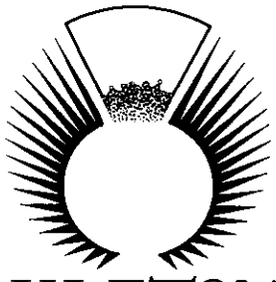

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The Arkleton Lecture 1979

THE AGRICULTURAL POTENTIAL OF MARGINAL AREAS

by

Professor J.M.M.Cunningham

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INTRODUCTION

The Arkleton Lecture was given on 5 June 1979 by Professor J.M.M.Cunningham, Director of the Hill Farming Research Organisation, Penicuik, Midlothian.

The occasion was a seminar of the Arkleton Trust held at Arkleton, Langholm, Dumfriesshire on 'Disadvantaged Rural Europe - development issues and approaches'. The purpose of the seminar was to consider problems of agricultural structure and education which have led to economic stagnation and decline in many of Europe's marginal areas. The participants in the seminar came from eight European countries and a number of international agencies. A report of the seminar is published separately.

The author wishes to acknowledge the help of three of his colleagues in the preparation of this paper, Mr J.Eadie, Dr P.Newbould and Dr T.J.Maxwell.

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THE AGRICULTURAL POTENTIAL OF MARGINAL AREAS

The remote rural areas have a long history of continuing depopulation: there are problems of farm structure and current argument about land use in general raises important issues of concern for the future.

Recent advances in agricultural science and technology indicate opportunities for improving the economic state of marginal agriculture by increases in production and productivity. The extent to which such improvements are made in practical agriculture will depend on a complex of other factors. These include issues to do with the environment, product markets and prices, farm structures, human attitudes including the quality of life, transportation and rural population trends.

The introduction of new technology is only one aspect of problem solving in marginal areas and the desirable overall policy package may be to a subtantial degree indivisible since changing one part may affect one or all of the other parts at a local, regional, national or European Economic Community (EEC) level.

THE LESS-FAVOURED AREAS

The areas designated in the EEC Council Directive 75/268 extend to 34.28 million hectares (m ha) and are of significance in all countries of the EEC Nine not only because of the overall proportion of land but also because of their importance in animal production (Table 1). Studies (1) show that considerable areas are being abandoned and around 2.3 m ha in Italy and 1.5 m ha in France have gone out of agricultural production whereas in Great Britain the main loss of 38,000 ha per annum (2) is to afforestation (30,364 in Scotland). It has been suggested that in Continental Europe the integration of mountain and lowland zones must be developed, the latter producing high energy crops for beef animals and the former developed for breeding beef animals for which they are more ecologically suited than milk (3). Of the total livestock units in these areas - 14,688 million - 59% (8,713 m) are eligible for headage payments including 2,488 m dairy cows. A significant percentage of the Community's sheep stocks - two-thirds (28 m out of the 43 m) are to be found in the regions covered by this Directive (4).

Because of the massive surplus of dairy products in Europe there will clearly be considerable pressures for change and

Table 1.

U.A.A., farms, livestock and livestock densities in less-favoured areas by member countries

Country	Utilised agricultural area (m ha)					Farms 3 ha +		Livestock		
	Mountain areas	Less-favoured areas	Special handicap areas	Total ha	% of total national U.A.A.	Number	% of national total	Livestock units (L.U) millions	% of national total	No. of L.U.s/ 100 ha U.A.A.
Belgium	-	0.31	-	0.31	19.7	16,000	13.1	0.42	21.4	135
France	4.15	7.02	0.33	11.50	35.1	601,581	40.3	6.19	34.1	54
Germany	0.35	3.40	0.26	4.01	29.7	271,700	25.1	2.58	26.3	64
Ireland	-	3.53	-	3.53	54.4	144,900	53.7	1.92	36.6	54
Italy	4.90	2.03	0.20	7.13	40.7	440,665	20.3	1.67	21.0	23
Luxembourg	-	0.12	0.01	0.13	99.1	4,400	99.0	0.14	99.0	108
Netherlands	-	-	0.01	0.01	0.6	3,650	2.4	0.01	-	100
United Kingdom	-	7.65	-	7.65	41.0	51,400	16.4	2.20	15.6	29
E.E.C.	9.40	24.08	0.80	34.28	35.8	1,534,277	26.4	15.1	26.1	44

