REPRINT

from

JOURNAL OF
AGRICULTURAL ECONOMICS

Vol. 40, No. 3
September, 1989

suppress an important aspect of market-widening, i.e. the gains arising from product variety. Further, it was not possible to adjust for quality differences due to data constraints.

Sources: FAO Production Yearbook, Census of Production, Quarterly Business Monitor Series and OECD Trade in Commodities.

EC6 domestic prices relative to import prices from the UK (RP)

This was constructed as an index of representative EC6 domestic prices relative to import prices from the UK. EC6 domestic prices were based on published indices, the representative countries were as before. Import prices from the UK were constructed from import value and quantity data, except for fertilisers where export value and quantity data were used.

Sources: FAO Production Yearbook, Statistisches Jahrbuch fur die Bundes-republik Deutschland and OECD Trade in Commodities.

Net Farm Income (Y)
Source: Annual Abstract of Statistics, HMSO.

Index of EC Agricultural Production (Y)
Source: FAO Production Yearbook.

UK FISCAL CHANGES AND NEW FORESTRY PLANTING

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The taxation and grant arrangements for UK forestry were radically changed in April 1988. This paper considers the consequence of these changes for new forestry investment in Scotland by examining five models which describe different site types. The investment appraisals show that after April 1988 forestry will no longer be of interest to investors seeking a tax shelter or wishing to invest borrowed capital. Acceptable real returns to capital will be found only on relatively good quality sites. A major reduction in the rate of new planting is indicated and a shift away from poorer planting land. The rate and location of new planting will depend critically on farmland prices and the extent to which better-quality land is released for planting under the normal consultation procedures.

Introduction

Prior to the changes in the taxation treatment of forestry announced in the 1988 Budget, new forestry planting was primarily undertaken by private individuals with high marginal rates of income tax, attracted by the tax-efficient nature of forestry investment. Planting grants were also given but these were a less important stimulus to new planting (Crabtree, 1987; Stewart, 1987). Under Schedule D, income tax expenditure on establishment of a forest (apart from the capital cost of land) could be offset against liability to tax from other sources of income. A change of occupancy (by sale or gift) and reversion to Schedule B assessment prior to the major income flow from thinnings and clear-felling produced an income stream virtually free from income tax. The ability to receive tax relief on expenditure without any corresponding tax liability on forestry income placed forestry in a unique category of investments. A characteristic of these tax arrangements was that post-tax internal rates of return were not only higher than pre-tax rates of return but were highest for those paying tax at the top marginal rate. Although some new planting was undertaken by non-taxed institutional investors, this is thought not to have been very significant in proportionate terms (National Audit Office, 1986).

The 1988 Finance Act has radically changed the taxation rules for new commercial forestry. Forestry is removed from income tax so that expenditure can no longer be offset under Schedule D and there is no liability to income or corporation tax on sales of timber.The Act also reduced the

highest marginal rate of income tax to 40 per cent, which would itself have reduced post-tax returns from forestry investment. Partly to compensate for the loss of tax relief on establishment expenditure, the rates of planting grant (for areas of 10 ha or more) were increased by £375/ha, to £615/ha for conifers and £975/ha for broadleaves. To encourage planting on better-quality land, a 'better land' supplement of £200/ha was introduced for planting on arable land or grassland cultivated and reseeded in the previous ten years.

Table 1   Area of New Forestry Planting (ha)

	Private Woodlands			Forestry Commission		
	1985/86	1986/87	1987/88	1985/86	1986/87	1987/88
SCOTLAND						
Conifer	17,047	16,781	20,113	3,997	4,845	4,320
Broadleaved	245	439	1,084	41	221	297
Total	17,292	17,220	21,197	4,038	5,066	4,617
GREAT BRITAIN						
Conifer	18,170	17,799	21,326	4,277	5,072	4,579
Broadleaved	849	1,348	2,495	56	270	373
Total	19,019	19,147	23,821	4,333	5,342	4,952

Source: Forestry Commission (1988b)

This paper examines the possible impact of these changes on new forestry investment. It is deliberately restricted to Scottish conditions because around 90 per cent of new private sector planting has been located in Scotland in recent years (Table 1) and restrictions on coniferous planting in England (Ridley, 1988) will continue to concentrate most new commercial planting in Scotland. Farm forestry, specifically supported by the Farm Woodland Scheme, is not considered.

