

Forestry Expansion –
a study of technical, economic
and ecological factors
Sporting Recreational Use of Land,

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INTRODUCTION

This paper examines some recent evidence of the use of land for sporting recreation and its possible implications for forestry. Benson and Willis (1991) have demonstrated that forested land can, and indeed does satisfy a variety of recreational demands. Here we are concerned primarily with the recreational use of non-forested land, and with one type of recreational use, namely sporting recreation.

A particular feature of sporting recreation (at least with respect to game fishing and shooting) is that, unlike most other forms of countryside recreation such as hill-walking or bird-watching, it is to a large extent a marketed activity; that is, the activity is provided at a price through markets. As such income is generated and the value of the activity can, to the extent it is marketed, be measured in terms of net output produced. In principle, therefore, the value of income and employment generated can be compared with alternative land uses such as agriculture or forestry. In practice, lack of data, price distortions and problems related to complementarities in inputs and outputs made this difficult to achieve in the present stage of empirical knowledge.

Despite the fact that 'hunting, shooting and fishing' are among the oldest uses of land in Britain, little has been known until recently about the economic significance of these activities. The growing importance of leisure industries, however, allied with the need to develop employment opportunities in rural areas to offset the decline in agricultural employment, has led to greater interest in the economic impact and potential of sporting recreational activities.

In the early 1980s, a major investigation into the structure and impact of 'country sports' was carried out by Cobham Resource Consultants (CRC) on behalf of the Standing Conference on Countryside Sports (CRC, 1982). More recently the Fraser of Allander Institute (FAI) at the University of Strathclyde completed an extensive study of The

economic impact of sporting shooting in Scotland (McGilvray *et al.*, 1990) on behalf of the British Association for Shooting and Conservation (BASC) and the Scottish Development Agency (SDA). In addition to providing a detailed profile of the structure of the sporting shooting 'industry', and estimating its output, income and employment effects, this study also provided a wealth of information on conservation practices, the relationship between sporting shooting and the protection of flora and fauna, and the interaction between sporting shooting and alternative land uses. Although more work remains to be done, this report is the major reference source for much of the content of this chapter.

In relation to (recreational) fishing, a major source is the CRC Report cited on page 1. Other, albeit more specialised studies include the report of the Tourism and Recreation Research Unit (TRRU) of the University of Edinburgh on salmon fishing in three areas of Scotland (TRRU, 1978); Ireland's Economic and Social Research Institute (ESRI) report on angling in Ireland (ESRI, 1988); and the study of MacKay Consultants on Scottish salmon fishing (MacKay Consultants, 1989).

Although this set of studies does not provide a complete picture of the economic significance of sporting recreational activity in the UK, it represents a significant advance in knowledge, and permits us to derive some conclusions or observations in relation to future forestry strategy.

COUNTRY SPORTS IN GENERAL

It is convenient to begin with an overview of country sports in Britain, as reported by Cobham Research Consultants (CRC, 1982). Table 1 records the CRC estimates of the number of organisers or providers, and the number of participants, for various categories of country sports in the early 1980s.

Table 1 Providers and participants in country sports, Great Britain, 1981-82.

<i>Sport</i>	<i>Estimated number of providers</i>	<i>Estimated number of participants</i>
Fishing	27 000	3 730 000
Shooting and stalking	52 000	579 000
Hunting	383	214 200

Source: CRC (1982)

These figures have to be interpreted with some caution but they provide reasonable order-of-magnitude estimates of the substantial numbers involved in country sports. Not surprisingly such a scale of participation generates significant expenditures, and estimates of direct expenditures by providers and participants are shown in Table 2.

Table 2 Direct expenditures on country sports by providers and participants, Great Britain 1981-82.