Source: Scully, J.J. E.E.C. Brussels

this most probably will be towards beef breeding. At present the EEC Nine are around 95-97% self-sufficient in beef production so opportunities for expansion appear to be limited. On the other hand the EEC Nine produces only 64% of its consumption of sheep meat and it is generally assumed that the UK with approximately 25% pf the EEC sheep flock and as the leading producer of 50% of Community production is well placed to reap some advantage which could be of benefit to the hills and upland areas. The extent to which this might be realised will depend not only on basic biological differences and the application of technology but ultimately on the economic competitiveness of the hill and upland areas in Great Britain and the pressures to use this land for other purposes, e.g. forestry.

Approximately 80% of the land in Italy is hill or mountain with stony and shallow soils subject to severe moisture stress. In the central hilly region 70% of the annual herbage production is obtained in the spring with near zero summer production. The Massif Central, a major disadvantaged area in France, has many free-draining brown earths but these are subject to stoniness, slope or depth limitations. At 1,000 metres, and with heavy fertilisation, yields of 10,000 kg dry matter /ha have been obtained and while adequate summer rainfall may favour grass growth, production is more generally likely to be at the level suggested in Table 2, and a long wintering period is a major constraint.

Table 2. Experimental forage yields in disadvantaged areas of the three EEC countries

Country	Region	Elevation m	Precipitation mm	DM Yield	N applic.	Ref.
Italy	Juribello Alps	1880	-	2660	0	(26)
"	"	"		6110	240	(26)
"	Sicily	1400	-	4130	80	(27)
France	Cantal	950	1650	4590	67	(28)
Germany	Rhon area	1000	1000	(1000	60	(29)
"	"	"	"	(4250	120	
"	Alps	"	"	(2130	Nil	(30)
				(6210	Int	

Generalised comparisons of yields can be both inadequate and misleading because of the range and variability of factors involved, climate, soils, fertiliser input, etc., both on a within and between country basis. However, the data in Table 2 do not suggest that the disadvantaged areas of Continental Europe have any major advantage in terms of yields of

primary product over those in Britain and Ireland (Table 3).

Table 3. Likely responses of four indigenous hill vegetation types to pasture improvement by moderate grazing control alone or to the establishment of sown pasture with good control of grazing. Estimated average annual levels of DM (kg/ha) and seasonal range of digestibility (DDM %)

Indigenous sward	No fence		+ fence		+ fence and sown pasture	
	yield	DDM	yield	DDM	yield	DDM
Acid grassland (sp. poor)	2500	76-40	2800	76-50	6000	78-66
Dry shrub heath (Calluna)	2000	60-40	2000	60-50	5000	78-66
Wet grass heath	1500	70-35	1600	72-55	4500	78-66
Bog	1400	68-40	1400	68-40	4000	87-66

after Newbould (1976).

Of greater significance are differences that occur in the difficulties and constraints in the utilisation of the basic resources. Animal production systems are extremely diverse because of the seasonality of plant production, the opportunities and problems for fodder conservation, the range of alternative animal foods available, the class and type of animal and the product of the enterprise. Furthermore, the social, cultural and economic framework within which production takes place, gives rise to part-or wholetime involvement in agriculture, differences in economic expectations and in the role and value of agricultural systems. Thus in Alpine regions transhumance systems, in which the mountain pastures are grazed in summer by sheep and cattle with the latter being in-wintered at lower elevations while the sheep flocks scavenge on arable farms during winter, are in marked contrast with the settled agriculture involving year-round grazing of sheep on a specific area of land which is characteristic of UK hill sheep farming.

National goals and regional policies for the less-favoured areas also vary and grounds for comparison are difficult to establish and may not be relevant. Indeed it is questionable if an overall EEC policy in regard to the disadvantaged areas would be sensible other than the acceptance that problems exist, local schemes will be required and that financial assistance for support measures is essential.

