularly during the present economic crisis in agriculture. Despite the practicality and efficiency of the flail for regular hedge trimming, to maintain the hedge in the long term it must eventually be steeped and cast up (Devon County Council, 1997). Making grant aid available to farmers assists them in paying for this work and meeting the Biodiversity Action Plan target for achieving favourable management. The Devon BAP (1998) defines 'favourable management' as that which will keep a hedge stock-proof in the long term, while allowing wildlife to thrive.

3.2 Existing expenditure on hedge restoration/management

3.2.1 In Devon, grants are available for hedge management under various agri-environment schemes.

Environmentally Sensitive Areas (ESAs)

3.2.2 Some of the most widely available grants for hedge management and restoration are provided through the ESA schemes on Dartmoor, Exmoor and Blackdown Hills. All farmers within an ESA are offered the chance to join the scheme. The scheme has a ten year duration with an option of termination after 5 years. A farmer receives annual payments on each hectare of land entered into the scheme. Each ESA has one or more tiers of entry and each tier prescribes specific agricultural practices to be followed. For example, in the Blackdown Hills ESA in Tier 1A land, agreement holders are expected to keep hedges stockproof. For a supplementary payment, hedges must be managed traditionally allowing hedges to grow up (i.e. no top trimming), regular side trimming and laying at the appropriate time in the management cycle.

Countryside Stewardship Scheme (CSS)

3.2.3 Since 1991, another important source of funding for hedge restoration work in Devon has been the Countryside Stewardship scheme which is based on a whole farm plan over a ten-year period. Payments are made for laying, coppicing, hedge planting and protective fencing. Special projects for 'casting up' are also made available in certain cases. Hedge management and restoration is a key objective in several of the CSS target areas in Devon. In the East Devon and South Devon AONB target areas, hedge management is recognised as important for extending the range of the rare cirl bunting. In the North Devon Coast target area, restoration and management of hedges over the whole holding is encouraged, particularly in the more open landscape of the coastal strip. The Tamar Valley is considered important for its hedgerows, and restoration of hedges over a whole holding is a key objective. **In 1999 CSS grants were allocated for**

Dartmoor National Park

3.2.4 Dartmoor National Park offers grants for 'special' hedge renovation work. Grants vary according to the work required and the budget available. The current annual budget is £1,500 and this limited amount means that grants are targeted where substantial public benefit is derived.

Exmoor National Park

3.2.5 Exmoor National Park offers grants for land outside of the ESA. The budget for conservation work is £30,000 per year of which approximately a quarter is spent on traditional hedge management.

Objective 5b projects

3.2.6 Two Devon County Council projects are part funded under the South West Objective 5b Programme which contain an element of hedge restoration. These are the Okehampton-Polson Bridge, which is now completed and the Lower Tamar Valley Schemes, which is in its second phase. Both schemes offered grant aid for land management works, which included hedgerow and bank works, such as hedge laying, new hedge planting, earth bank and stone bank restoration. The Okehampton – Polston Bridge scheme covered 9 parishes between Okehampton and the Cornish border in the vicinity of Launceston. There were 2 phases, and a total of 42 projects were undertaken involving hedge work, totalling 27.5 km. Phase 1 of the Lower Tamar Valley scheme covered parishes between Plymouth and Lifton on the Devon side of the Tamar. The South Devon AONB Land Management grant scheme is another Objective 5b project. It is aimed at farmers and landowners in 25 South Hams parishes. One-off payments are made to help with capital grants for a range of projects including hedge planting and management. The scheme runs until March 2001 and is funded by South Hams District Council and EAGGF. It is administered by the South Hams Coast and Countryside Service.

3.2.7 Table 3.1 summarises the current expenditure on hedges in Devon. Excluding ESA payments, which were unobtainable from MAFF, the total amount of public funding committed to hedge restoration work in Devon in 1998 amounted to £540,000.

Table 3.1 Total public expenditure on hedges in Devon (1998)

Operation	**Expenditure (£)**
ESAs	(figures unavailable)
Countryside Stewardship *	365,770
Objective 5b projects:	
Okehampton to Polson Bridge Scheme (total over 3 Years)	104,000
Lower Tamar Valley Scheme (total over 2 years)	63,900
Council grants:	
South Devon Land Management Grant Scheme	4,849
Dartmoor National Park	1,500
Exmoor National Park (Devon only)	2,500
TOTAL	542,519

* 1999 figures

4. Socio-economic analysis

4.1 Introduction

4.1.1 This section examines the direct, indirect and induced impacts of implementing the BAP target for species-rich hedges in Devon based on an annual expenditure of £1 million per year from 2000 to 2005.

4.1.2 In conducting this analysis two key assumptions have been made and are stated below:

- The £1 million of public expenditure will meet the 60% of the costs of hedge restoration. This assumption is based on the average current level of funding of actual costs for work under agri-environment. For example, under ESAs grants between 30% and 80% of actual costs are available to assist in funding capital works, whilst for CSS the percentage of actual costs funded is higher. (Results of the £1 million public expenditure meeting 100% and 40% of the costs of hedge restoration are presented in Table 5.3)

- It is assumed that no funds will be provided for hedge trimming. Its inclusion in the analysis would significantly reduce the total length of hedge that could be restored for £1million.

4.2 Hedge restoration: Determination of what £1 million will buy

4.2.1 In order to estimate the socio-economic impacts of spending an additional £1 million per year on hedge restoration to meet hedge BAP targets, it is first necessary to estimate how much can be achieved for £1 million.

4.2.2 The main practices considered for achieving "favourable management" of hedges in order to meet the biodiversity action plan targets for species rich hedges are: hedge laying, coppicing, planting, bank restoration and protective fencing. Each of these operations have different costs and labour and material inputs and this will affect the employment and income impacts on contractors, farmers, local suppliers, trainers and processors of hedge products. Thus, it is important to clearly describe each operation in detail.

Hedge laying

4.2.3 Hedge laying (or steeping as it is referred to locally in Devon), is a method of converting a gappy or over-grown hedge into a stock-proof barrier by partially cutting through the base of the hedge shrubs (or 'steepers'), bending them over until they are parallel to the top of the bank, and pegging them down with crooks. These steepers remain alive and sprout new growth which, with appropriate management, will thicken and form a new hedge. Ideally a hedge should be laid when it is between 8-10 years of age. Charges for hedge laying will vary depending on the condition of the hedge. The survey of contractors revealed that an average charge for hedge laying is £6.50/m, including a machinery operating costs of about £0.15/m for chainsaw fuel and repairs. This does not including raking up and burning of the cut material, work which is

generally left to the farmer. The contractor survey also suggested that on average 15 m of hedge can be laid per person per day.

Coppicing

4.2.4 If a hedge has become too large and gappy to be laid then it may be coppiced, a technique which involves cutting each shrub back to the base and allowing it to regrow. By coppicing, leggy old hedges can be rejuvenated and made thicker and young hedgerows can be encouraged to bush out and become thicker. This is better for both wildlife and stock shelter. Stems are cut off within 10 centimetres of ground level on young stems or just above old coppice stools. There then follows a long rotation (depending on species) with light topping and shaving annually to encourage bushing out (Wilson, 1979). The survey of contractors revealed that an average charge for coppicing a hedge is £4.00/m. This includes machinery operating costs of £0.30/m for chainsaw fuel and repairs, but excludes clearing up the cut material. It is assumed that on average 25 m of hedge can be coppiced a day per person.

Planting

4.2.5 Some hedge restoration will require planting a length of hedge or "gapping up" where there are gaps in the hedge. A hedge is planted with locally common species found in other hedges in the area, with a mix of at least three other hedging species. Usually the hedge is planted in two staggered rows, each set approximately 30 cm apart, and at a density of four to eight whips planted every metre. To protect the plant from grazing a plastic guard is placed around the plant and a cane provided for support. In this analysis it is assumed that 6 whips are planted every metre. The survey identified an average labour cost for planting as £2/m. The materials have been costed at £1.50/m for trees, £1.62/m for guards and £0.30/m for canes. As guards will not be used if there is adequate stock-proof fencing, the analysis assumes that only half the trees planted are protected with guards. The survey of contractors revealed that on average 150 m of hedge can be planted per person per day.

Bank repairs and restoration

4.2.6 Devon hedges often consist of an earth bank faced with either turf or stone, on top of which hedge shrubs usually grow. The choice of the facing material depends upon the local availability of suitable quarry or field stones. Turf-faced hedges benefit from 'casting up', which involves transferring slumped material from the base of the bank to the top, so restoring the bank height and profile. Any hedgebank which is laid or coppiced is likely to require some 'casting up'. The contractor survey revealed that contractors charge between £1-3/m for casting up. For the purposes of this analysis an average charge of £2/m has been assumed.

4.2.7 Some earthbanks may require the filling in of significant gaps or sections of stone-faced hedgebanks may require re-building. A wheeled digger or swing shovel is often used for major restoration jobs on earthbanks, whilst work on small gaps, where access is difficult, is generally done by hand. Charges for restoration by hand are between £11-£20/m and an average charge of £13.50/m for bank restoration has been assumed. This includes machinery operating costs of £1.50/m for digger fuel and

repairs. The survey also revealed that on average 10 m of bank can be repaired a day per person.

Protective fencing

4.2.8 When restoring a hedge, stock-proof fencing is often required to prevent livestock grazing the tops of newly planted whips. The type of fencing used depends on the type of livestock damage anticipated. For cattle, a 3-wire and post fence is adequate, whilst sheep will require more costly netting. For the purposes of this analysis it is assumed that post and wire fencing will be used at a cost of £1.50/m for materials and machinery and £0.50/m for labour. It is assumed that 100 m of hedge can be fenced a day per person.

Hedge Trimming

4.2.9 Many farmers trim hedges annually, which can have a long-term detrimental effect on hedgerows (Semple *et al*, 1995). This is shown by a reduction in the vigour of a number of hedgerow species in mixed hedges and the mop-headed and gappy appearance of many others. A recognised management practice is a cut twice every 5 years, or alternate years. This will maintain and enhance the vigour of a hedge. Inevitably this will also reduce the demand for annual contractor services, but also save farmers money as identified by Semple *et al* (1995). A number (4 out of 7) of contractors contacted, who only trim hedges as part of their contract business, felt that the demand for hedge cutting had not increased as a result of the availability of environmental grants. If anything, one contractor felt that the grants had actually reduced the demand for his services as hedges were cut less frequently. It could be argued that this decline is compensated by more hedges being brought into management. As hedge trimming is an activity already undertaken by many farmers and landowners, this operation has been excluded from the analysis.

4.2.10 Table 4.1 identifies the total direct expenditure on each hedge management operation, using £1 million per year in order to achieve favourable management of species-rich hedges.

4.2.11 Based on an examination of the allocation of Countryside Stewardship funds for different hedge tasks in Devon and data from the hedge contractor survey it was possible to identify the tasks most likely to predominate when restoring Devon hedges. These sources of information revealed for example, that the main hedge restoration operation in Devon is hedge laying. Using the average costs for each operation, identified above, it was then possible to estimate the length of each operation that could be achieved for £1 million. For example, taking into account materials and operating costs, 90 km of hedge laying can be achieved

4.2.12 The analysis identified the total length of hedge that could be restored for £1 million as 177 km, 0.5% of the estimated total length of species rich hedges in Devon. This figures includes only the hedge length for hedge laying, coppicing and planting and excludes the bank repair and fencing as these operations will usually occur concurrently with the other tasks. Protective fencing has been included as 75% of the total hedge length restored, as not all restored hedges are fenced.

Table 4.1 Potential length of hedge restoration achievable for £1 million direct expenditure on hedge restoration

	Actual avg. costs (£/m)	Grant-aided costs (£/m)	Total km	Total (£)
Labour				
Hedge laying	6.50	3.90	90	342,900
Coppicing	4.00	2.40	45	99900
Planting	2.00	1.20	42	50400
Casting up	2.00	1.20	55	66000
Bank repair	13.50	8.10	20	162000
Protective fencing [1]	0.50	0.30	133	39825
Sub total – labour				761025
Materials				
Planting – Plants	1.50	0.9	42	37800
Planting – Guards	1.62	0.97	42	40824
Planting – Canes	0.30	0.18	42	7560
Fencing - 3 wire	1.50	0.9	133	119475
Sub total – materials				205659
TOTAL			177 [2]	1,000,884

[1]Fencing for 75% of total hedge length restored.
[2]Total length includes hedge laying, coppicing and planting.