<i>Sport</i>	<i>Expenditure (£m in August 1982 prices)</i>		
	<i>Providers</i>	<i>Participants</i>	<i>Total</i>
Fishing	7*	636	643
Shooting and stalking	41	171	212
Hunting	6	97	103
Total	54	904	958

* Expenditure by water authorities only.
Source: CRC (1982)

Fishing emerges as the major activity in terms of expenditure, accounting for 67% of total direct expenditure. In terms of expenditure per participant, however, the order of magnitude is reversed; per participant expenditure is £453 for hunting, £295 for shooting and stalking, and £171 for fishing. It is reported by Cobham that 86% of total direct expenditure was generated in England and Wales, and 14% in Scotland. The CRC study also reported estimated employment effects, summarised here in Table 3.

Once again, fishing is the major contributor, accounting for nearly one half of the 29,500 full-time equivalent (FTE) jobs provided directly. However, it is noticeable that shooting and stalking generated 12 200 FTE jobs, and so the employment-expenditure ratio is substantially higher for shooting than fishing. Of this total, 4 000 were estimated to be keepers. As noted below, keepers have an influential role in maintaining ecological diversity in the countryside.

Table 3 Direct and indirect employment sustained by expenditures on country sports, Great Britain 1981-82

<i>Sport</i>	<i>Direct employment (FTE)</i>
Fishing	14 300
Shooting and stalking	12 200
Hunting	3 000
Total	29 500
	<i>Indirect employment (FTE)</i>
	9 800*

*Incomplete survey coverage, and hence believed to be a substantial underestimate. See text.
Source: CRC (1982)

Table 3 also includes an estimate of employment in associated trades and services which are sustained by providers' and participants' expenditure. This figure of 9 800 is however claimed as a lower bound estimate, due to incomplete survey coverage. This conclusion is supported by the results of the FAI study reported in the following section, and by alternative estimates of employment impact made by CRC using the UK input-output tables. These latter calculations suggest a total of nearly 88 000 FTE jobs sustained by expenditure on country sports, including not only the direct and associated trades employment noted in Table 3, but also the multiplier effects on other industries. However estimates of this kind have to be carefully interpreted; they do not imply that this number of jobs would disappear if expenditures on country sports were to cease, since disposable income would presumably be spent in other ways.

As far as the balance of payments are concerned, CRC found that country sports generated a balance of visible trade surplus of £5.4 million in 1980 prices, this being the difference between (visible) exports and imports of £39.6 million and £34.2 million respectively. The report was unable to estimate the, probably more important, contributions to invisible earnings, noting however that since country sports (especially fishing and shooting) attract many foreign visitors, one would expect a substantial positive net contribution to the balance of invisible trade.

SPORTING SHOOTING

More up-to-date information on the economic significance of sporting recreation is available from the Fraser of Allander Institute study of The economic impact of sporting shooting in Scotland (McGilvray *et al.*, 1990). The objectives of this study were:

1. to evaluate the economic significance of sporting shooting in Scotland, including its impact on output, incomes and employment;
2. to assess the contribution of sporting shooting to conservation, recreation and the management of the countryside;
3. to identify issues of importance to the future development of sporting shooting and its role in Scotland's rural economy.

Since this study was confined to Scotland, its results cannot necessarily be generalised to the UK as a whole, and the structure of sporting shooting in Scotland is certainly distinct from that of southern England. There are also, of course, marked differences in climate, land use, agricultural structure and productivity. For these and related reasons, sporting shooting may well play a more significant role in rural Scotland than in other (more southerly) parts of the UK, and this must be borne in mind in interpreting the results of the Scottish study.

In view of the lack of published statistics or economic data on sporting shooting, it was necessary to undertake extensive survey work, primarily by means of postal questionnaires, but supplemented by fieldwork and interviews. The major survey work was directed towards the providers of sporting shooting – that is, estates or properties

which offer sporting shooting facilities* – rather than to the consumers of sporting shooting (participants). However, in addition to the survey of providers, surveys were also conducted of game dealers, game farmers, sporting agents and participants.