The common ground for the biologist is in the study of the resources - plant and animal - their potential, utilisation and role in systems of animal production and their relationship to forms of land use.

This paper examines the contribution of research to hill farming in Scotland and the opportunities and possibilities that exist for change in the industry.

THE ORGANISATION OF RESEARCH

As far as agriculture is concerned, Great Britain is the only country in Europe which has a research institute, the Hill Farming Research Organisation (HFRO), with responsibility to investigate problems of food production in its less-favoured areas. Its remit, however, is limited to improving the economic viability of meat production on hill and upland farms. This involves research into the factors influencing both plant and animal production at both the component and systems levels. The latter has led to the development and promotion of improved systems of hill sheep production by the official advisory services.

Other organisations are also involved in research in relation to the mountain and hill areas - the Institute of Terrestrial Ecology, the Forestry Commission, the Countryside Commission, and several university departments.

It is arguable that biological, economic and sociological studies might be more effectively and productively pursued and co-ordinated under the aegis of a single organisation but this view has not prevailed in Great Britain.

HILL FARMS IN SCOTLAND

These are units in which 90% or more of the land is classified as rough grazing. There are 1,005 such units and the average farm extends to 1,698 ha and carries 935 ewes and 26 beef cows. Sheep flocks are set stocked and are dependent on pasture the year round apart from a limited provision of fodder in times of storm or supplementary food in late pregnancy while cattle are customarily fed during winter.

The main problem in economic terms is that net farm incomes are substantially lower than for other farm enterprises and types.

The limitations to production are several and are illustrated in Figure 1. Hill soils are acid and low in available phosphorus (5) and in many have an accumulation of organic matter, either within the profile or on the surface as peat, the depth of which can be variable, (5 - 3,500 cm). The main range of hill soils and vegetation types are listed in Table 4, and this is a simplification of a wide variety of intermediate types.

Figure 1. The main limitations to production from the uplands

Limitation	Nature: Permanent	Nature: Temporary
Climate	Temperature, rainfall	Wind (shelter)
Site	Topography, rockiness, access	Wetness (drainage)
Soil	Stoniness, texture, parent material	Acidity (+ lime), Fertility (+ N,P,K & trace)
Vegetation	Weeds, eg rush, seeds	Low yield, poor quality (Replace + better species)
Management	Farm size - Business more often than area	Traditional - year-round set-stocked (Change by strategic control of grazing and breeding times with fence: feed: veterinary medicines)

( ) = means of removing temporary limitation

Table 4. The main hill soils and vegetation types

Soil	pH	Vegetation
Brown earth	5.2 - 5.5	Acid grassland (sp rich)
	4.6 - 5.2	Acid grassland (sp poor)
Gleys, peaty gleys	4.0 - 5.2	Grass heath
Podsols, peaty podsols	3.8 - 4.5	Shrub heath
Blanket peat	4.0	Bog

after Newbould (1978)

TECHNICAL INNOVATION

From an increasing understanding of soils and how to improve their nutrient status for increased plant production and associated work, a number of techniques have been developed for the reclamation of hill land (6). These vary from grazing management alone to soil amelioration and the introduction of new species. The effects of a range of techniques suitable for unimproved rough grazings are shown in Table 3.(page 4)

Since current levels of utilisation of native pastures are extremely low, being around 20-25% at best for *Agrostis-Festuca* and about 10-15% for blanket bog and heather-dominant communities, opportunities for improving utilisation should and indeed do exist. Experimental work (7) demonstrates that improved utilisation is possible, without detriment to sheep performance and also without deterioration in the indigenous species content.

An analysis of the biology of the hill sheep problem and a synthesis of the available knowledge has been made and this shows the potential for production of the hill ewe to be adequate and that manipulation of nutrition during the important physiological phases - lactation, pre- and post-mating, and late pregnancy - can lead to significant increases in the lamb crop both in numbers and quality (8). Central features of the new system are (a) land improvement and (b) the way in which it is used.