4.3 Employment and income impacts

4.3.1 Work rates obtained from the hedge contractor survey enabled an estimate of the person days required to complete £1 million of hedge restoration work. These labour requirements were divided between contractors and farm labour. The proportion allocated to each was informed by the hedge contractor survey and evidence from the literature review on labour input into agri-environment schemes.

4.3.2 A number of socio-economic assessments of agri-environment schemes have identified an increase in the use of contractors for capital works, such as hedge restoration work, whilst the impact on farm labour requirements is less significant (CEAS, 1997; CEAS, 1996; ADAS, 1996; Devon County Council, 1997; Devon County Council, 1998). Table A2.1 and A2.2 in Appendix 2 identify the division of labour between farm labour and contractors for different schemes and for different hedge restoration tasks.

4.3.3 The proportion of work undertaken by either contractors or farm labour will vary depending on the hedge operation. The telephone survey revealed that few contractors (4 out of 30) undertook hedge planting, as this is a task usually undertaken by farm labour during the winter months. Whereas skilled tasks, such as hedge laying and bank repair, are undertaken by more contractors than farm labour. Table 4.2 indicates that contractors will do the majority of hedge laying, coppicing and bank repair and farmers will do most of the planting.

Table 4.2 Division of hedge restoration work between contractors and farm labour

Task	% contractor	km	Contractor total (£) *	% farm labour	km	Farm labour total (£) *
Laying	60%	54	294,840	40%	36	196,560
Coppicing	60%	27	90,720	40%	18	60480
Planting	10%	4	7,056	90%	38	63504
Casting up	60%	33	55,440	40%	22	36960
Bank repair	80%	16	201,600	20%	4	50400
Protective fencing	50%	66	27,878	50%	66	27878
TOTAL		85 **	677534		92 **	435,782

* includes 60% public funding and 40% payment by farmer/landowner
** Total length includes length of hedge laying, coppicing and planting.

4.4 Contractor employment

4.4.1 As Table 4.3 illustrates, the total direct employment impact for contractors of £1 million for hedge restoration work in Devon equates to approximately 32 full-time equivalent (FTE) jobs. Of these FTE jobs approximately a half will be additional jobs, as existing contractor businesses have the capacity to absorb some of the additional demand for their services before recruiting further employees. The hedge contractor survey found that over half of the contractors (11 out of 16), who would consider expanding their business, would only recruit an additional employee if the demand for their services increased by between 30-50%. Thus the analysis adjusted the FTE contractor jobs by 50%, resulting in 16 additional FTE jobs. A higher number of actual jobs will be created as most hedge restoration work is part-time and seasonal. The survey revealed that of those contractors who employed staff (73%), only 6 were full-time, compared to 18 part-time and casual workers. The University of Exeter (1998) estimated a ratio of 1 FTE per 1.3 actual jobs, based on a survey of the structure of farm employment in the South West. The hedge contractor survey suggested a higher ratio of 1.7 jobs per 1 FTE job as more hedge contracting jobs are part-time compared to farm labour jobs. Thus the analysis estimates that 27 actual jobs would be created directly as a result of £1 million expenditure on hedge restoration work in Devon.

Table 4.3 Employment impact for hedge contractors in Devon

Operation	km	km/ day/ person	Person days	FTE jobs *	Total FTE jobs (adjusted by 50%)	Actual jobs
Laying	54	0.015	3,600	15.5	7.8	13.2
Coppicing	27	0.02	1,350	5.8	2.9	4.9
Planting	4	0.15	28	0.1	0.06	0.1
Casting up	33	0.15	220	0.9	0.5	0.8
Bank repair	16	0.01	1,600	6.9	3.4	5.9
Protective fencing	66	0.1	664	2.9	1.4	2.4
Total			7,462	32.2	16.1	27.3

* 1 FTE jobs = to 232 days/year

4.4.2 Leakage of funds out of Devon will be minimal as the hedge contractor survey revealed that contractors work within a small radius of between 10 to 20 miles of their workplace. Contractors in neighbouring counties are unlikely to travel into Devon to undertake hedge restoration work.

4.4.3 As well as creating new jobs, the provision of funds for hedge work will also help to sustain existing contractors' jobs. The survey revealed that 80% of contractors undertook hedge work that was grant aided. The percentage of work granted aided varied from between 10% to 100%, with an average of 49%. A number of hedge contractors in the survey expressed concern that without grants for hedge work their businesses will severely suffer. Although, increasingly they were working for smallholders moving into the area, who had sufficient funds to contract out hedge work without needing to apply for grants.

4.4.4 Table 4.2 also shows that local hedge contracting businesses will receive an income of approximately £677,534 and farm labour an income of £435,782. It is assumed in this analysis that the funding for hedge work will cover 60% of the cost of contractors' services, farm labour and materials. This implies that there will be a negative impact on farm incomes, which must fund 40% of these costs.

4.5 Farm labour employment

4.5.1 Table 4.4 summaries the employment impact on farms and reveals that the main hedge restoration tasks undertaken by farm labour are, tree planting, fencing and hedge laying. The literature review indicated that the impact on farm labour of environmental grants is relatively small compared to increases in the demand for contractors. The socio-economic assessment of the Countryside Stewardship Scheme (CEAS & University of Reading, 1996) found that of the CSS work undertaken by farm labour, an average of 84% fitted into existing work timetables and 16% was classified as overtime. In this analysis it is assumed that farmers and landowners will employ part-time staff to undertake the hedge work, rather than pay existing farm workers overtime. Thus the analysis has assumed that only 16% of the additional hedge work on farms will create new jobs, the remainder will be met by the existing labour force. As many of these additional jobs will be part-time, a ratio of 1 FTE job per 1.7 actual job is assumed, equating to 5.6 actual jobs created.

4.5.2 The increased hedge work will also help to secure approximately 21 FTE jobs on farms. Most of the hedge work on farms is done during the winter months, which is usually a slack period in the farming calendar when demands on farm labour requirements are generally low.

Table 4.4 Employment impact for farm labour in Devon

Operation	km	km/ day/ person	Person days	FTE jobs *	Total FTE jobs (adjusted by 50%)	Actual jobs
Laying	36	0.015	2400	10.3	1.7	2.8
Coppicing	18	0.02	900	3.9	0.6	1.1
Planting	38	0.15	252	1.1	0.2	0.3
Casting up	22	0.15	147	0.6	0.1	0.2
Bank repair	4	0.01	400	1.7	0.3	0.5
Protective fencing	66	0.10	664	2.9	0.5	0.8
Total			4762	20.6	3.3	5.6

4.6 Local purchases

4.6.1 A number of studies have shown that agri-environment schemes result in an increase in the demand for local products and services. A business survey undertaken as part of the Tir Cymen socio-economic assessment found that 29 out of 35 local businesses involved in providing services to farmers in the scheme had seen an increase in the demand for their products or services. Such increases included the demand for timber and fencing materials, manufactured timber products such as gates, stiles and bird boxes (ADAS, 1996).

4.6.2 In addition to the direct creation of local employment and direct purchase of materials, hedge work will also produce employment multiplier impacts. New or increased employment will itself lead to increased purchasing of a range of goods and services in an area. Employment multiplier coefficients have been calculated at a regional level by a number of studies and are presented in Appendix 3.

4.6.3 Tables 4.5 and 4.6 identify the main materials, tools and machinery used for each hedge operation as revealed by the telephone survey of contractors. Both contractors and farmers use these inputs to implement hedge restoration work, although if a contractor is planting the farmer tends to supply the trees, guards and canes

4.6.4 Calculations for expenditure on tools and machinery purchases were based on the price per item and multiplied by the number of jobs created. New purchases for machinery and tools have been included for each new actual contractor job created (as identified in Table 4.3). One hedge contractor surveyed estimated that it cost about £900 for a new hedge layer to become fully equipped, so the figures in Table 4.5 may underestimate total expenditure for new equipment. No new machinery purchases were included for existing contractor and farm jobs as it is assumed that an increase in hedge work for existing contractor businesses and farms is unlikely to lead to increases in purchases of large machinery.

Table 4.5 Expenditure on equipment required to implement £1 million of hedge work

Input	Price/item	Actual jobs *	Expenditure on hedge inputs
Laying/coppicing			
Hand tools	125	18.1	2267
Chainsaw	300	18.1	5441
Protective clothing	300	18.1	5441
Bank restoration			
Wheeled digger	4500	5.9	26379
Total			39528

* see Total FTE jobs in Table 4.3

4.6.5 As Table 4.6 shows calculations for materials, such as trees and guards and machinery variable costs, such as fuel and repairs, were based on the cost of each item per km and multiplied by the length of hedge. Repairs for a chainsaw comprise a full service, including a replacement chain each season.

4.6.6 The total purchases for equipment, materials and machinery operating costs, as identified in Tables 4.5 and 4.6, assuming £1 million public expenditure, is £439,293. Sixty percent of the cost of materials (£239,859) are funded under the £1 million expenditure, the remaining costs for equipment, materials and machinery operating costs are met by the farmers or contractors. This means that just over 25% of the £1 million is spent on materials, whilst the remainder of this expenditure relates to labour. Similar proportions were used by ADAS (1997) when estimating the value of hedging for the Tir Cymen scheme.

Table 4.6 Expenditure on materials and machinery operating costs required to implement £1 million of hedge work

	km of hedge operation *	£/km **	Expenditure on hedge inputs
Laying			
Chainsaw repairs	90	50	4500
Chainsaw fuel & oil	90	100	9000
Coppicing			
Chainsaw repairs	45	100	4500
Chainsaw fuel & oil	45	200	9000
Planting			
Trees	42	1500	63000
Guards	42	1620	68040
Canes	42	300	12600
Bank restoration			
Digger repairs	20	500	10000
Digger fuel	20	1000	20000
Fencing	133	1500	199125
Total			399765

* see Table 4.1

** £/km assumes chainsaw used for all coppicing, but half hedge laying work

4.6.7 The survey revealed that local linkages are extremely strong as contractors tend to purchase all their inputs, including machinery locally. Only 2 out of 30 contractors interviewed purchased inputs outside of Devon. One bought a second-hand tractor from Hampshire and the other a chainsaw from a mail-order catalogue. This evidence is supported by the socio-economic assessment of CSS (CEAS & University of Reading, 1996) which also found that a high percentage of inputs were purchased within a small radius of farms. It was found that on all farms a greater proportion of machinery purchases and machinery repairs and fencing purchases, came from a distance of less than 15 km from the farm.

4.6.8 The socio-economic assessment of the CSS (CEAS & University of Reading, 1996) also found that relatively modest increases in machinery purchases and supplies like fencing materials have a surprisingly large positive impact on jobs in these sectors because they are relatively labour intensive. The same pattern is repeated in the indirect impact upon firms further upstream.

4.6.9 Having identified the total expenditure on purchases arising from £1 million expenditure on hedge restoration work, it is possible to estimate the volume of employment generated in businesses benefiting from such expenditure. The jobs generated per £1,000 of turnover in such businesses will vary depending on the nature of the business and its management. A National Trust study (1999) estimated that in the supply sector in the South West, one FTE job is created for every £100,000 turnover, reflecting the warehouse distribution function of many suppliers. On the basis of this assumption, it is estimated that 4.4 FTE jobs arise directly as a result of purchases by contractors and farmers for the hedge restoration work. A higher number of actual jobs will be supported, taking account of part-time working. The National Trust study used a ratio of 1 FTE per 1.14 actual job reflecting the numbers for the service sector as recorded in the National Census of Employment data. On this basis around 5 actual jobs are supported directly in the supply chain by spending £1 million on hedge restoration work. A summary of the direct employment impact in Devon arising from purchases of supplies is given in Table 4.7 below.