The sampling frame for the providers' survey was the valuation roles of the Regional Councils. This permitted a stratification of properties by region and by rateable value. For sampling, and for analytical purposes, rateable value classes used in the study were £0-99, £100-£799, £800-£1499, £1500-£2999, £3000 and over.

There are 7 761 properties (as defined by local authorities) rated for sporting shooting in Scotland, of which 947 (12.2%) were selected for the stratified random sample. A total of 393 returns were obtained, a sample response rate of 41.5%. Sample returns represented 5.1% of total properties, but 19.5% of the total rateable valuation of all properties in Scotland. This was because the sample was weighted towards large properties i.e. the sampling fraction increased with rateable value class.

Population estimates based on the survey data suggest that around 4 460 (57%) of the 7 761 properties are not used for sporting shooting, at least not in any organised or systematic way. Most "unused" properties lie in the two smallest rateable value classes (up to £799 RV), with an estimated 3 597 "not used" in the £0-99 class alone, out of 4706 properties in this class. Unfortunately, the survey questionnaire did not ask for the size of property, so that it is not possible to estimate the total areas of land used or not used for sporting shooting. Prima facie, however, this result suggests there may be scope for a substantial increase in the supply of sporting shooting facilities, should demand warrant it.

Estimates of current levels of demand are indicated in Tables 4 to 6 – with respect to Table 4, for reasons explained in the FAI Report, numbers of pigeon, rabbit and hare shot are thought to be significantly underestimated. The number of grouse shot is also considered an underestimate.

Table 4 Volume of game shot, 1988-1989

<i>Species</i>	<i>Number shot</i>
Grouse	303 319
Pheasants	1 019 401
Partridge	36 820
Geese	7 933
Duck	107 639
Woodcock	18 067
Snipe	13 470
Other game Birds	860
Pigeons	195 339
Rabbit	407 871
hare	94 672

(Excluding game shot by wildfowlers)

Source: McGilvray *et al.*, (1990)

*For the purposes of the study, the term 'sporting shooting' was taken to comprise grouse and upland shooting, red deer stalking, roe deer and other lowland stalking, lowland game shooting, coastal wildfowling, inland duck and goose shooting, and rough shooting.

Table 5 Volume of deer shot, 1988-89.

<i>Red Deer</i>	<i>Number shot</i>
Stags	20 823
Hinds	26 976
Calves	4 573
Total Red Deer	52 372
Roe, sika and fallow	12 637

Source: McGilvray *et al.*, (1990)

With respect to Table 6, estimates of participants relate almost exclusively to paid for shooting. They exclude participation by owners and their family and friends invited to shoot without charge. This exclusion particularly affects the estimated number of Scottish participants.

Table 6 Number and origin of participants in sporting shooting, 1988-89.

<i>Origin</i>	<i>Number</i>
UK, of which:	39 312
Scotland	16 904
Rest of UK	22 408
Rest of world, of which:	11 573
Europe	8 101
North America	2 546
Other	926

Source: McGilvray *et al.*, (1990)

In 1988-89, almost 51 000 participants took part in paid for shooting, with an average length of participation of 2.32 days. Through time series data were not collected in the study, interviews with providers and agents suggested that the number of participants had risen sharply over the past 10-15 years.

In 1988-89, providers' revenue from sporting shooting was estimated to be £28.6m, including over £5m in sales of game and venison to game dealers. Out of this turnover, providers spent £16.7m on purchases of goods and services, £13.0m on wages and salaries, and £3.0m on other outlays, including shooting rates. Expenditure exceeded income by £4.1m.

Although there may be some understatement of income and/or overstatement of expenditure, analysis of sample data reveals a consistent and pervasive pattern of negative profitability across all rateable valuation size bands, except for the largest. The data are summarised in Table 7.

Table 7 Profitability by rateable value size band.