These improved systems have been evaluated in practical farm scale tests in widely contrasting hill environments with outstanding results (Table 5)

Table 5. Examples of production increases in hill sheep farm improvement schemes

Location, area and period	Sheep breed	Land improved %	Increase in ewe numbers %	Increase in weight of lamb output %
Southern Scotland Sourhope 283 ha 1969 - 1976	Cheviot	7*	57	152
West of Scotland Lephinmore 444 ha 1956 - 1976	Blackface	11	121	218
Upland Northumberland Redesdale EHF Dargues Dipper 162 ha 1969 - 1976	Blackface	16	122	292

*In addition to 20 ha (7%) improved by surfacetreatment, some 100 ha of Agrostis-Festuca grassland have been enclosed and improved by grazing control.

Because of the high costs of land improvement (Table 6) which can be exacerbated by problems of access and slope and the short-term cash flow consequences of capital expenditure (9), the area of improved pasture must be relatively small. The capital requirement cost to the farmer of £5 -£15 net per ewe for hill sheep systems development are considerable in relation to the creation of a capital fund from profits. However, results show that returns of the order of 15 - 20% on invested capital are realised.

Table 6. The main processes of hill land improvement and their relative cost

Fence to control grazing	Cost relative to fencing
Alone	1.0*
+ herbicide - Dalapon (to reduce Nardus)	1.3
-Asulam (to control Pteridium)	1.7
+ lime and phosphorus	2.1
+ lime, phosphorus and white clover seed	2.2
+ lime, phosphorus , nitrogen, potassium, white clover and grass seed	
- by oversowing	3.2
- by light cultivation	3.7
- by ploughing	4.4
+ deep tile drainage	7.6

*The base line was taken as £85, i.e. the gross cost per ha of enclosing an area of 8 ha with a cheap mains electric fence costing £0.60 per m

Although these technical advances will not significantly alter the dominant influence of climate on the length of the growing season or on the difficulty of harvesting crops in the hills, the ideas on which they are based seem to be relevant and applicable to a wide range of hill environments and can accommodate many of the regional variations in farming practice.

The problem of cyclical nutrition is characteristic of many environments including those which are more arid as in Mediterranean areas. Here also the provision of small areas of high quality forage by means of the use of suitable plants, e.g. subterranean clover, or irrigation for the production of herbage for grazing or cutting could have a significant influence in animal production.

Upland farms usually have at least 50% or even all of the land

classified as enclosed, sown, short-term and permanent pastures. Opportunities for conservation are greater so cattle become more important. The systems of animal production based on crossbred breeding females - sheep and cattle - are in many respects more similar to those of the lowlands. The higher altitudes, shorter growing season, poorer soils and topography are the factors which constrain the levels of production and systems possibilities relative to the lowlands. Farms in this category are more numerous; there are 5,688 in Scotland with an average of 197 ewes and 49 beef cows. There has been a fall in the numbers of beef cows receiving the hill cow subsidy in Scotland from 459,000 in 1975 to 442,000 in 1978. Numbers are declining because of the removal of the calf subsidy, the level of calf prices and the rapid escalation in fodder prices, leading to a substantial drop in profit levels. Many farmers, especially those on hill farms dependent on purchased fodder, have significantly reduced cow numbers or have dispersed their herds entirely. Undoubtedly it would appear to be more sensible in the longer term for cattle numbers to be limited to those which can be sustained on the winter fodder production capabilities of the farms so as to eliminate fodder purchases.

Meat and Livestock Commission surveys show that stocking rates and outputs of weaned lambs are substantially lower than obtained in the lowlands, 9.1 as compared to 11.4 ewes/ha and 427 as compared to 636 kg weaned lamb/ha yet the most profitable third of the recorded flocks attained an average of 10.4 ewes/ha.

Although average stocking rates for beef cows would be around one ha/cow it has been demonstrated that 0.4 ha/cow (1 acre/cow) of productive grassland with moderate nitrogen fertiliser inputs will meet grazing requirements and produce a substantial part of the winter feed requirements(10).