Table 4.7 Employment impacts from expenditure on supplies to implement BAP targets for species-rich hedges in Devon

Direct income	Direct FTE jobs *	Actual jobs **
439,293	4.4	5.0

* 1 FTE job per £100,000 turnover
** 1 FTE per 1.14 actual job

4.7 Training

4.7.1 There is evidence that hedgerow work through agri-environment schemes increases the demand for training (Gaskell & Curry, 1999). Some farmers in agri-environment schemes will undertake training courses in order to implement the work themselves and cut costs or to diversify into contracting businesses to meet the demand for hedge work generated by agri-environment schemes

4.7.2 Our research has revealed that there are a large number of organisations in Devon offering training in hedge restoration skills. These include colleges, national training organisations, small specialist training companies and individuals. When running courses they will often hire in a trainer from outside the organisation. Organisations contacted who are providing training in Devon are listed below:

Devon Rural Skills Trust

4.7.3 The Devon Rural Skills Trust run day courses, mainly at the weekends, for those interested in learning more about rural skills. Courses are also arranged for those keen to reach proficiency standards and attain a qualification in rural skills. Each course requires four participants to run and takes place between September and March. The Trust also run apprenticeship schemes with an average of 1-2 apprentices a year and a maximum capacity of 10. They have their own system of certification, building up to Master Craftsman.

BTCV

4.7.4 The BTCV runs an annual hedge laying weekend course with approximately 12 participants, including BTCV volunteers. BTCV also runs the Sustainable Careers scheme, an environmental training scheme for people living in South and West Devon funded by Leader II, providing vocational training, such as NVQs and practical environmental courses, including hedge laying and relevant work experience.

Silvanus Trust

4.7.5 The Silvanus Trust operates the Woodworks Project which assists in training and funding new employees in countryside skills who are between the age of 16 and 30 years. The Trust also operates the Tap Routes programme which helps individuals gain employment in woodland skills, including hedge laying, through vocational experience and training. This programme, supported through the European Social Fund, has helped over 80% of participants gain employment.

National Trust

4.7.6 The National Trust runs 2-3 training courses in hedge laying a year in Devon. These are 2 day courses led by a National Trust warden, with an average group size of 8 participants.

Lyner Training

4.7.7 This is a private training company offering training in land-based skills. It runs tailor-made courses and this season aims to undertake 15-20 courses in hedge laying with a maximum of 6 on each course.

Drake Training SW

4.7.8 This is a private training company offering training in land-based skills leading to NVQ or NPTC qualifications. Training in hedge management is offered on demand with a maximum of 4 in a group.

Dartmoor National Park

4.7.9 Under the Moor Care Project the National Park organises two 1 day courses in traditional hedge management practices for up to 12 people. The tuition is free and the courses have proved popular.

Bicton College of Agriculture

4.7.10 Bicton College of Agriculture currently offer 3 weekend courses in hedge laying from November to February with a maximum of 8 people per course. The course costs is £50.00

Table 4.8 Approximate numbers trained in hedging skills in Devon in 1998

Organisations	Approximate nos. trained in 1998 in hedging skills
Devon Rural Skills Trust	50
BTCV	20
Lyner training	100
Silvanus Trust	20
National Trust	24
Drake Training	12
Dartmoor National Park	24
Bicton College of Agriculture	24
TOTAL	274

4.7.11 As Table 4.8 shows approximately 275 people were trained in hedge skills in Devon in 1998. This is probably an underestimation as some local councils also run training days in traditional hedge management practices.

4.7.12 All trainers contacted felt there was an increased demand for training in rural skills. Trainees are generally either landowners aiming to learn skills to fulfil the conditions of their environmental grants or are smallholders with a desire to improve their property. This increased demand for training in rural skills is supported by a number of studies, which are referred to in the literature review.

4.7.13 Although there are evidently a large number of people in Devon obtaining training in hedging skills, several hedge contractors surveyed commented that they have problems recruiting new employees with appropriate hedging skills. Those who have received training will usually establish themselves as self-employed contractors. This means that existing contractor business have to train new employees on the job for a whole season before they are proficient in hedging skills. Only 8 out of 30 hedge contractors

surveyed had received any training in hedging skills. The remainder had learnt their skills "on the job" working with either contractors or on family farms. Businesses are reluctant to train new employees, although increasingly schemes are available, such as the Silvanus Trust Woodworks Project, that will provide wage subsidies to businesses to help train a new employee.

4.7.14 Examples of training received by some of hedge contractors contacted include:

- National Trust employment trainee for two years, followed by five years training with DRST;
- apprentice with DRST attended 36 to 40 courses over a two year period. Also undertook 6 days training in six different rural skills on a one-to-one basis; and
- ten one day hedge laying courses with DRST;
- attended a training scheme offered by the Dartmoor National Park

4.7.15 Hedge layers and trainers reported that ten days training in hedge laying and coppicing is required to become proficient. Bank restoration work is more difficult and requires approximately twenty days of training. Table 4.9 calculates the likely expenditure on training as a result of £1 million expenditure for hedge work. It assumes that a third of actual direct contractor job created will require training in hedge laying and bank restoration as the hedge contractor survey revealed that only eight out of thirty hedge contractors has received training in hedging. The remainder had learnt their skills "on the job" working with either contractors or on family farms. It also assumes that 10% of farmers receiving funds for hedge work will undertake training to help them implement the scheme themselves. It is estimated that 184 farmers will undertake the hedge restoration work themselves. This figure is based on calculations in Table 4.2 which estimated that 92 km of hedge work will be undertaking by farmers and the assumption that each farm undertakes 0.5 km per year, based on figures produced for the evaluation of Hedgerow Incentive scheme, in the South West (Catherine Bickmore Associates, 1996). Thus it is calculated that 18 farmers will undertake training.

Table 4.9 Expenditure on training in order to implement £1 million of hedge restoration work

	Contractors receiving training *	Farmers Receiving training **	No. of training days required	Total no. of training days	Charges £/day/ person	Total expenditure on training	FTE jobs created
Laying/Coppicing	5.4	11.0	10	165	20	3,292	0.3
Bank repair	2.0	7.3	20	187	20	3,739	0.4
TOTAL	7.4	18.4		352		7,031	0.7

* A third of figures presented in Table 4.3

** Assumes 191 farmers undertaking hedge work and 10% of these receive training

4.7.16 Table 4.9 shows that the training industry will receive approximately £7,031 from expenditure on training as a result of the £1 million funds for hedge restoration. Expenditure on training will increase initially, but then decline once sufficient labour is trained and can pass on skills to others either on-farm or within contractor companies.

4.7.17 If it is assumed that 1 FTE jobs is created for every £10,000 expenditure on training then our analysis estimates that 0.7 FTE training jobs, or 0.9 actual jobs, will be created as a result of heightened demand for hedge work resulting from £1 million expenditure (see Table 4.9).

4.8 Hedge products

4.8.1 The Devon Biodiversity Action Plan (1998) states that one of the wider benefits of enhancing hedges is to increase the available supply of hedgerow products, such as firewood, hurdles, walking stick and fruit or jams. (Devon Biodiversity Plan, 1998). Using existing studies and the telephone survey of contractors an analysis was conducted of the market potential for products resulting from increased hedge restoration in Devon.

4.8.2 As Table 4.10 indicates the survey of hedge contractors revealed that 20 out of 30 contractors used the by-products from hedge work. The spreadsheet analysis identified the total income likely to be derived from by-products due to £1 million spend on hedge restoration work. It should be noted that these figures represent the potential value of products provided there is a market for these goods. Although the demand for traditional woodland products is currently on the increase, these products often fall victim to recession or downturns in the economy.

4.8.3 This analysis was based on information on the quantity and value of products derived from the survey of hedge contractors. An old neglected hedge will not produce any by-products other than firewood. For younger hedges where the wood is cleaner and straighter, about 20% of the hedge could be used for products shown in Table 4.10 (DRST, pers. Comm.).

Table 4.10 Value of by-products produced from Devon hedges

	No. of Respondents	Average charge
Firewood	12	£30/m^3
Hurdles	2	£30/hurdle
Thatching spars	2	£70/1000 spars
Walking sticks	2	£20/stick
Greenwood chairs/stools	2	£30/stool
Blackberry jam	0	£1.50/pot

Firewood

4.8.4 The most common use for hedge by-products was firewood. Often contractors would leave the surplus material from hedges for the farmer or landowner to use for firewood

or occasionally the contractor would take the wood to burn in the home. It was generally felt that there was a high demand for firewood, especially as wood-burning stoves are fashionable. In the analysis it was assumed that surplus material from 30% of all hedges laid and coppiced for the £1 million would be used for firewood. An output from hedges equal to 25 m^3 per km was assumed based on a study valuing the benefits of hedge restoration in Normandy (Bonnieux & Le Goffe, 1997). An average charge per m^3 of firewood is approximately £30, including delivery. The analysis revealed that additional hedge restoration work for £1 million will produce a total output of 510 m^3, with a potential market value of £20,250 (see Table 4.11).

Hurdles

4.8.5 If a hedge has clean rods of hazel that are not twisted and bent then they can be used to make hurdles or thatching spars. Three contractors surveyed made hurdles from the by-products of hedge work. The basic requirement for a hurdle is a mould comprised of a piece of timber, about 2.1m in length, drilled with 10 holes. To create hurdles it is necessary to lay or coppice hedges which contain hazel with 2.1 m straight lengths of wood. In the analysis it is assumed that only 4% of all hedges coppiced and laid contain suitable wood for hurdle-making. Of this 4%, it is assumed that 5 m^3 of straight, long hazel rods are produced per km of hedge. An average hurdle is 1.8m by 0.9 m in size and it is estimated that they contain 0.005 m^3 of wood, comprised of two 2.1 poles for the frame and horizontal layers of interwoven branches. An average sized hurdle sells for between £26-£30 per hurdle. Using these figures, it is estimated that approximately 550 hurdles can be produced for £1 million of hedge restoration, with a total potential value of £25,313 (see Table 4.11)

Thatching spars

4.8.6 Four contractors surveyed produced thatching spars from by-products of hedge restoration work. Spars are split hazel rods 75 cm in length pointed at each end and twisted in the centre into a 'staple' shape and used to fix ½ coat work or the liggers on the ridge. They are usually sold in bundles of 1,000 spars and cost £60-£70 per bundle. In this analysis it is assumed that 5% of all hedges laid or coppiced produce by-products suitable for making thatching spars. Of this 5% it is estimated that approximately 200 bundles of thatching spars can be produced, from £1 million of hedge restoration, with a total potential value of £19,688 (see Table 4.11).

Walking sticks

4.8.7 Two contractors surveyed produced walking sticks from hedge work by-products. The main wood used for walking stick is ash. A thumb stick is sold for around £10, whilst a stick with a carved cross-piece sells for between £35-45. Generally walking stick sells well at local craft fairs. In this analysis it is assumed that 1% of all hedges laid or coppiced will generate by-products used for making walking sticks. Of this 1%, it is assumed that approximately 75 walking stick/km could produced, with a total potential value of around £4,050 (see Table 4.11)

Green wood chairs

4.8.8 Two contractors surveyed produce green wood furniture from hedge by-products. This furniture is made from fresh wood cut from the hedges, which when dries shrinks and binds the furniture together. A stool is sold for around £45. In this analysis it is assumed that 1% of all hedge laid and coppiced will produce by-products used for making green wood chairs. Of this 2% it is estimated that approximately 100 green wood chairs could be produced from £1 million of hedge restoration work, with a total potential value of around £12,150 (see Table 4.11).

Blackberries

4.8.9 A range of products can be produced from the fruits of hedges, such as blackberry jam, rose hip jelly, elderflower wine. In this analysis blackberries are used to demonstrate the potential value of hedgerow fruits. It is assumed that 10% of hedges restored through laying, coppicing and planting will be picked for blackberries between August and September for making jam. It is also assumed that this 10% will produce approximately 2,100 kg of fruit, which will make around 440 pots of jam. If these pots of jam are sold for £1.50/pot then the total potential value of blackberries picked from restored hedges is around £11,800 (see Table 4.11).

4.8.10 There is also potential for additional employment to be created from processing of the hedge products. Most of the hedge contractors surveyed who produced hedges products undertook this activity themselves. It was seen as an additional source of income, although its contribution to the total business turnover was minimal. The processing work itself is quite labour intensive, for example it takes a day to product between 800 to 1,000 thatching spars. One hedge contractor surveyed employed 2 people part-time to make green wood chairs and another extracted wood from hedges for someone else to process into hurdles. It is difficult to assess the additional employment impact resulting from the processing of more hedge products. The National Trust study assumed that in the construction sector 1 job would be generated for a turnover of £50,000, reflecting the employment of specialist craftsmen. On this basis additional processing of hedge by-products resulting from £1 million expenditure on hedge restoration would create 1.5 FTE jobs or 1.9 actual jobs.

4.8.11 The estimated potential value of hedge products from £1 million expenditure on hedge restoration work is given in Table 4.11. Hurdles, firewood and thatching spars have the potential for providing major sources of value.