<i>RV</i> (£)	<i>Average excess of income over expenditure</i> (£)
0-99	- 327
100-799	- 914
800-1 499	- 4 250
1500-2 999	- 6 414
3000 +	+ 1 590

Source: McGilvray *et al.*, (1990)

We comment further on this table below.

In addition to their expenditure on sporting shooting, participants, especially visitors from outwith Scotland, generate income and employment through expenditure on accommodation, food and drink, purchases of ammunition and other sporting accessories, gifts and other items. To estimate this expenditure a survey of participants was undertaken.

Table 8 below records average expenditure and estimated total expenditure for five distinct sub-groups of participants. Estimated total expenditure by all participants is £78.0m, but as noted in the FAI Report this may be an over-estimate. In particular, reported expenditure by participants on sporting shooting exceeded the income from sporting shooting reported by providers. The FAI report attributes most of this discrepancy to bias in the participants sample, but it is also possible that there may have been some under-reporting of income by providers.

Table 8 Estimated expenditure by participants in the preceding 12 months.

	<i>Average sample expenditure per person</i>		
	<i>On sporting shooting</i> (£)	<i>Other expenditure</i> (£)	<i>Estimated total expenditure</i> (£m)
Participants, other than coastal wildfowlers from:			
Scotland	378.2	977.5	22.9
Rest of UK	657.4	731.1	31.1
Rest of World	733.8	845.3	18.3
Coastal wildfowlers, from:			
Scotland	69.6	956.6	2.4
Rest of UK	196.2	462.1	3.3
			-
			78.0

Note: These data include indirect taxes, where applicable, travel costs to and from Scotland, and fees paid to agents outside Scotland, where applicable.

Source: McGilvray *et al.*, (1990)

Finally, Table 9 records estimates of the total (direct, indirect and induced) employment and income effects of sporting shooting in Scotland. It should be noted that the sporting shooting 'industry' here includes not only providers but also associated trades, in particular game dealers, game farmers and sporting agents. The results suggest that in 1988-89 sporting shooting generated nearly £28m in income and the equivalent of 4 319 full-time jobs. Adding on the multiplier effects of 'other expenditure' by participants (on hotels, restaurants, gifts, etc), total income and employment generated rise to £53m and 7 212 FTEs respectively.

Table 9 Employment and income generated by sporting shooting, 1988-89.

	<i>Employment FTEs</i>	<i>Income (£m)</i>
Sporting shooting 'industry'		
1. Direct employment and income	2 411.1	11.367
2. Indirect employment and income	1 907.6	16.563
3. Totals (1) + (2)	4 318.7	27.930
Multiplier (3) + (1)	1.79	2.45
Other participant expenditure		
4. Indirect effect of other expenditure by participants	2 893.2	24.882
5. Total (3) + (4)	7 211.9	52.812
Multiplier (5) + (1)	2.99	4.65

*Employment measured in full-time equivalents.
Source: McGilvray *et al.*, (1990)

As noted earlier, this should not be interpreted to mean that total -employment would be 7 212 less if sporting shooting ceased, since participants would spend their income in other ways.* It is clear however that sporting shooting makes a valuable contribution to the rural economy of Scotland. Despite very low or negative returns, many respondents to the survey regarded sporting shooting income as important to the viability of their estates', and as a means of sustaining a higher level of employment than would be otherwise justified by other activities such as agriculture and forestry. In employment terms, there are synergy effects between different land uses; pest control and woodland management, for example, yield returns to agriculture and/or forestry as well as to sporting shooting. Moreover, the FAI study suggests that sporting shooting enhances the capital value of estates. In general, one would expect the capitalised value of the net income from any given use of land to be reflected in the market price of that land. This does appear to be the case for larger, profitable estates. Inspection of the prices of such

*But not necessarily in Scotland. This issue of 'additionality' is discussed in Chapter 7 of the FAI report.