In the south-east of Scotland (11) a system based on the annual rotation of sheep, hay and cattle or simply alternating cattle and sheep each year to provide 'clean' grass has demonstrated impressive increases in production. Summer stocking rate of ewes has been increased from 7.5 to 10 to 12 to 15 ewes/ha. This intensification of the sheep enterprise has enabled farmers to increase the acreage released in several ways and on average the percentage increase on the farms adopting the new methods has been an increase of 23% cereals, 21% sheep and 14% cattle. The performance of the sheep flocks has been maintained or improved with no increase in fixed costs, the ewe flock having risen to 668 ewes/man.

ALTERNATIVE USES

Apart from agriculture the unimproved native grasslands are used for forestry, sporting purposes, nature conservation, recreation, water collection and military training, the last three being prominent only in limited locations. Some of these uses give rise to conflict in requirements for land and in mutual interference.

Alternative strategies for the use of this land are the subject of considerable contemporary argument and debate. However, it is around the two main potential uses of this land - agriculture and forestry - that discussion must revolve. Both can state powerful claims for import saving and the production of essential commodities. But it is extremely difficult to predict the developments in market demands and production techniques which will occur in the next 25 years and which might contribute to determining the size of each of these industries. The only certain thing about the future is its uncertainty and therefore prudence dictates that flexibility must be retained and options kept open. In any event the consequences of change as it will affect many rural communities is not fully understood and if a viable social structure is to be retained in the remote areas it will be necessary to proceed with caution.

CASE FOR DEVELOPING HILL AND UPLAND AGRICULTURE

Are there, however, good reasons for investing in and so developing upland and hill agriculture? It has been argued (12) that the use of arable land for livestock production is wasteful and this activity ought to be confined to the 'upland' areas. An alternative view (13) is that because these areas contribute only 7% of the gross agricultural output their contribution is of little importance and is sustained at an unacceptable cost to the nation.

On the assumption that present levels of production are maintained, I estimate that replacement of the 'uplands' would require 0.5 - 0.6 m ha (1.25 - 1.5 m acres) of lowland Britain. This would have to carry the 3.0 m ewes which the Meat and Livestock Commission consider would be needed to provide the present contribution, 50% of national lamb production, from upland and hill ewes as well as the 800,000 or so cows receiving subsidy.

Also of concern is not only the cost but the amount of fossil energy subsidy required for intensive agriculture. Extensive grassland based systems are especially sparing of energy use (14) and could well assume an increasing importance not only

for this reason but also because the rate of expansion of production has now declined to around 2% per annum in lowland agriculture and may not increase (15).

Market opportunities within the EEC undoubtedly exist for animal products. Currently the EEC Nine is only 64% self sufficient in lamb and mutton and around 95 - 97% in beef. It is anticipated (16) that both sheep meat and beef consumption will continue to rise in Continental Europe and UK producers can certainly compete on equal terms with Continental producers. A valuable export market for sheep and sheep meat to Europe from the United Kingdom has developed, even though a sheep meat agreement has not yet been concluded. Mutton and lamb exports from the UK in 1978 amounted to 41,400 tonnes, 7% less than in 1977 but there was a substantial increase in live sheep exports from 356,000 in 1977 to 587,000 in 1978.

The addition of Greece, Portugal and Spain to the EEC will increase the size of the potential export market. However, the danger is that uncontrolled trading would pull a substantial part of the UK production into the Continent leading to a massive decline in sheep flocks in the less-favoured areas in France and Germany. There could also be a price explosion leading to a collapse of the UK market which is currently the most important.