Investment Appraisal

Five models were developed to cover a range of Scottish site types and their associated species, management systems, costs and revenues (Table 2). Three of these models cover traditionally important upland site types. Model 1 is typical of exposed peaty sites above 300m in North and West Scotland, whereas Models 2 and 3 would typify dry heaths in East Scotland and hill sheep ground in the Southern Uplands, respectively. Because of the increased support for planting on 'better land', two other models were used to cover higher coniferous yields and broadleaved planting (Models 4 and 5).

In all cases, typical costs for commercial planting were used, timber yields were obtained from standard yield tables (Forestry Commission, 1987), and timber prices were based on long-run price-size curves for Scottish conifers (Forestry Commission, 1986). Real prices were assumed to remain constant over time. Recent prices for Scottish standing conifer sales (Forestry

that real prices will increase over time. Such assumptions are, however, difficult to defend (National Audit Office, 1986) and are not used in the present analysis.

Table 2 Description of Forestry Models

	Species	Yield Class	Windthrow Hazard Class	Thinning Regime	Rotation Length (Years)
Model 1	Sitka spruce: Lodgepole pine mix (1:1)	12	5	No thin	46
Model 2	Sitka spruce	14	4	Thin	43
Model 3	Sitka spruce	16	3	Thin	42
Model 4	Douglas fir	18	2	Thin	46
Model 5	Sycamore	8	2	Thin	60

For each model* an annual cash-flow stream over a single rotation was derived for a 200 ha block of new planting with all costs based on 1988 prices. As an example of the basis on which the cash-flows were constructed, the data for Model 1 are given in the Appendix. Calculations of real internal rates of return for the investments under pre-April 1988 tax and grant arrangements were made both before and after tax. The taxed investor was assumed to have a constant marginal tax rate of 60 per cent and to switch from Schedule D to B at the 20th year (prior to first thinnings in all models). Costs incurred after the 20th year were taken as non-allowable against tax and income tax-free. No tax effects were considered in the appraisal of the post-April 1988 situation. Prices from planting land sales are available (e.g. Scottish Landowners' Federation, 1988) but these are based on a small sample size. The average price in the year to April 1988 was £725 per ha with a range of £600-1060 per ha. It is known, however, that large areas of poor-quality planting land were sold for around £250 per ha, suggesting that actual prices were more variable than indicated in the sample. In the absence of better data it is assumed here that typical land values for Models 1-3 are £550, £700 and £850 per ha respectively. These prices are not critical to the analysis, since the range £0-£1200 per ha was examined in each case. For 'better land' (Models 4 and 5), no relevant published price data were available and a price of £1200 per ha is used in the examples. Real land prices were assumed to remain constant over time such that the residual value at the end of the single rotation equalled the purchase price.

Internal Rates of Return on New Planting

Returns to capital for all five Models are shown in Table 3, calculated over a range of purchase prices for land. On traditional planting land (Models 1-3), the switch from tax allowances to enhanced grants increases the return to non-taxed investors by 0.5 per cent whereas for investors previously taxed at 60 per cent it is reduced by up to 0.4 per cent. With conifers on 'better land' (valued at £1200/ha), the pre-tax IRR is increased from 4.5 per cent to

5.2 per cent but the broadleaf system produces a very poor return of 2.9 per cent even in the post-April situation with the planting grant supplement for 'better land' of £200 per ha. The poor performance of the broadleaves reflects the low growth rate expected (yield class 8) and the long rotation length of 60 years. A very substantial shift in the hardwood prices would be needed to produce an IRR of interest to commercial investors — a doubling of timber prices merely increases the return from 2.9 per cent to 4.4 per cent. It should, however, be noted that investment analysis of hardwood options is difficult due to the variability in timber quality, and hence price, which may be produced at the end of the rotation.