†43.5% of respondents (to this question) regarded sporting shooting as 'very important' to the viability of the estate, and a further 19.4% as 'important'.

estates being offered on the market shows that these capitalised returns are, indeed, included in the price. Since land use can change, these values would also be incorporated in the price of land not currently devoted to shooting, if a potential for that activity exists. However, this is in apparent contradiction to the situation found on other properties experiencing negative financial returns from sporting shooting. This contradiction may be more apparent than real since as noted above the income data in the survey exclude the nominal value of shooting enjoyed by those invited to shoot without charge, including the owner and his family. Logically this imputed income could be estimated as the difference between the (observed) financial rate of return and the opportunity cost of the capital tied up in the shoot, but there are more complex issues involved here which must qualify such a simple calculus. Moreover, as pointed out above, there are certain costs such as pest control expenditure which yield benefits to other estate activities, but which are not included in sporting shooting income.

Furthermore, unlike agriculture, the demand for sporting shooting facilities appears to be bouyant although there is concern over competition from other countries, particularly Eastern Europe. A majority of respondents foresee sporting shooting increasing in importance as a source of revenue, and apart from forestry very few respondents identified viable alternative uses of land currently devoted to sporting shooting. The opportunity cost of such land appears to be very low; in this respect, even negative returns from sporting shooting may reflect optimal use of fixed assets. It is also worth noting here the contrasting fiscal treatment of sporting recreational land use and alternative land uses. While agriculture and forestry are directly subsidised, recreational land use is taxed, through the payment of sporting rates. Whether or not such discrimination is merited, its effect is to distort relative prices and comparative evaluations of alternative land uses.

SHOOTING AND CONSERVATION

The FAI study also explored the role of sporting shooting in conservation and the potential conflict between shooting interests and conservation. It must be noted that the views expressed on this matter, and summarised here, are predominantly from those with an interest in sporting shooting; views of those uninvolved in shooting, which might be critical of the impact of sporting shooting on the natural environment, were not covered in the survey. From the survey returns, a summary of conservation-related practices is depicted in Table 10, page 10.

Many respondents elaborated their answers in supporting correspondence, and a large number added 'pest control' as an additional conservation activity. Moreover, many noted that leaving woodlands 'uncut or uncultivated' was damaging to environmental diversity, and stated that they managed woodlands rather than leaving them alone. There are clearly ambiguities in the interpretation of 'conservation'.

It is a widely, and often strongly expressed view that the control of pests is a very important contribution to the diversity of wildlife and enhancement of the natural environment. Of course the term 'pest' is a somewhat pejorative description of certain

species, in the present instance those which are predators of game birds or eggs (as well as of other species). It is argued that an active policy of pest control, in which keepers play a critical role, protects species other than game and that if there were no pest control predator populations such as foxes, grey squirrels, crows and stoats, along with rabbits and pigeons, would dominate the countryside. Indeed it is claimed that in certain (unkept) areas they already do so.

Table 10 Conservation activities on sporting shooting properties.

<i>Activity</i>	<i>Percentage of respondents undertaking activity</i>
1. Improve or create woodlands, ponds or waterways.	51.4
2. Leave areas unfertilised to encourage game.	31.0
3. Leave woodlands uncut or uncultivated.	31.1
4. Open up woodlands and widen rides.	38.2
5. Conserve and develop heather cover.	33.3

Source: McGilvray *et al.*, (1990)

Though the FAI study did not attempt scientific verification the report is broadly sympathetic to the view that pest control, as defined by sporting shooting interests adds to ecological diversity. However in certain instances protected species (e.g. buzzards, harrisers) were mentioned in this context, and there is clearly some conflict at the margin between sporting shooting and wildlife protection. Overall, however, these interests appear complementary rather than competitive.

In the final analysis the conservation impact of sporting shooting should be judged against what would happen if the land were not used for sporting shooting. This would require a wider inquiry, but on the basis of the partial information available, sporting shooting would appear to compare quite favourably with alternative land-uses, including both commercial and non-commercial utilisation. This is particularly so with respect to pest control, development and management of small woodland areas, and conservation of heather moorland and other uncultivated areas of land.