Table 4.11 Value of hedge by-products

Wood products	% of hedges laid and coppiced suitable for products (a)	Length of hedge laid and coppiced suitable for products (km) (b)	Volume of suitable wood/km of hedge (m^3/ km) (c)	Volume of wood/product (m^3) (d)	No. of products per km (e=c/d)	Price per product (£) (f)	Total (£) (g=b*e*f)
Firewood	20%	27	25.0	1	25	30	20250
Hurdles	5%	6.8	5.0	0.04	125	30	25313
Thatching spars	5%	6.8	10.0	0.24	42	70	19688
Walking Stick	1%	2.7	0.1	0.002	50	20	4050
Green wood chairs	1%	2.7	2.0	0.02	100	45	12150
Fruit products	**% of hedge laid, coppiced and planted suitable for blackberries**	**Length of hedge laid, coppiced and planted suitable for blackberries (km)**	**Quantity of fruit per km (kg)**	**Quantity of fruit per pot (kg/pot)**	**No. of pots per km**	**Price per pot (£)**	**Total**
Blackberry jam	10%	17.7	200	0.45	444	1.5	11,800
Potential Total							73,000

4.9 Tourism

4.9.1 This section estimates the extent to which hedge BAP implementation might increase expenditure by visitors induced to visit Devon due to the improved landscape.

4.9.2 As the literature review in Appendix 2 indicates, hedges are highly valued features within the Devon landscape attracting visitors to the area. However, it is difficult to estimate how many additional visitors would be induced to visit the county from landscape enhancement through hedge restoration.

4.9.3 In the short term it is suspected that the impact of £1 million spent on hedge restoration on visitor numbers will be minimal. The only people likely to be attracted are those with specialist knowledge of the environment. In particular, examples of hedge restoration 'best practice' would attract this type of visitor to the area. Further visitor interest could be generated if additional information was supplied on the differences between well-managed and badly managed hedges. For hedge restoration to have an impact on visitor numbers they would need to be promoted as an important feature of the landscape.

4.9.4 In the longer term an improved landscape through hedge restoration will have a positive impact on visitors. Although some disbenefits may arise if visitors' views are impede by restored hedges. If it is assumed that the £1 million expenditure on hedge restoration work will attract an additional 100 visitor groups to the county, then visitor expenditure in the county will increase by £28,000 (see Table 4.12). This assumes an average group size of 2.9, with 7 holiday nights per trip and an average daily spend per group of £40.00 as calculated by the National Trust study (1999). This figure for visitor expenditure must be treated with caution as there are many other factors that attract visitors to an area, such as the quality and quantity of facilities provided.

Table 4.12 Visitor expenditure motivated by £1 million spend on hedge restoration

No. of additional visitor groups	Holiday nights per trip	Daily spend per group (£)	Total additional visitor expenditure (£)
100	7	40.00	28,000

4.9.5 As shown in Table 4.13, the £28,000 visitor expenditure was adjusted to turnover per sector, based on proportions used in the National Trust study (1999). Then using regional wage rates into FTE jobs.

Table 4.13 FTE jobs directly supported by increased visitor expenditure motivated by £1 million of hedge restoration work

	Turnover (£)	Wages (£)	Direct FTE jobs
Shops	4,214	884	0.06
Restaurants, pubs	6,418	1925	0.15
Attractions/entertainment	2,208	706	0.05
Garages/transport	4,125	1032	0.06
Accommodation	11,035	3641	0.3
Total	28,000	8188	0.62

4.9.6 From these calculations it is estimated that 0.6 FTE equivalent jobs are directly supported by the expenditure of an additional 100 visitor trips motivated by the enhanced landscape to visit Devon. Accommodation and catering are the sectors that benefit most in direct employment terms.

5. Total Economic impacts on the Devon Economy

Tables 4.2 to 4.13 above show the direct employment and expenditure impact of the £1 million on local contractors, farm labour, suppliers, trainers, processors of hedge products and visitors. Considering these different activities and using a number of assumptions, it is possible to estimate the employment and multiplier impact of £1 million spend on hedge restoration on the Devon economy:

5.1 Income multiplier impact on the Devon economy

5.1.1 Table 5.1 identifies the income multiplier impact on the Devon economy of £1 million expenditure on hedge restoration work. The multiplier analysis identifies three separate effects:

- **the direct effect:** the key activity and the associated activities, which are the result of final expenditure and employment outside the boundaries of the hedgerow restoration work that nevertheless can be attributed to this activity;
- **the indirect effect**: the income arising from activities benefiting directly from hedgerow expenditure that make their own purchases of goods, services and raw materials from other local suppliers related to hedge restoration work, but not directly associated with it; and
- **the induced effect**: the knock on effect on the local economy of increases in the personal spending of local inhabitants arising from the addition to local incomes caused by expenditure on hedgerow restoration.

Table 5.1 Potential output impact on Devon economy from £1 million expenditure on hedge restoration

	Potential direct impact (£)	Potential indirect impact (£) *	Potential induced impact (£) **	Total (£)
Hedge restoration	1113315	0	222663	1335978
Supplies	439293	131788	114216	685297
Training	7031	879	1582	9492
Tourism	28000	8400	7280	43680
Hedge products	73000	11849	16970	101819
Total	1660639	152916	362711	2176266

* Assumes supply chain coefficient of 0.3 for local suppliers and tourism, assuming one third of second round spending on supplies occurs within Devon
** Assumes induced coefficient of 0.2

5.1.2 Following an input of £1 million into the local economy for hedge restoration work the direct impact is to generate an output of about £1,660,639. In other words, the immediate impact of an additional £1 million expenditure on hedge restoration work is to generate around a £1.5 million increase in demands for locally-produced output. It

should be noted that the £1 million expenditure covers only 60% of the costs and that the remainder are met by the farmers or landowners.

5.1.3 The indirect effect represents the second round industrial support requirements for each activity following an increase in income. As Table 5.1 indicates substantially less of the indirect expenditure on supplies is spent locally. For example, whilst machinery and fuel are purchased from local suppliers the materials themselves are actually imported into the local area from elsewhere. In this analysis it is assumed that the indirect multiplier coefficient for supply chain businesses for local machinery and equipment purchases and provisions for the tourism industry is 0.3, based on the National Trust study (1999). In other words, only a third of supplies purchased by local suppliers are provided by businesses located in Devon.

5.1.4 The main indirect expenditure associated with training is the cost of travelling to the place of training. The indirect expenditure for hedge products is related to supplies purchased to produce these products, such as nails for hurdles and greenwood chairs and jars and sugar for jam.

5.1.5 The induced effect represents the impact on the local economy from increased household consumption as a result of additional local income due to increased expenditure on hedge restoration. Employees typically channel a large part of their wages and salaries into local retail, entertainment and other activities. The level of these induced impacts will reflect the relative status of the local economy, with greater impacts where there are more services available. In this analysis an induced coefficient of 0.2 is used based on induced impacts calculated for spending in the tourism industry in the South West as a result of visitor expenditure (National Trust Study, 1999).

5.1.6 As Table 5.1 shows, an initial injection of £1 million for hedge restoration work, produces an output into the economy of £2,176,266 taking into account the direct, indirect and induced effects. The key multiplier that indicates the total effect of hedge restoration expenditure on the local economy is the ratio of the Total Impact (Direct+Indirect+Induced) divided by the Direct Impact. This produces an overall expenditure multiplier of 1.3 (direct+indirect+induced effects/direct effect). A £1 expenditure on hedge restoration in Devon would result in a total output in the Devon economy of approximately £1.30. This compares favourably with multipliers calculated for other land-based industries. The South West Economic Research Centre at the University of Plymouth suggests that the output multiplier for the agricultural industry in Devon and Cornwall is 1.272, taking into account both indirect and induced effects (McVittie, 1999). Psaltopoulos and Thomson (1993) calculated an output multiplier for forestry planting in rural Scotland of 1.38. Cobham Resource Consultants (1992) calculated an expenditure multiplier of 1.82 for the UK fishing and shooting industries, although this excludes induced effect.

5.1.7 A high multiplier implies that there are strong inter-industry links, with less reliance on imports. A low multiplier indicates weak linkages with other sectors. Table 5.1 shows that there is a strong linkage between expenditure on hedge restoration and contractors and local suppliers and that other linkages are weak. Hedge restoration leads to a high level of purchases of material and services locally, leading to strong linkages. However, the indirect link between suppliers is weak as many goods, such as

machinery and tools are imported into the county, rather than produced locally, so reducing the multiplier effect. Although some supplies, such as fencing posts and specialist tools, such as billhooks, are produced within the county.

5.1.8 Caution must be exercised when comparing different multipliers as most are location specific and cannot be reliably transferred to other areas. They vary from one local area to another, reflecting variations in the structure of local economies and hence the degree to which money is retained in the economy rather than leaking from it. The size of the multiplier increases with that of the economy in questions, as leakages are reduced. Hence multipliers for UK as a whole are higher than those for local areas.

5.2 Employment multiplier impact on Devon economy

5.2.1 Table 5.2 shows the employment multiplier impact of £1 million expenditure on hedge restoration in Devon. The direct FTE jobs created for each activity were calculated in sections 4.2 to 4.6. The indirect employment effect for local supplies is calculated using the indirect expenditure figures in Table 5.1 and assuming 1 FTE jobs is created for £100,000 expenditure in the supply industry in Devon.

5.2.2 The spending of wages by employees whose jobs are supported by the £1 million of hedge work will in itself generate further employment locally and elsewhere. The National Trust study (1999) assumed that an additional induced job will arise with every 11 jobs supported either directly or indirectly at a county level. Therefore, the employment multiplier coefficient of 0.1 was to used calculate the induced impact.

Table 5.2 Potential employment impact on Devon economy from £1 million expenditure on hedge restoration

	Direct FTE jobs	Indirect FTE jobs *	Induced jobs **	Total FTE jobs
Hedge restoration	19.4	0	3.55	22.9
Supplies	4.4	1.2	0.56	6.2
Training	0.7	0.01	0.07	0.8
Tourism	0.6	0.08	0.07	0.8
Hedge products	1.5	0.12	0.16	1.7
Total	26.6	1.41	4.40	32.4

* Assumes 1 FTE job created for every £100,000 expenditure on second round supplies and service
** Assumes induced employment coefficient of 0.1

5.2.3 Table 5.2 shows that 27 direct FTE jobs are created in the Devon economy as a result of £1 million public expenditure on hedge restoration work. When both the indirect and induced effects of this expenditure are taken into account the figure rises to around 32 FTE jobs. From these figures it is possible to identify the employment multiplier for hedge restoration work in Devon as 1.2. Based on input-output tables produced by Plymouth University for Devon and Cornwall the National Trust study concluded that the employment multiplier for agriculture in the region is 1.2. Psaltopoulos (1995) and Slee & Snowdon (1997) have calculated employment

multipliers for forestry in Scotland of between 1.2–1.3. It should be noted, however, that most of the employment opportunities in forestry are associated with the harvesting of timber and new planting takes a long time to develop significant levels of employment (RSPB, 1995). Cobham Resource Consultants (1992) calculated an employment multiplier of 2.01 and 1.77 respectively for the UK fishing and shooting industries, although this excludes induced effects.

5.2.4 The direct links between hedge restoration work and employment for hedge contractors is strong, as most of the jobs will go to local contractors, who work within a small radius. The indirect links are weaker as, unlike forestry and agriculture which support significant timber and food processing industries, there is minimal processing of hedge by-products.

5.2.5 As stated previously the analysis assumes that £1 million expenditure on hedge restoration covers 60% of the costs and the rest is met by the farmers. Table 5.3 shows the impact on the Devon economy if the £1 million expenditure covers either 100% or 40% of the costs. The distribution of labour between contractors and farm labour remains the same for each scenario, although in reality if only 40% of the hedge restoration is grant-aided it is likely that more work will be undertaken by farm labour.