Table 3   Real Internal Rates of Return on Capital (%) from Different Forestry Models Under Tax and Grant Arrangements Before and After April 1988

(Figures in bold refer to the land prices assumed centrally for each model)

		Land Price (£/ha)					
		0	250	550	700	850	1200
Model 1							
Before April 1988	Pre-tax	3.1	2.8	**2.5**	2.3	2.2	2.0
	Post-tax	4.8	4.0	**3.4**	3.2	3.0	2.7
After April 1988		4.0	3.5	**3.0**	2.8	2.7	2.4
Model 2							
Before April 1988	Pre-tax	4.6	4.1	3.7	**3.5**	3.3	3.0
	Post-tax	6.5	5.5	4.7	**4.4**	4.1	3.7
After April 1988		5.7	4.9	4.3	**4.0**	3.8	3.4
Model 3							
Before April 1988	Pre-tax	6.2	5.5	4.9	4.7	**4.5**	4.0
	Post-tax	8.2	6.9	5.9	5.6	**5.2**	4.7
After April 1988		7.7	6.5	5.7	5.3	**5.0**	4.5
Model 4							
Before April 1988	Pre-tax	6.6	5.9	5.3	5.1	4.9	**4.5**
	Post-tax	8.5	7.2	6.3	5.9	5.6	**5.0**
After April 1988		9.7	7.8	6.6	6.2	5.8	**5.2**
Model 5							
Before April 1988	Pre-tax	3.8	3.4	2.9	2.8	2.6	**2.3**
	Post-tax	5.3	4.3	3.6	3.3	3.1	**2.8**
After April 1988		*	5.1	4.0	3.7	3.5	**2.9**

* IRR does not exist — initial grant payment exceeds investment costs.

Because of the differential effects of the changes to the tax and grant arrangements depending on the tax position of the investor, the impact on taxed and non-taxed investors is examined separately.

(i)   Taxed Investors

payments does not therefore fully compensate for the loss of tax offset, particularly for sites with relatively high establishment costs where the value of the tax offset was highest. To maintain the returns to capital, land prices would have to fall by around £300 per ha on the upland peat site (Model 1) but rather less (£100 per ha) on the better upland soils (Model 3).

The decline in IRR is, however, only one of several factors which will reduce demand for planting land by taxed investors. Prior to April 1988 the ability to reduce tax payments directly by offsetting planting expenditure against other taxable income provided an important and identifiable investment stimulus which is no longer present. In addition, the reduction in the highest rate of marginal taxation to 40 per cent has increased the opportunity value of capital for investors taxed at the highest rate. For example, if 20-year government bonds are used as the alternative investment, then at April 1988 nominal yields of 9.1 per cent (CSO, 1988), and assuming all income is subject to income tax, the after-tax return from bonds increased from 3.6 to 5.5 per cent or by around 1.9 per cent.

A further change affecting investment behaviour is that interest on cash borrowed for forestry investment will no longer be an allowable expenditure under Schedule D. The effect of this on the opportunity cost of borrowed capital is considerable* and effectively rules out any forestry investment using borrowed capital unless amenity or other benefits not considered here are important.

For these various reasons, investors looking for a tax offset to reduce their immediate tax liability will find forestry much less attractive than hitherto. Any attraction in forestry investment is now likely to be located with individuals or organisations investing non-borrowed capital, not seeking a tax offset against current income and prepared to invest for long-term tax-free returns.

(ii)   Non-taxed Investors

Prior to April 1988 the amount of new planting undertaken by institutional investors was quite small. For such non-taxed investors the enhanced level of planting grant increases returns by around 0.5 per cent at existing land prices. In analysing whether this increase will lead to effective demand for planting land by institutions, the return from long-term index-linked gilts is used as a risk-free baseline for comparative purposes. Returns average 3.7 per cent in 1987, increasing to 3.8 per cent in early 1988 (CSO, 1988). To invest in new planting it seems likely that the risk/liquidity characteristics of forestry will lift the required IRR to a minimum of 4 per cent and probably to at least 5-6 per cent (National Audit Office, 1986). Poor planting land cannot achieve this even at a zero land valuation, but on higher-quality sheep grazing it does seem possible to achieve 5 per cent at current prices. A higher premium over gilt-edged returns would require a corresponding fall in land prices, but a quite substantial fall in price of around £500 per ha would be needed to lift the IRR by 1 per cent (Table 3).