A number of respondents to the FAI survey asserted that, if not used for sporting shooting (or converted to agriculture or forestry use), many areas of land would revert to 'unproductive wilderness'.

FISHING

Chapter 2 summarised the findings of the Cobham Report which relate to recreational fishing in Great Britain. We now turn to consider the Tourism and Recreation Research

Unit (TRRU) (University of Edinburgh) study into the economic value of salmon fishing in three areas of Scotland. The rivers chosen were the Tay, Spey and Kyle of Sutherland. Inferring from the sample areas to Scotland as a whole, TRRU estimate there to have been 373 703 rod days in Scotland in 1982, generating £34 million total expenditure. This puts salmon angling in Scotland on a more or less equal footing with shooting sports in terms of this measure, (The Cobham Report, for purposes of comparison, estimates expenditure by Scottish-only anglers to have been approximately £43 million in 1979-80. Later studies cast doubt on the accuracy of this estimate, suggesting it is substantially too high).

The study by Whelan and Marsh (1988) on Irish Angling estimated overall expenditure per angler to be just over IR £500, with total expenditure by visiting anglers to be IR £28 million, and by Irish anglers to be IR £29 million. Fishing visitors to Ireland tend to be very keen and active, often returning many times. Although anglers themselves rate fishing in Ireland very highly, the main item of dissatisfaction was poor physical access to waters, with two-thirds of the sample expressing this opinion. The Irish study estimated that direct and indirect effects of expenditures generated 1900 FTE jobs, and argued that demand for fishing in Ireland was strong and rising, with a potential for 1 500 new jobs arising if this demand is adequately managed and catered for.

MacKay Consultants, investigating Scottish salmon fishing in 1988-89, estimated there to have been 435 000 rod days of fishing, a total expenditure effect (both direct and indirect) of £50.4 million, and an overall FTE employment-creation effect of 3 360 jobs. Fishermen in Scotland were, in general, highly satisfied with their activity; of the improvements which could be made, most fishermen wished to see greater control over large scale netting, and over poaching. However, it is noticeable that some respondents believed that the rivers upon which they fished were polluted or suffered from excessive acidity. Although only a small proportion (4%) of respondents mentioned this, rather more proprietors of fishing were concerned about water quality, and there are reasons to believe that any future decrease in water quality may impact significantly upon the benefits derived from fishing. In this context, it is interesting to consider the impact that afforestation has upon water quality, and so indirectly upon fishing. This is analysed extensively by Hornung and Adamson (1991), who conclude that the main adverse effects of further planting on water quality will be in upland areas, where forestry would represent a relatively intensive form of land use.

In lowland areas, conversely, forestry is more benign in its impacts upon water quality than other land uses, including agriculture. A considerable proportion of fishing recreation in the UK as a whole is undertaken on the river systems, canals, lakes etc. in low lying areas in relatively heavily populated areas. Land transferred from intensive agriculture to forestry would generate positive net effects upon water quality through the reduced use of fertilisers, pesticides and herbicides, the reduction of sediment entering water courses, and lower discharge of animal waste. In addition, such a change of use would probably permit greater freedom of access and a more attractive setting in which anglers can enjoy their recreation. Lowland forestry would have clear and substantial benefits for lowland fishing, particularly near centres of population where demand is greatest.

Finally, MacKay Consultants believe that Scotland's salmon fishing has great potential for expansion and development. However, fishing levels are presently constrained by full capacity in the main seasons (which vary between rivers), and so an expansion would require more out-of-season fishing or more fishing on less popular rivers.

Sea loch/lake and coastal recreational fishing is outside our sphere of interest, having few (if any) practical implications for the expansion of forestry.