Table 5.3 Total income and employment impact on Devon economy under different funding scenarios

% of hedge restoration work funded	100%	60%	40%
Total hedge length restored for £1 million	106	177	266
Hedge restoration labour			
Total output from contractor work	580743	813,040	929,189
Total output from farm labour work	373527	522,938	597,643
Total no. of jobs created from contracting	11.6	19.3	28.9
Total no. jobs created from farm labour work	2.2	3.6	5.4
Local suppliers			
Total output from expenditure on local supplies	411,178	685,297	1,027,945
Total no. of local jobs created from expenditure on local supplies	3.7	6.2	9.2
Training			
Total output from expenditure on training	5695	9,492	14,465
Total no. of local jobs created from expenditure on training	0.5	0.8	1.2
Hedge products			
Total output from producing hedge products	61092	101,819	152,729
Total no. of local jobs created from producing hedge products	1	1.7	2.6
Total output into Devon economy	1,475,915	2,176,266	2,765,650
Total no. of FTE jobs created in Devon	19.7	32.4	48.2
Direct expenditure by farmers/landowners	0	605,232	1123205

6. On-farm benefits and costs of implementing BAP targets for species rich hedges

6.1 This section identifies the private benefits and costs to farmers of implementing the BAP targets for species rich hedges in Devon. It differs from the previous section in that it focuses on the impacts to the individual farmer, rather than to the Devon economy as a whole.

6.1 On-farm benefits

6.1.1 Whilst less importance is attached to the traditional functions of hedgerows, especially as boundary markers that distinguish separate field or farm management units, many farmers still attach an agricultural value to particular features of hedges (Westmacott, 1997).

6.1.2 The analysis attempted to estimate the direct income to farmers derived from on-farm benefits of species-rich hedges in terms of soil erosion, provision of shelter for stock and crops, the support of beneficial invertebrates and firewood. It is recognised this list is not exhaustive, there may be other benefits of hedges, such as browsing value for livestock, or an aid to drainage in wet areas.

Shelter

6.1.3 Semple *et al* (1995) argue that the semi-permeable structure of a hedge can act as an effective windbreak, as it slows the airflow but does not create adverse turbulence. The reduction in air speed has been shown to have an effect on crop yields by conserving heat and extending the growing season (Wadsworth, 1964 and Caborn, 1965). This is particularly applicable in areas of predominantly level terrain where protection from the wind is necessary to ensure good crop establishment. Yields losses are experienced in the narrow strip bordering the hedge, but increase down-wind within an area equal to 10-12 times the height of a hedge.

6.1.4 They also maintain that livestock derive benefits from the shelter effect provided by hedges. Investigations into the environmental stress on exposed sheep and cattle indicated that heat production by animals rose by 30% as unsheltered stock required more energy from feed for maintenance (Blaxter *et al*, 1964). Reports of increased yield in dairy cattle and weight gain in beef herds are also cited as a benefit of shelter, as well as a reduction in the incidence of toxaemia in sheep (Caborn, 1965). In some exposed areas of the county, such as Exmoor and Dartmoor, shelter by hedgerows from the prevailing wind is seen as an important function of hedges particularly during the winter and critical times such as lambing and immediately after dipping and shearing. However, in other areas of the county in-wintering of beef and dairy stock is a common agricultural practice so the benefit of additional shelter over the winter period is limited. It is difficult to quantify the benefit of shelter in terms of live weight gain of animals but Mills & Morris (1998) assumed that there is a 1% increase in energy value of grass for livestock due to shelter from hedges.

Soil Erosion

6.1.5 A further benefit of shelter is a reduced risk of wind erosion on susceptible soils. This is confirmed by the Royal Commission on Environmental Pollution's report on Sustainable Use of Soil (1996) which reports that removal of hedges has increased the risk of soil erosion, particularly by wind. Silt, sand and peat soils are all prone to this form of erosion in dry windy conditions. Wind blow generally occurs in spring cultivated fields (crops such as sugar beet, potatoes and onions) after a low rainfall period combined with strong, typically north easterly, winds. Some protection against this type of erosion is offered by any hedge in the appropriate orientation but it is generally thought that a hedge over 2 m is required to achieve meaningful reductions in soil depletion.

6.1.6 Hedges can also reduce soil erosion on sloping land. A study in the South Hams, Devon revealed that farmers on sloping land saw the function of hedges as soil containment (Halliwell, 1997). Nationally, losses from water and wind erosion amount to 0.1% of the annual output from crops and sheep (Royal Commission on Environmental Pollution, 1996). Both the shelter effect of hedges on crops and the protection provided from soil erosion led to the assumptions by Mills & Morris (1998) that crop yields increase by 1% within an area equal to 10 times the height of the hedge. Soil erosion and shelter benefits interact with and to some degree compensate for the losses associated with shading and compaction.

Game

6.1.7 A reason frequently cited by farmers for retaining hedges is for the shelter of game birds. Farmers' interest in game shooting is confirmed by Macdonald (1994) who found that the most popular outdoor hobby of farmers interviewed was shooting. Hedges provide direct benefit to game birds in terms of nesting cover, particularly for partridges, shelter from wind, and food and refuge. Hedges are also considered important in 'forcing up' game birds during shoots, making them easier targets. Well-kept, mixed species hedges, planted on a ridge with grassy banks are best suited to this purpose.

6.1.8 Mills & Morris (1998) and Cox *et al* (1996) found that much of the game shooting on farmland is in private hands, often with no paying Guns. However, the value of the shoot often lies in the ability to return invitations to shooting days with neighbours and can be valued at typical charge rates. The cash value of habitat improvement for shooting is often difficult to estimate, as rents vary considerably depending upon the reputation and location of the shoot, the quality of sport that can be provided and charges for similar shoots in the area. The rental value might range from £0.80 per hectare per shoot for the right to shoot over "unimproved" farmland up to perhaps £4 per hectare per shoot for areas of known reputation where the habitat is ideal (Game Conservancy, pers. comm., 1996).

Table 6.1 Game Conservancy Shoot Revenue and Cost Analysis 1995/1996

	Owner's Shoots		Rented Shoots	
Inputs	**Average Costs**	**Premium Costs**	**Average Costs**	**Premium Costs**
	£/bird shot	£/bird shot	£/bird shot	£/bird shot
Output				
Game sales	1.69	1	0.82	0.24
Let of shoot	17	17	17	17
Total Output	18.69	18	17.82	17.24
Rent	0.39	0.23	1.39	1.45
Rates	0.11	0.12	0.2	0
Keepering	8.57	3.03	4.41	1.06
Equipment	1.11	0.77	0.56	0.74
Restocking	3.23	2.16	3.64	2.92
Post Release Feed	2.48	2.18	2.71	2.78
Game crops	0.53	0.35	0.42	0.68
Beaters	1.38	1.47	0.98	0.16
Total Costs	17.8	10.31	14.31	9.79
Net Income per Bird	0.89	7.69	3.51	7.45
Net Income/km² (100 ha) (assuming 1000 birds/km²)	890	7690	3510	7450

Premium costs are taken from top 25% of sample. (Source: Game Conservancy, 1995)

6.1.9 Table 6.1 demonstrates that profits from game shooting are likely to be relatively small. This is supported by Cox *et al* (1996) who found that income from shooting in Devon was negligible. For the purposes of this study is it assumed that a 1 km length of hedgerow supports a pheasant population density of 10 birds/km from which the average net income would be £8.90. There is considerable variation in the distribution of pheasants across the county.

Habitat for beneficial insects and mammals

6.1.10 Many beneficial insects reside in hedges and their associated ground vegetation. Although hedgerows harbour pests, most available evidence points to the net benefit of hedges as sources of the natural enemies of pests, including carabid beetles, ladybirds and parasitic wasps. Research by the Game Conservancy found that when the number of predatory arthropods was reduced by 80%, cereal aphids increased sufficiently to cause 0.3 t/ha drop in yield (Boatman & Sotherton, 1994). A mixed species hedge provides an excellent source of predator insects, which will move into the crop in the spring months to live, breed and multiply, feeding on incoming pests. This evidence

that hedges provide a habitat for predators of crops pests led Mills & Morris (1998) to assume that there would be a 1% increase in arable crop yields in fields bordered by hedges, or alternatively the need for prophylactic sprays could be reduced.

6.1.11 There are additional beneficial functions which have not been included in the analysis. For example hedges provide a barrier or retention function, keeping animals in or trespassers or predators out. This function could be substituted by an artificial fence. However, as Mills & Morris (1998) indicate, it is unlikely that hedges that deliver the required barrier services to a farm would be replaced by an artificial fence.

6.1.12 Using farm models run for previous studies (Mills & Morris, 1998; Semple *et al*, 1995) it was possible to estimate the on-farm benefits of managing species rich hedges in Devon. The farm models used to demonstrate the on-farm benefits of hedge management are: a dairy farm in the Culm Measures with 30% species rich hedges; a cattle & sheep farm in Exmoor with 10% species rich hedges and an arable farm in Devon Redland, South Devon, with 20% species rich hedges. The analysis estimates the benefits of hedges in terms of shelter effects and the reduction of soil erosion, game birds, beneficial insects and savings in machinery and labour costs on land which would otherwise be in agricultural production.

Table 6.2 Annual on-farm benefits of well managed species rich hedges

Devon	Boundary Length km	% species rich hedges on farm	Species rich boundary length km	Shelter/ wind erosion £/km	Game birds £/km	Beneficial insects £/km	Saving in machinery and labour £/km	Total farm benefits £/km
Dairy	11	30%	3	114	9	0	107	230
Cattle & Sheep	6	10%	1	307	9	50	46	412
Arable	7	20%	1	66	9	207	59	341

Source: Adapted from Mills & Morris (1998)

6.1.13 Table 6.2 shows that the annual on-farm benefits of well managed species rich hedges for typical Devon farms range from between £230 to £412 depending on the enterprises on the farm and the length of species-rich hedges present.

6.2 On-farm costs

6.2.1 The on-farm costs resulting from the management of retention of species-rich hedges have been estimated. These arise through, for example, land loss, shading and labour and machinery costs of hedge maintenance

Land loss

6.2.2 The presence of species-rich hedges can result in land lost to agricultural production. In this analysis land take approximates to the width plus 0.5 m of species-rich hedges. A land take of 1.5 m equals 0.15 ha per 1 km length of hedgerow. The linear extent of

hedgerows on a farm is affected by the number, size and shape of the fields, and the percentage of field boundaries that are occupied by hedgerows. Formulas used by Mills & Morris (1998) were used to calculate the area and hedge boundary length for each of the model farms. Land take is most significant where hedges fragment areas which otherwise could be managed as larger units.

Shade

6.2.3 The shading effect of a species-rich hedge depends on the height and the orientation of the hedge and the incidence angle of sunlight. The length of shadow produced by the hedge varies depending on the orientation of the hedge to the sun. In this analysis it is assumed that there is 50% reduction in crop yield in the areas shaded by a species-rich hedge or a 50% reduction in energy value obtained from grass for livestock. The shaded area represents one hedge height distance from the hedge and is applied to 75% of the hedges to account for shading in only three orientations. For the most part land adjacent to the species-rich hedge constitutes a headland which is often compacted by animals or turning machinery. Yields on headlands are observed to be less than elsewhere in the field. It is assumed that headland yields are 85% of the nominal field yields. Thus the shade effect on the headland has a lower absolute impact on yields than that which might be associated with average in-field yields.

Costs of mechanised field operations

6.2.4 The main impact on mechanisation costs of species-rich hedges is the loss of potential field efficiency of machines due to the presence of the hedge.

6.2.5 Where a species-rich hedge constitutes an infield obstacle or fragments fields which otherwise could be farmed as one unit, the removal of the hedge can increase the working efficiency of farm machinery, leading to savings in labour and machinery costs. There are significant economies of scale in modern farming, especially with respect to labour and machinery costs. Modern farming practices favour large scale, highly mechanised specialised crop production systems, with an emphasis on timeliness of operations. Large fields of regular shape are needed to exploit the potentially high work rates of large scale machinery. Hedgerows can impede machinery operations. This is supported by a survey of farmers conducted by Macdonald (1994) who found that 87.2% of those who had removed hedges in the previous decade had done so to increase the efficiency of machinery use. The retention of species-rich hedges which obstruct machinery use tend to increase the costs to farmers of field operations.

6.2.6 The relative work efficiency of field operations will be affected by:

- field size, shape and infield obstacles - small fields have a larger proportion of their total area given to headlands on which machines turn. The smaller the field, the greater is the proportion of total in-field machine time spent on non-productive turning and idle travel. Irregular shaped fields and infield obstacles also increase non productive work as a proportion of total field time. Removing hedges to deliver larger, rectangular fields can reduce machinery costs; and

- machinery operations and operating characteristics. The degree to which machinery performance is affected by field and related hedgerow characteristics depends on the type of operations, such as ploughing, crop protection, harvesting, and the operating characteristics of machines such as width, travelling speed and manoeuvrability speed.