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* The real after-tax rate of interest (r) is $(1+m(1-t))/(1+i)-1$
  where   m is the nominal interest rate
            t is the marginal tax rate
            i is the expected inflation rate

Forestry Policy

The changes in government support for forestry announced in April 1988 appeared to be a response both to pressure by the environmental lobby (e.g. RSPB, 1987; NCC, 1986), and to public concern about the use of forestry as a tax-avoidance measure by high-income individuals. Some stimulus for change may also have resulted from the analysis of government forestry policy by the National Audit Office (1986). The stated objectives of the new arrangements are to maintain the target UK planting rate at 33,000 ha per year, to encourage a higher proprotion of planting on low ground of better quality, and to increase the share of broadleaves in the area of new planting (Rifkind, 1988).

The change in government support for new afforestation, following the switch from tax incentives to enhanced grant payments, can be measured by the impact on new investment as discussed above. A second approach is to calculate the change in public expenditure associated with the switch of policy instruments. Only a simplified analysis is presented here, since the precise response of investors, in terms of species, locations and the area of new planting, is not known, and no attempt has been made to account for the change in exchequer cost associated with a change in land use. Any policy effect on land prices would also have public expenditure implications insofar as it affected the price of land purchased or sold by the Forestry Commission.

Table 4 Changes in Per-Hectare Public Expenditure Before and After April 1988

After April 1988 planting grant cost compared with:

Model	Before April 1988 Grant and 60% Tax Offset (£ per ha)	(%)	Before April 1988 Grant and 40% Tax Offset (£ per ha)	(%)
1	−200	−26	−20	−3
2	−180	−24	−10	−2
3	−98	−15	+48	+9
4	+104	+16	+248	+48
5	+210	+24	+322	+42

+ (−) Indicates an increase (reduction) in public expenditure for 10+ ha blocks.

The figures are net changes in exchequer cost derived as present values using the 5% Treasury test discount rate.

The cost in terms of tax offset and grant payments for the pre-April situation can be compared with the post-April grant cost on a per hectare basis. Table 4 shows that, for Model 1, the discounted stream of public expenditure falls by £200 per ha when the comparison is made at the 60 per cent tax rate. This is the difference between the pre-April cost of £764 per ha and the post-April cost of £564 per ha — a reduction of 26 per cent. In this case the savings realised from taking forestry out of income tax exceed the increase in the planting grant. Where establishment costs are lower (Model 3), the exchequer saving is less and for 'better land' sites the much enhanced

enhanced grant levels lead to very little change in public expenditure per hectare on traditional planting sites but a sizeable increase elsewhere. Thus in public expenditure terms the new grant levels have been set at a level which leaves support roughly unchanged for coniferous planting on traditional sites. The support for 'better land' planting is increased. The anticipated reduction in the total area planted will, however, lead to a reduction in total expenditure.

The analysis of changes in the returns to investment consequent upon introduction of the new support arrangements allows comment on the extent to which the new policy objectives may be achieved. The commitment to the target planting rate of 33,000 ha per year remains as a fundamental objective although the precise definition of 'target' has always been obscure. The previous target of 30,000 ha was not achieved, and unless the Forestry Commission dramatically increases its planting the indications here are that there will be a substantial fall in the rate of new planting. There will be little demand for planting on low-yield class sites with high establishment costs, since returns are unattractive for all investors even at very low land prices. This can be generalised to include most sites in yield class 14 or less. Since the average yield class for private sector Sitka spruce is estimated as 12 by the Forestry Commission for its North and Central Conservancies (Kupiec, 1988), the implication is that large areas of North and West Scotland will become unattractive for planting. Even on the Model 3 yield class 16 site, the land price would have to fall before the expected return is likely to interest institutional investors.