SPORTING RECREATION AND FORESTRY

The FAI Study, and the earlier Cobham Study, have demonstrated the economic significance of sporting shooting, particularly in sustaining income and employment in rural areas. Equally, the report by MacKay Consultants has shown the economic importance of salmon fishing. Sporting recreation sustains significant levels of employment and income, mainly in rural areas, and attracts large numbers of relatively-affluent overseas visitors, often in off-peak seasons. Moreover, demand for sporting recreation facilities is growing, and there is potential for increasing supply. Hence, although returns appear to be low (at least for sporting shooting), land use demand for sporting recreation is increasing; as other Papers in this series have shown, this is also true for other forms of countryside recreation.

In addition to the direct benefits conferred by sporting recreation, which are measurable, albeit incompletely by market prices, there is *prima facie* evidence of additional benefits through land use management and conservation practices by the providers of sporting recreation. The evidence here is not unambiguous, but offers support to the argument that a well-managed sporting estate contributes to the diversity of flora and fauna and country landscape.

However, few if any estates rely wholly upon income from sporting recreation. Typically, sporting use will be combined with agriculture or forestry. This conjunctive use of land is increasing as agricultural returns fall and returns to forestry, despite fiscal benefits, are not particularly attractive. Complementarity between agriculture and/or forestry and sporting recreation may therefore be necessary to maintain a minimum level of viability.

It is clear that for certain types of sporting recreation, woodland (if not extensive forest) cover enhances sporting potential. A significant proportion of estates carry out continuous woodland planting and management to realise this potential, as indicated in Table 10, page 10. Around 20% of the FAI sample claimed to be expanding their woodland cover on a regular basis and to leave some parts of their woodland stock to natural regeneration, while at the same time opening up their woodland resources. These activities were particularly prevalent on mixed shooting estates.

Assessment of the implications of the foregoing findings for forestry policy are necessarily speculative given the rather general nature of the data available. However, some tentative comments can be offered. First, the derived demand for land for sporting recreation – as well as for other forms of recreation – is increasing and this raises the social opportunity cost of land for extensive forestry cover. The demand for sporting shooting recreation

appears from the FAI study to be growing rather quickly, however, almost certainly at a rate faster than that indicated in Benson and Willis (1991) for forest recreation. Unfortunately, it is not possible to translate this demand increase for the activity into the derived demand for additional land. As noted earlier, the study indicates considerable supply potential, but this tends to be concentrated in properties towards the lower end of the size distribution of estates. Because demand increases are anticipated across all sizes of estates and all types of shooting, there is likely to be an increased demand for-land for sporting recreation, and other things remaining equal, a rise in land prices for such properties.

At a more disaggregated level, the FAI study found evidence to suggest that demand is increasing for each category of sport analysed, including the predominantly upland activities of deer stalking and grouse shooting, and the predominantly lowland pheasant, duck, geese and other woodland-bird activities. While it is reasonable to infer that the premium on land for sporting recreation will be highest nearest to large urban areas, the sport is one in which participants are willing to travel long distances, and a sense of isolation and exclusiveness can enhance the attractiveness of a particular venue.

The implications of this seem to be that new planting programmes close to population centres or within easy reach of airports and other centres of population are most likely to be competitive with sporting demands for land. Land which is currently devoted to grouse shooting is in scarce supply, and any extension of forestry into such ground would incur a very high opportunity cost (probably reflected in the market prices were this land to be available). Deer stalking land cannot accommodate substantial monocultural afforestation, although it is quite possible for an estate to plant a significant proportion of its land provided the sites were carefully selected to not interfere with the requirements of stalking.

Land area requirements for lowland sporting activities tend to be less extensive than for upland varieties of the sport, and can more easily accommodate extensive additional planting. However, there is clearly a trade-off between the size of game-bag on the one hand, and the quantity of timber derived from any given area of land. When designing land use policy, it is probably misleading to ask whether a given tranche is better suited for either sport or commercial timber, for example. A better approach is to consider the architecture and design of an estate as a whole, optimising the mix of different types of woodland, agricultural land and other open ground. Thus pheasant shooting can be accommodated within heavily wooded areas, provided there is a sufficiency of glades, cuttings and thinned woodland in the overall mix.