Table 6.3 Extra machinery operation costs for cereals per km of hedgerow

Operation	Implement size m	% field efficiency	Operation speed km/hr	Work rate ha/hr	Machinery operation costs/ha £/ha	Machinery operation costs/hour £/hr	Total extra costs £/km
Ploughing	2	80%	7	1.1	37	41	373
discing	6	85%	7	3.6	12	42	96
drilling	4	65%	6.5	1.7	15	26	89
fert/spray	12	60%	10	7.2	42	302	1,277
combine	5	70%	5	1.8	71	124	447
Total costs					177		2,282
Cereals					177		2,282
Beans/oilseeds					150		1,940
Roots					336		4,337
Grass					71		913

Source: Mills & Morris, 1998.

6.2.7 Table 6.3 estimates labour and machinery costs associated with the extra time required to turn on and finish headlands for one km of hedgerow assuming adjacent crops of cereals (wheat and barley). Estimates for oilseeds (such as rape), grain legumes (such as beans and peas) and root crops (such as potatoes and sugar beet) and grass are 85%, 85%, 190% and 40% respectively, of those for cereals, reflecting the relative intensity of field operations. It assumes that the hedge divides two fields that could be joined, such that there is a headland on either side of the hedge.

Labour and machinery costs of species-rich hedge management

6.2.8 As identified in Section 4.2 of the report there are labour and machinery costs associated with maintaining species-rich hedgerows. Costs per unit length depend on hedgerow dimensions and composition. In this analysis it is assumed that species-rich hedges are managed on an 8 year rotation and that the cost of restoring a typical species-rich hedge in Devon is £800/km.

Weeds and pests

6.2.9 Hedgerows are often perceived by farmers to harbour weeds and pests. A study by Macdonald (1994) revealed that rabbits were the most common cause cited by farmers of significant damage on farms. Farmers have reported that hedges provide shelter for rabbits and that cereal and grassland damage from rabbit grazing is often found close to hedges. This damage is usually at its most intense from December to April and generally occurs within 10 m of the hedge (Mills *et al*, 1996). Rabbits can cause

considerable damage if no control is exercised. In Britain rabbits cause an estimated £120 million of damage to crops each year (MacDonald, 1995). On grassland, 10 rabbits can eat as much as a 50 kg ewe and one rabbit can consume as much as 1% of wheat yield per hectare. Rabbits normally become established where there are suitable burrowing sites (sandy, free draining soil) and an abundant food supply. Densities of rabbits vary seasonally, with numbers relatively stable during winter (<1 to 15/ha) followed by highly variable summer peaks (1 to 40/ha) (Tittensor, 1981). Density for over wintered rabbit population on chalk grassland in Oxfordshire was estimated at 8.4/ha (Cowan, 1984).

6.2.10 For the purpose of this study it is assumed that a rabbit density of 8.4/ha represents full infestation. However, there is likely to be some rabbit control resulting in a possible 50% reduction in the rabbit population and a rabbit density of 4.2/ha either living in or using hedges for refuge. This would result in a 4% reduction in crop and grass yields within 10 metres of a hedge. In practice, the degree of rabbit infestation varies considerably according to local circumstances, including farm specific control measures.

6.2.11 Relatively few of the field edge plant species commonly associated with hedges are potential field weeds (Marshall, 1986). There are, however, some exceptions and species, such as *Bromus sterilis*, are capable of invading fields. Where weeds are allowed to spread into the field unchecked, yield losses of the order of 5% to 10% have been recorded (Boatman and Sotherton, 1988). However, surveys of farmers have shown that around 60% of farmers use herbicides in their field boundaries (Boatman, 1989) and so it has been assumed in the analysis that weeds have limited impact on yields.

6.2.12 Table 6.4 reveals that the annual on-farm costs of well managed species rich hedges for typical Devon farms range from between £1,339 to £1,661 depending on the enterprises on the farm and the length of species-rich hedges present. The analysis suggests that the on-farm benefits of managing species-rich hedges are small relative to the on-farm costs.

Table 6.4 Annual on-farm costs of well managed species-rich hedges

Devon	Boundary Length km	% species rich hedges on farm	Species rich boundary length km	GM loss due to shade & land loss £/km	Reduced machinery efficiency £/km	Weeds & Pests £/km	Hedge restoration costs £/km	Total farm costs £/km
Dairy	11	30%	3	279	228	32	800	1,339
Cattle & Sheep	6	20%	1	174	255	76	800	1,305
Arable	7	10%	1	264	534	63	800	1,661

Source: Adapted from Mills & Morris (1998)

7. Conclusions and recommendations

7.1 Conclusions

7.1.1 The research has shown that implementing the BAP targets for species-rich hedges in Devon, assuming an expenditure of £1 million per year over a 5 year period, will have a positive socio-economic impact on the local economy. It has demonstrated that any expenditure on hedge restoration can generate additional spending by farmers and contractors in the local economy over and above the money provided by a capital grant, multiplying the effect of the grant payments. In fact local linkages are strong as most hedge contractors and farmers purchase their supplies locally. The income multiplier effects have been show to be similar for those calculated for other land-based industries, particularly agriculture and forestry.

7.1.2 Expenditure on hedge restoration work also results in high direct employment effects. The research has shown that expenditure on hedge restoration can both generate and maintain employment on the farm and for contractor businesses. The labour-intensive nature of this work seems to offer potential for improving economic activity in the county. Any grant scheme providing funds for hedge restoration can generate and maintain employment in the local economy and provide the confidence for the establishment of new small businesses supplying contractor services. This would be particularly welcome in Devon at a time of substantial decline in the agricultural labour force. Small farms are being forced to restructure due to declining agricultural support prices and CAP reforms creating a need to identify alternative rural employment opportunities. These new jobs would be created in rural areas where alternative employment opportunities are scarce. However, these employment effects are due to the high direct impact of hedge restoration in the economy, rather than the indirect and induced effects of other industries. The indirect employment effects of hedge restoration are minimal, unlike other land-based industries such as agriculture and forestry which support significant timber and food processing industries. The analysis has, however, revealed that there is potential to increase processing of hedge products.

7.1.3 The objective of the Biodiversity Action Plans is to promote sustainable management of wildlife and landscapes and thereby improve wildlife diversity. However, it is increasingly recognised that wildlife has the potential to increase economic prosperity in Devon, being the basis of the tourist industry and a key reason for small businesses choosing to locate to Devon. Wildlife can give added value to much of the County's economy and wealth creation. This research has shown that the implementation of BAP targets can have socio-economic benefits to the local economy in terms of wealth and employment creation. It could be argued that an additional by-product of the BAP process is the socio-economic benefits of implementation. Implementation of other Habitat BAPs in Devon could also result in significant socio-economic benefits to the Devon economy, such the Oak Woodland, Alder/Willow Wet Woodlands and Parkland and Wood Pasture BAPS.

7.1.4 Hedge restoration will make a significant contribution to the local economy in terms of both income and employment opportunities. The mechanism for delivering these funds are already available in the form of agri-environment schemes. Grants are available to financially assist farmers and landowners in hedge restoration work. However, there

was evidence from the number of hedge contractors interviewed that farmers are often deterred from applying for these grants because they are too cumbersome and complex for their needs, if they just wish to restore a few hedges. Most schemes require a whole farm plan involving a number of features on the farm. A number of contractors lamented the demise of the County Council grants to hedges, which were directed specifically at hedges and were favoured by farmers.

7.1.5 The BAP target for species rich hedges in Devon is to achieve the favourable management of 50% (c. 38,000 km) of species-rich and ancient hedges by the year 2005. It is estimated that the total UK public expenditure in the year 2000 will have to be about £4.2 M if the targets are to be met (EN project brief, 1999) and that approximately £1 million of this expenditure a year for 5 years should be directed to Devon to meet the county targets. However, this research suggests that estimates of expenditure required to meet BAP targets are unrealistic. To achieve the favourable management of 50% of species-rich and ancient hedges in Devon by the year 2005 would require a much greater expenditure than £5 million over the five years. The research has shown that approximately 180 km of hedge can be restored for £1 million expenditure, assuming these funds cover 60% of the costs of hedge restoration work. Five million pounds over 5 years would achieve favourable management of around 1,000 km (1%) of the target 19,000 km of species rich and ancient hedges in the county.

7.2 Recommendations

7.2.1 A key assumption in this research is that Devon contains 20% of the country's species-rich hedges, although no data is available to quantify the condition of the county's hedges. Further research should be directed at quantifying the current condition of hedges.

7.2.2 The research findings indicated that visitors value the presence of hedges in the landscape, suggesting that substantial economic benefits can be derived from positive management of these features. However, it was difficult within the scope of this study to estimate the exact economic benefit of these features. It is, therefore, recommend that a contingent valuation survey is undertaken to estimate the Willingness to Pay by visitors for improved environmental quality of Devon's hedges.

7.2.3 The analysis identified a significant potential value for hedge products provided there is a market for these goods. The economic benefit from these products is important for the local economy and it is therefore recommended that a marketing study for hedge products is conducted to identify the demand for such products.

7.2.4 The analysis makes a number of assumptions and it may be useful to examine the sensitivity of these results by varying the main assumptions and identifying the percentage change.

7.2.5 The use of primary data obtained from a telephone survey proved invaluable in identifying the key factors involved in implementing the hedge BAP targets in Devon. It is recommended that any further studies looking at the socio-economic impacts of implementing BAP targets also incorporate some primary research.

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Appendix 1. Hedge Contractor Survey

Date	
Name of respondent	
Area	
Tel. No	

1. Contracting Business

1.1 Do you undertake any hedge work in your contracting business Yes/No
(if 'No' end interview)

1.2 Are you a full-time contractor Yes/No

If No, what proportion does contracting contribute to your total income

.....

1.3 What types of contracting work do you undertake and what is the percentage contribution of each type to the total?

Task	✓	Percentage
Fencing		
Hedge work		
Tree surgery		
Drainage		
Field work (ploughing etc)		
Harvesting/silaging		
Other.....		

1.4 What type of hedge work do you undertake and what is the percentage contribution of each type to total hedge work?

Task	✓	Percentage
Hedge cutting		
Hedge steeping/laying		
Hedge coppicing		
Hedge planting		
Earthbank restoration		
Other.....		

1.5 Last year, approximately how many miles/kilometres of hedge did you:

	miles	kilometres
Cut		
Steep/lay		
Coppice		
Plant		
Restore earthbank for		
Other.....		

1.6 Do you ever employ someone to assist with hedge work? Yes/No

If, Yes, how many people and how often?

	Full-time	Part-time	Casual
Family labour			
Hired labour			
Other			

1.7 What percentage of your hedge work is carried out in Devon?

.....

1.8 Is any of your hedge work grant aided Yes/No/DK

If Yes, approximately what percentage of the hedge work is grant aided?

.....

1.9 Has your hedge work increased over the last 5 years?
(if started within last 5 years go to 1.9) Yes/No/DK

If Yes, approximately by what percentage has it increased?

.....

What proportion of this increase has been due to environmental grants?

.....

What other factors that might account for an increase in hedge work?
***

	✓
New wealth in rural areas	
Non-farmers buying services	
Less farm labour available	
Other.....	
Other.....	

1.10 Are you aware of any new hedge contracting businesses that have started up over the last 5 years

Yes/No/DK

If Yes, how many new hedge contracting business have started up over the last 5 years?
.....

How important was the availability of environmental grants in influencing these new hedge contracting businesses to start up

Very Important/ Important/Minor importance/No importance

1.11 By what proportion would the demand for hedge contracting work have to increase before you would consider taking on further employees?

.....

1.12 What is an average charge for:

	£/m	£/hour + (how many metres per hour)
Cutting		
Laying		
Coppicing		
Planting		
Raking up/burning brush		
Casting up (earthbank restoration)		

2. Training

2.1 Have you undertaken any training to learn hedge restoration/management skills

Yes/No

If Yes, what training have you undertaken, over how many days and with whom did you train.