For more productive sites on improved land the returns to capital have the potential to produce a demand for planting land, but two factors will be important determinants of the rate of planting. Firstly, land must be 'released' by DAFS as part of the normal consultation process. The existing guidelines (Scottish Office, 1986) give a presumption in favour of forestry for hill land with unimproved peat and peaty gley soils but a presumption against forestry for higher quality land (Land Capability for Agriculture classes 1 to 3). It could therefore be that areas of land technically free for planting will not find a demand from forestry whereas high-quality hill land will not be released under the consultation process. Secondly, the extent of planting on 'better land' will depend critically on land prices which will reflect demand for agricultural, residential and amenity purposes. Where land prices are largely determined by expectations of income from farming, it is clear that the support offered to agricultural incomes through agricultural policies will be a key determinant of the rate of new forestry planting. While price policy provides the main support for farm incomes in the uplands (Crabtree, Evans, Revell and Leat, 1987) the more specific role of socio-structural policy in the Less Favoured Areas and the new initiatives of set-aside, diversification and extensification will all provide support for land prices and reduce the rate of afforestation that might otherwise have taken place.

In terms of other government policy objectives for forestry, the decline in the use of forestry as a tax shelter will certainly lead to a move away from investment dominated by highly taxed individuals. There will be a shift in balance towards investment on better land and the loss of forestry interest in poor, exposed land will reduce conflicts between forestry and conservation interests. For example, the conflicts over afforestation on the poorest forestry

While this paper has not attempted to cover the variety of broadleaved planting that could be entertained, it does suggest that such investments will normally not be made with income from timber as the sole objective. Amenity, sporting and other factors will be relevant. In 1986/87 broadleaved planting was only 7 per cent of total new planting in Britain, and, while there may be a shift away from conifers, the increased grant levels are quite inadequate to stimulate new commercial broadleaved investment.

Discussion

This analysis of the consequences of changes to the tax and grant arrangements for forestry indicates that most of the stated policy objectives (Rifkind, 1988) will be met. The main exception is that the annual rate of new planting will fall, as the important set of high-tax investors find forestry much less attractive. At current land prices there will be a major shortfall in the 'target' planting rate of 33,000 ha per year. This view is supported by other analyses (Economic Forestry Group, 1988; Taylor, 1988). Much depends on the interest of institutional and other investors with substantial capital for long-term investment and on whether land prices adjust downwards sufficiently to produce satisfactory returns to capital. Even so, the analysis suggests that much of the poorer planting land will cease to be of interest for forestry and the focus will be on higher-quality hill land and land of limited agricultural potential that qualifies for the 'better land' supplement. To maintain the rate of planting observed in recent years will require not only a substantial fall in land prices, which implies reductions in the degree of agricultural support, but also a greater flexibility in the release of agricultural land for planting. Whilst the planting target has no locational context, it appears that a major shift of new planting in Scotland will occur away from poor land in the north and west towards better sheep grazing and improved farmland.

While the policy objective to increase the proportion of broadleaves planted may well be achieved, it is less clear that an expansion in the absolute broadleaf planting will occur. Single-stem broadleaves are characterised by low rates of growth, long rotation lengths and very low internal rates of return. Unless higher timber prices can be achieved for higher quality output or other benefits obtained (e.g. from shooting), the scope for a response to the enhanced grants for these trees is very limited.

There are other implications of the expected reduction in planting rates and the locational shift in planting which have not been considered in detail here. One concerns rural employment. While employment comparisons between forestry and agriculture are subject to controversy, in part because of the different time profiles involved (Johnson and Price, 1987), any move to planting land with greater agricultural potential will cause a net loss of employment relative to the pre-April situation. Reduced new planting also has implications for the growth in timber supply for the processing industry but this is of no immediate significance. Not only are supplies assured from the current growing crop but the granting of felling licences normally carries a re-planting requirement.

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APPENDIX

Details of Costs and Revenues for Model 1

Costs Operation	Cost (£/ha)	Year	Before April 1988 Year	Before April 1988 (£/ha)	After April 1988 Year	After April 1988 (£/ha)
Initial Roading	120	0	0	192	0	430.5
Deer Fencing	100	0	5	48	5	123.0
Ploughing	114	0			10	61.5
Drainage	60	0				
Planting	350	0				
Fertilising	105	0				
Fertilising	105	8				
Fertilising	105	15				
Beating-up	55	1				
Weeding	40	2				
Drainage	8	10				
Final Roading	72	45				
Protection/ Insurance	6/year	0-46				
Management/						

Revenue from Grants

Revenue from Timber

Year	Volume (m³/ha)	Price (£/m³)
46	360	14.8