More generally, there would appear to be a significant complementary role for forestry in conjunctive land use management, combining agriculture, forestry and various forms of recreational use. In part this reflects the more heterogeneous nature of land in the UK compared with other land masses whose homogeneity and scale offer distinct advantages to monoculture.

If true, these comments would imply that the development of forestry will involve more dispersed and smaller units of woodland, designed to complement rather than displace other land uses. The effects of this pattern of development on the economics of forestry operations is beyond the scope of this paper, but economic theory suggests that smaller

production units should concentrate on higher value-added products, since overhead costs per unit of output are higher. Such a strategy may have implications for the management structure of the forestry industry, for incentives schemes for woodland development, and for associated downstream industries.

The forestry industry in the UK has largely developed as a public service strongly influenced by considerations of national security. The perceived importance of the latter has greatly diminished, to be replaced by concern over environmental issues. Our review of the sporting recreational use of land has to be viewed in the context of this strategic shift of emphasis, and supports the need for the reappraisal of forestry policy addressed by this series of Papers.

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'FORESTRY EXPANSION: A STUDY OF TECHNICAL, ECONOMIC AND ECOLOGICAL FACTORS'

This is one of a series of papers which form part of a study to consider the scale, location and nature of forestry expansion in Britain.

The Forestry Commission invited fourteen specialist authors, including economists, foresters, ecologists and biological scientists to write about current knowledge and to assess the main factors bearing on decisions about the future direction of forestry expansion. It is intended that the papers will form the basis for future discussions of the location and type of forestry that will best meet the demands of society for wood products, jobs, recreation, amenity, wildlife conservation, carbon storage and the other uses and public benefits supplied by the country's forests.

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The full list of papers is as follows:

<u>Occasional Paper No</u>	<u>Title</u>	<u>Author</u>
33	Introduction	Professor Ian Cunningham, Macaulay Land Use Research Institute
34	British Forestry in 1990	Hugh Miller, University of Aberdeen
35	International Environmental Impacts: Acid Rain and the Greenhouse Effect	Melvyn Cannell and John Cape, Institute of Terrestrial Ecology
36	The Long Term Global Demand for and Supply of Wood	Mike Arnold, Oxford Forestry Institute
37	UK Demand for and Supply of Wood and Wood Products	Adrian Whiteman, Forestry Commission
38	Development of the British Wood Processing Industries	Iain McNicoll and Peter McGregor, University of Strathclyde and Bill Mutch, Consultant
39	The Demand for Forests for Recreation	John Benson and Ken Willis, University of Newcastle
40	Forests as Wildlife Habitat	John Good, Ian Newton, John Miles, Rob Marrs and John Nicholas Greatorex-Davies, Institute of Terrestrial Ecology
41	Forestry and the Conservation and Enhancement of Landscape	Duncan Campbell and Roddie Fairley, Countryside Commission for Scotland
42	The Impacts on Water Quality and Quantity	Mike Hornung and John Adamson, Institute of Terrestrial Ecology
43	Sporting Recreational Use of Land	James McGilvray and Roger Perman, University of Strathclyde
44	The Agricultural Demand for Land: Its Availability and Cost for Forestry	David Harvey, University of Newcastle
45	Forestry in the Rural Economy	John Strak and Chris Mackel, Consultants
46	New Planting Methods, Costs and Returns	Jim Dewar, Forestry Commission
47	Assessing the Returns to the Economy and to Society from Investments in Forestry	David Pearce, University College London

The summary document is free; each of the 14 papers is available at £2.00 (including postage) and the full set is priced at £25.00 (including postage) from: Publications, Forestry Commission, Alice Holt Lodge, Wrecclesham, Farnham, Surrey GU10 4LH, Tel: 0420 22255 .