	✓	Days	Trainer
Hedge steeping/laying			
Hedge planting			
Earthbank restoration			
Hedge cutting			
Tree surgery			

2.2 If No, would you consider undertaking training if the demand for hedge restoration/maintenance work increased
Yes/No/DK

3. Suppliers

3.1 What are the main inputs used in your hedge work. What percentage of each is purchased in Devon

	✓	
Tractor and maintenance		
Fuel and oil		
Flail		
Tools – bilhook, axe, crook, digger		
Tree quips		
Tree guards		
Stone		
Stakes		
Other.....		

4. Hedge products

4.1 Do you keep the by-products of hedge work? Yes/No/Sometimes

If Yes or Sometimes what are these by-products of hedge work used for and do you derive any income from them.

	Used (✓)	Income derived (✓)	Sold to
Firewood			
Walking sticks			
Woodwork			
Basket making			
Other.....			
Other.....			

Appendix 2 Literature Review

The aim of this section is to review the literature that has examined the socio-economic impacts of funding environmental work.

Employment creation from hedge work implemented under agri-environment schemes

In the UK a number of research projects have sought to estimate the amount of employment created from the management of wildlife features. Two sources of employment for hedge restoration and management work are either use of farm labour or use of contractors. Most of the research reveals that demand for contract work significantly increases as a result of agri-environment schemes, whereas the impact on farm labour is small. A significant proportion of the contract work used in agri-environment schemes can be attributed to hedge restoration and maintenance as it is labour intensive work.

A socio-economic assessment of ESAs by CEAS (1997) identified a significant increase in the use of contractors, whilst the impact on farm labour requirements were minimal. The scheme has also encouraged farmers to start or expand off-farm contracting businesses. Saunders (1994) identified a 50% increase in contract employment on farms in the Pennine Dales ESA compared to only 13% on non-agreement farms. Also Skerrat (1994) in a study of Breadalbane ESA found that much of the extra labour requirement was filled by contract workers.

A socio-economic assessment of the Countryside Stewardship Scheme (CSS) in England (CEAS & University of Reading, 1996) also found that the impact of the scheme on labour employed directly on the farm was minimal, with only 8% of respondents indicating CSS had led to an increase in labour requirements. These changes were greatest among part-time rather than full-time labour and hired rather than family labour. In terms of the net changes in on-farm labour usage there was a net increase of 15 extra staff (20% full-time staff and 80% part-time staff). Of the CSS work undertaken by farm labour, an average of 84% fitted into existing work timetables and 16% was classified as overtime. Fifty-one percent of respondents indicated that some CSS work was undertaken by outside contractors. Total annual expenditure by respondents on contractors was around £675,000 with an average expenditure of £2,862. The use of farm labour was particularly prominent for maintenance work, with the use of outside contractors mostly associated with capital work, such as hedge maintenance and restoration. Existing farm labour undertook 60.7% of the capital work and outside contractors 39.3%.

Throughout England the effect of money spent on contractors as a result of the CSS (£5.7 million) amounted to 391 direct and indirect FTE jobs, or 448 once induced impacts were included (Harrision-Mayfield *et al*, 1998). This occurred mainly on farms where access and capital payments, such as hedge restoration work, accounted for a significant part of the total payment (over 20%). The man days for contractors when grossed up to a national level came to 48,250 which is equivalent to about 220 full-time jobs created by CSS work (CEAS & University of Reading, 1996).

A socio-economic analysis of the Tir Cymen scheme in Wales by ADAS (1996) has also indicated a substantial positive employment impact, particularly in contracted work, for activities such as hedge laying, coppicing and woodland management. In some areas this

positive employment effect has been large enough to reverse the decline in agricultural employment. One newly established contractor specifically mentioned that Tir Cymen had given him the confidence to move from being a casual labourer to setting up a small contracting business. The study also revealed that there was an unquantified use of extra casual and seasonal labour in the contracting businesses in particular. It was acknowledged that this largely 'black' economy, together with an identified expectation among some businesses to rely on existing staff to cope with an increased workload, means that a survey of employment impact is likely to underestimate the true knock-on effect of Tir Cymen on job creation. Contractors were generally optimistic about future development of their business over the next few years. Where possible they were diverting their resources to those skills such as fencing, hedging and walling which were in demand as a result of Tir Cymen.

In Devon there is also evidence of increased work for contractors through agri-environment schemes. Under a 3 year Objective 5b project, the Okehampton to Polson Bridge Recreation Land Management Initiative, which included 17,278 metres of hedgerow management, contractors spent more time on project work than farmers. Contractors were employed for 4,896.5 hours on work directly related to the project. This is equivalent to 612 man days which represents 2.7 full time equivalent jobs. Whereas, farmers spent 2,542 hours of their time or their employees' time on the project. This is equivalent to 317.5 man days which represents 1.4 full time equivalent jobs. The total cost of the hedge management work was £69,453 (Devon County Council, 1997). In the Lower Tamar Valley Recreation and Land Management Initiative, involving 13.7 km of hedgerow management, contractors were employed for 3556 hours on the completed work. This is equivalent to 444.5 man days or approximately 1.8 full time equivalent jobs. Whereas farmers spent 2845 hours of their own or their employees' time on the work. This is equivalent to 355.6 man days or approximately 1.5 full time equivalent jobs (Devon County Council, 1998).

Tables 3.1 and 3.2 provide a summary of recent research identifying the division of labour between farm labour and contractors for agri-environment work. Table 3.1 reveals that contractors account for 39-66% of labour in three agri-environment schemes. Under CSS hedge restoration work is spread over the first 5 years of a 10 year agreement, the Objective 5b schemes offer one-off grants concentrating work in one particular year. This is likely to lead to a need to use non-farm labour. Table 3.2 provides a more detailed breakdown of the division of labour by task for the Hedge Renovation scheme in Wales

Table A2.1 Division of labour for agri-environment schemes

Schemes	Contractor days %	Farm Labour days %
Countryside Stewardship Scheme over 5 years [1]	39.3	60.7
Okehampton to Polston scheme (one-off annual grant) [2]	68	32
Lower Tamar Valley scheme (one-off annual grant) [3]	56	44

[1] source: CEAS & University of Reading, 1996* (includes just capital works, a large element of which is hedge restoration)

[2] source: Devon County Council, 1997

[3] source: Devon County Council, 1998

Table A2.2 Division of labour for Hedge Renovation Scheme in Wales

Operation	North Wales				East/South Wales				West Wales			
	Farm labour nos	%	Contr nos	%	Farm labour nos	%	Contr nos	%	Farm labour nos	%	Contr Nos	%
Laying	21	62	13	38	9	47	10	53	8	33	16	66
Coppicing	19	63	11	37	10	63	6	37	9	38	15	62
Planting	26	76	8	24	12	67	6	33	11	46	13	54
Bank repairs	16	64	9	36	2	25	6	75	5	50	5	50
Fencing	28	70	12	30	15	63	9	37	8	35	15	65

Source: ADAS, 1997

Costs of hedge work implemented under agri-environment schemes

Costs of hedge work will vary depending on the complexity of the task. Table 3.3 provides a summary of the range of costs for different hedge management operations.

According to Werret (1999) laying a hedge using a contractor costs between £2.60 - £10.40 per metre depending on condition. An average UK hedge may cost £5.20/m. Repairing a bank or 'casting up' can cost from £3/m (DETR, 1998) up to £40/m (Nix,1998), depending on whether the work is done by hand or with machinery.

Table A2.3 Cost of hedge management operations

	Grants		Actual costs		
	CSS £/m	ESA £/m	Werret £/m	Nix £/m	Devon Hedge Group £/m
Hedge laying	2.00-4.00		2.60-10.40	3.00-5.00	5.00-8.00
Coppicing	2.00	1.50	-	2.00	-
Planting	2.00	1.75	-	2.00	-
Sheep fencing	1.20	1.20	-	-	-
3 line wire for cattle fencing	0.80	0.80	-	2.50	-
Casting up	1.00	-	-	-	3.00
Earthbank restoration	3.00	-	-	-	
Stone-faced hedgebank repair	10.00	-	-	-	-
Stone-faced hedgebank restoration	25.00	-	-	25.00-40.00	-

Sources: MAFF (1999); Werret (1999), Nix (1998); Devon County Council & Devon Hedge Group (1997)

Training

There is evidence that hedgerow work through agri-environment schemes increases the demand for training. The Countryside and Community Research Unit (1999) looked at the economic impact of training programmes in Wales and found that almost two thirds of farmers

in training courses were participating in one or more agri-environment schemes. For some of the farmers the training was a catalyst that prompted them to join schemes. The training removed barriers and gave them greater confidence in their ability to carry out the work prescribed and to apply for schemes. The report also concluded that farmers in agri-environment schemes were learning new skills as part of cost-cutting strategies and that by carrying out the work themselves they could save money. Thirteen out of 20 farmers (65%) who were already in a scheme said their training had helped them implement their schemes. Other participants on the courses wanted to diversify into contracting business to meet the demand for hedge work generated by agri-environment schemes.

Hedge Products

Evidence from France that one of the benefits of hedges is the market value of firewood and timber. A study valuing the benefits of landscape restoration in Normandy estimated the benefits of hedge restoration in terms of firewood and timber yields (Bonnieux & Le Goffe, 1997). Output from hedges was expected to equal to $25m^3$ km^{-1}/yr for firewood and 60 m^3 km^{-1} every 60 years for timber.

One of the native bushes found in Devon hedges which has a significant economic value is Hazel (*Corylus avellana*). This is excellent for hurdles, wattle fencing and basketry. Another tree found in Devon hedges is Crack Willow (*Salix fragilis*). The stems are very flexible and are sometimes used in basket making. (Plants For A Future website, 1999).

Tourism

Tourism is one of the major industries in Devon and fundamental to the county's economic and social well being. Exeter University, in a visitor survey of the South Hams in Devon, identified the unique patchwork appearance of hedges in the Devon landscape that attracted people to the county (Exeter, 1988). A study by the Devonshire Heartland Tourism Association also revealed that the county's main asset was its beautiful countryside. Agriculturally managed landscape and infrastructure feature in much of the promotional literature of tourist agencies and operators in Devon.

A National Trust study (1999) estimated that 3.7 million or 79% of all annual holiday trips to Devon are motivated by the conserved landscape. The definition of the term "conserved landscape" was broad, describing fields, woods, moorland, villages and coastline. It did not specifically focus on the agricultural landscape, where hedges predominate. These trips were estimated to last 20.7 million nights with a visitor spend of £749 million. In addition, a total of 23,900 full time equivalent (FTE) jobs were supported by landscape motivated holiday trips. Of these 16,000 were directly supported by landscape motivated holiday trips and the linkage and multiplier effects supported the balance. Actual jobs supported by conserved landscape motivated holiday trips to Devon were 23,500 directly supported and 9,000 indirectly supported (National Trust, 1999).

Work by Willis & *et al* (1993) in the Somerset Levels and Moors and South Downs ESAs identified the importance attached to hedges by the general public, as indicated in Table 3.4.

Table A2.4 Visitors landscape feature preferences in the Somerset Levels and Moors and South Downs ESAs (%)

	Somerset Levels & Moors			South Downs		
	less	same	More	less	same	more
Wildflowers	-	10.3	89.1	0.0	14.1	85.9
Wildlife	0.4	19.2	80.3	0	30.4	69.6
Hedgerows	5.1	36.7	58.2	2.2	42.0	55.8
Broadleaved woodland	3.6	38.6	57.8	1.5	48.5	50.0
Coniferous woodland	48.5	38.7	12.8	33.3	53.7	13.0
Fields of crops	29.3	57.0	13.6	27.8	58.9	13.3
Haymeadows	2.5	39.1	58.4	5.6	48.5	48.7

Source: Willis, *et al* (1993)

Willis *et al* (1993) also examined the residents and visitors Willingness to Pay (WTP for specific landscape features in the Somerset Levels and Moors ESA landscape. Table 3.5 again shows that hedges are highly valued landscape features.

Table A2.5 Residents and visitors mean Willingness to Pay for ESA by landscape features

	Somerset Levels and Moors ESA (£)		South Downs ESA (£)	
	Residents	Visitors	Residents	Visitors
Hedgerows	18.94	12.76	30.27	31.62
Wildlife	19.44	19.44	31.76	26.06
B'leaved woodland	21.43	14.26	28.82	19.13
Coniferous woodland	11.60	8.93	68.93	12.34
Wildflowers	17.82	12.16	28.48	25.24
Hay meadows	21.01	12.24	25.24	26.31
Grazing animals	23.63	9.73	29.24	30.09
Fields of crops	4.53	11.46	73.51	26.91

Source: Willis *et al* (1993)

On-farm benefits and costs

A number of studies have examined the benefits and costs of hedgerows (Semple *et al*, 1995, Mills & Morris, 1996; Mills & Morris, 1998). These studies have found that the costs borne by farmers when changing their hedge management system will vary depending on the individual characteristics of the farm. Factors such as size and growth rate of the existing hedge, field size and the type and intensity of the main enterprises on the farm will all affect the final cost. Also the configuration of a hedge influences shade, shelter, land loss and pest incidence (Mills & Morris, 1996).

The direct on-farm financial benefits of hedge retention and management appear to be small compared to the costs. Where livestock enterprises are dominant, as in Devon, hedges may provide an important stock barrier function. Predatory insects harbouring in hedges may also be an important benefit to farmers, but this effect is hard to quantify due to the absence of relevant field research (Mills & Morris, 1998).

Impact on machinery operations from non-productive turning on headland affects work efficiency of field operations. This has been identified as a key determinant of the costs of hedgerow retention (Mills & Morris, 1998). A further cost of hedgerow retention is associated with loss of income due to the shading effect and land take of hedges (Mills & Morris, 1998). This is particularly important in counties where there is a high density of hedges, such as Devon. Hedge management costs are also important in the cost of hedge retention. There are also significant costs associated with managing hedges. Semple *et al* (1995) estimated that hedge cutting costs for a standard hedge cut every year in Devon are approximately £8.00 per 100m.

Methods of assessing economic impact

In estimating the impact of projects on local employment and incomes a large number of studies have employed variants of the Keynesian open-economy multipliers. These multipliers measure the marginal propensity to consume locally produced goods. A summary of employment, income and expenditure multipliers used in a number of rural economic impact studies are presented in Appendix 3.

One economic impact study that used local multipliers is the National Trust study of the economic impact of conserved landscape and of the National Trust in the South West (1998). This study examined six main forms of impact, namely:

- National Trust expenditure on employment;
- National Trust supply chain expenditure on services and goods purchased as a result of its activities in maintaining and managing its estate;
- National Trust tenants expenditure on employment, that is to say the employment on land and sites leased by the Trust to tenants
- National Trust tenants supply chain expenditure on services and good purchased as a result of the activities of tenants in relation to the land and sites leased from the Trust;
- external expenditure taking place in the local economy arising from off site spending by visitors and volunteers to National Trust sites;
- induced expenditure arising as a result of expenditure of wages locally by people whose employment is supported directly or indirectly by reason of the National Trust's activities.

The National Trust's direct expenditure on goods and services was based on categorising the purchases made by the Trust and estimating the jobs in those businesses in receipt of this spend. The study also estimated the multiplier effect of this spend (ie. the second and

subsequent rounds of spend and the jobs supported). The basis for estimating the jobs directly supported and the multiplier effects was drawn from the Cambridge Economic Model, which draws upon a variety of published and unpublished data. To estimate the supply chain expenditure on services and goods purchased as a result of the activities of tenants, employment multipliers for agricultural activity and manufacturing industry, distribution and other sectors were used. These were based on input-output tables for the counties in the region produced by the South West Economic Research Centre at the University of Plymouth. They take into account both supply chain effects and induced effects. To estimate the induced economic impact of employee's wages, an induced multiplier was used. No local multipliers were available so it was assumed that an additional induced job would arise for every 11 jobs supported either directly or indirectly at County level (ie. a multiplier of 0.09)

In an examination of the socio-economic effect of the Countryside Stewardship Scheme (CEAS & Reading University, 1997) regional input-output modelling was used. This technique relates any given change in the inputs used and outputs produced on the farm to equivalent 'knock-on' changes in upstream and downstream industries in the wider economy and various 'rounds' of effects are measured

The input-output models were constructed using basic national and regional economic data by identifying 'multipliers' for each link in the trading chain. The total impact was calculated by combining the effects on each 'round'.

Regional direct and indirect effects were estimated using forward (downstream) and backward (upstream) multipliers derived from regional input-output tables which had been constructed using the Generation of Regional Input-Output Tables (GRIT) technique. The regional employment changes were estimated using employment coefficients from regional input-output models. These had been created for each of the Standard Economic Regions in England using a coefficient reduction method (Richardson, 1972). The tables were adjusted mechanically using simple location quotients and inserting 'superior' data (regional output data from BSO) in an effort to improve the coefficient reduction.

Crabtree *et al* (1994) estimated the direct, indirect and induced income and employment effects of visitor spending on wildlife sites in Scotland. A survey estimated expenditure per visitor to the sites and this was attributed to wildlife conservation on the basis of the importance of wildlife in their decision to visit the area. Expenditure by local residents was excluded. A survey of local businesses provided information for estimating the full expenditure, employment and income effects from direct visitor spending. The indirect expenditure effects were derived by determining the expenditure profile of firms in each of the sectors benefiting from visitor spending. This was assessed in terms of Goods and Materials, Wages, Rent and Profits and Other items. The expenditure on Goods and Materials was adjusted by the proportion that were imported into the locality so as to give an estimate of expenditure on goods and materials supplied locally. The estimation of induced expenditure involved calculation of the locally retained incomes in each of the relevant sectors and the resultant level of local spending.

Employment supported by wildlife site-related visitors was also calculated by estimating the relationship between business turnover and employment and relating this to the overall pattern of wildlife site-related visitor spending. This wildlife visitor site-related expenditure was divided by the average visitor expenditure required to directly support one job and thus

provided an estimate of the number of jobs directly supported by wildlife site visitors. The indirect and induced expenditures were also calculated based on spending patterns of local businesses.

Local income generation by wildlife site-related visitor spending was assessed in terms of the Area Income Generation (AIG) coefficient which measures the proportion of each £1 of wildlife site-related visitor spending which is transformed into income and retained by local residents.

An alternative approach to measuring the economic impact of landscape from tourism is through means of contingent valuation (CV). This is a technique increasingly used in the UK for valuing non-market natural resources. It involves the use of structured interviews or questionnaires to derive an expression of a willingness to pay from individuals for some change in quality or quantity of a good or service. Several studies have estimated the value of the agricultural landscape using this approach. In the Yorkshire Dales National Park, Willis and Garrod (1993) obtained a WTP for the landscape of £26.03/ household/year for visitors and £22.23/household/year for residents. On the South Downs ESA the annual household WTP for the landscape for residents was £27.53 and for visitors £19.47 (Willis *et al*, 1993). There are particular problems in using CVM for aesthetic goods, particularly for improvements at a small scale. The method has attracted considerable adverse criticism generally in terms of the techniques applied (for instance, McFadden, 1994; Bateman & Langford, 1995; and Bateman and Willis, 1999)

Appendix 3 Summary of multipliers

Table A3.1 Summary of multipliers

Type of Multiplier	Source	Area	Size
1. Tourism			
1.1 Employment			
Visitor expenditure per FTE job	Surrey RG	Scotland	£19-28,000 [1] (visitor spend/job)
	MacKay	Islay & Jura	£25,000 [1] (visitor spend/job)
	Christie	Wales	£18,000 (visitor spend/job)
	Griffiths	Wales	£18,000 (visitor spend/job)
	Crabtree	Scotland (local areas)	£14-18,000 [2] (visitor spend)
	MacKay	Scotland (local areas)	15,000 [3]
	National Trust	England	74,600 [4] (retailing)
	National Trust	England	42,400 [4] (catering)
	National Trust	England	46,300 [4] (entertainment)
	National Trust	England	37,700 [4] (accommodation)
	National Trust	England	140,800 [4] (travel)
	National Trust	England	52,000 [4] (other spend)
Non accommodation visitor spend per FTE job	National Trust	West country	£62,500 [5]
Indirect supply chain business	National Trust	West country	£33,000 [6]
Total Employment per Direct Job	Halhead	Highland	1.2-1.25 [7]
	MacKay	Islay & Jura	1.25 [7]
	Ind N Cons.	Highlands & Islands	1.5 [7]
	Griffiths	Wales	0.25 [7]
1.2 Income			
Ratio of Net Income: Visitor Expenditure	Surrey RG	Scotland (local areas)	0.29-0.39 [8]
	CEAS	Eng/Wales	0.25-0.46 [8]
	Christie	Wales	0.3 [8]
	Crabtree	Orkney	0.251-0.042-0.032 [9]
		H Perthshire	0.174-0.038-0.019 [9]
		W Ross	0.231-0.061- 0.027 [9]

Type of Multiplier	Source	Area	Size
1.3 Expenditure			
Total expenditure: Visitor expenditure	Crabtree	Orkney	1.24 [10]
	Crabtree	H Perthshire	1.34 [10]
	Crabtree	W Ross	1.18 [10]
	Crabtree	Scotland (national)	1.82-1.91 [10]
	Mackay (1989a)	Scotland (local areas)	1.13-1.35 [10]
		Scotland (national)	1.5 [10]
2. Industry			
2.1 Employment			
Total Employment per Direct Job			
Agriculture	National Trust	Devon	1.2 [11]
Manufacturing., distribution & other sectors	National Trust	Devon	1.2 [11]
Forestry supply and processing	Slee & Snowdon	Scotland (local areas)	1.2-1.3 [11]
3. Goods and services			
3.1 Employment			
Expenditure per FTE job	National Trust	South West	£50,000 [12] (construction sector)
	National Trust	South West	£25,000 [12] (services sector)
	National Trust	South West	100,000 [12] (supply sector)
	National Trust	South West	100,000 [12] (other sectors)
4. Countryside sports			
4.1 Expenditure			
Fishing	Cobham RC	UK	1.82 [13]
Shooting/stalking	Cobham RC	UK	1.82 [13]
Hunting (including falconry)	Cobham RC	UK	1.91 [13]
Game fishing	MacKay (1989b)	Scotland	1.5 [13]
Sporting Shooting (Organisers)	McGilvray *et al*	Scotland	2.45 [13]
Sporting Shooting (participants)	McGilvray *et al*	Scotland	4.65 [13]
Grouse shooting	McGilvray *et al*	Scotland	5.29 [13]
4.2 Employment			
Total employment per direct job			
Fishing	Cobham RC	UK	2.01 [14]
Shooting/Stalking	Cobham RC	UK	1.77 [14]
Hunting	Cobham RC	UK	1.91 [14]

[1] Level of expenditure by visitors required to create one job in the local economy: takes account of multiplier effects

[2] Level of expenditure by visitors required to create one job in the local economy; excludes multiplier effects

[3] Level of indirect/induced expenditure required to create one job in the local economy. Additional to[2]. Requires use of expenditure multiplier

[4] Level of expenditure by visitors to create one direct job in the sector; excludes multiplier effects

[5] Level of expenditure by visitors on non accommodation businesses required to create one job in the local economy; excludes induced effects

[6] Level of expenditure by visitors to create one job in the supply chain business.

[7] Total number of (direct+indirect+induced) jobs created per direct job. Excludes visitor impacts

[8] Ratio of visitor expenditure to local net income (profits, wages, salaries, rents). Includes multiplier effect

[9] Ratio of visitor expenditure to local net income (profits, wages, salaries, rents). Includes multiplier effect (direct-indirect-induced effects)

[10] Ratio of total (direct+indirect+induced) expenditure to visitor expenditure

[11] Total number of (direct+indirect+induced) jobs created per direct job in industry sector.

[12] Level of expenditure by National Trust to create one job in the sectors; excludes induced effects.

Ratio of expenditure on countryside sports to total (direct+indirect) expenditure.

Total number of (direct+indirect) jobs created per direct job.

Appendix 4 Hedgerows Regulations Schedule 1 Section 6(3)

Wildlife and landscape criteria

6. The hedgerow contains species listed or categorised as mentioned in sub-paragraph (3):

(a) listed in Part I (protection at all times) of Schedule 1 (birds which are protected by special penalties), Schedule 5 (animals which are protected) or Schedule 8 (plants which are protected) to the Wildlife and Countryside Act 1981[41];

(b) categorised as a declining breeder (category 3) in "Red Data Birds in Britain" Batten LA, Bibby CJ, Clement P, Elliott GD and Porter RF(Eds.), published in 1990 for the Nature Conservancy Council and the Royal Society for the Protection of Birds (ISBN 0 85661 056 9); or

(c) categorised as "endangered", "extinct", "rare" or "vulnerable" in Britain in a document mentioned in sub-paragraph (4).