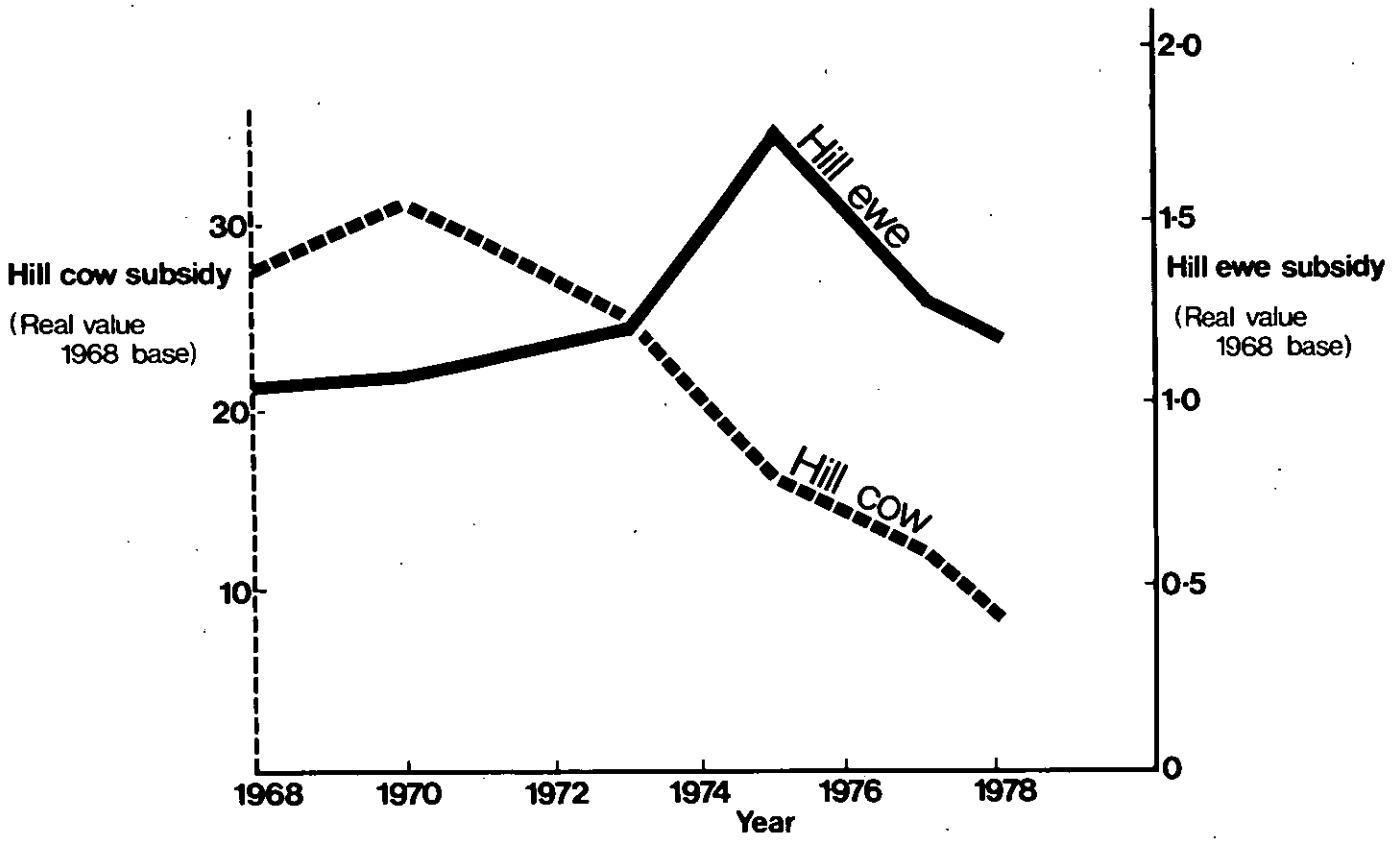
Wilson (17) has suggested that to exploit the potential market, producers must take on a new, invigorating, active, forward-looking stance and lay aside the conservatism, traditionalism and isolation which have hindered development in the past. To what extent are these strictures pertinent to marginal farmers?

CONSTRAINTS TO USE

There are a number of factors which suggest that the rate of application of new technology will be slow in hill farming. Indeed, there is a time lag in the uptake of many research ideas of up to at least a decade in some instances (18). Historically change has been limited in extent since traditional lore and experience play a greater part in extensive systems. It is to be anticipated that there will be a continuing and innate resistance to change. The extent of agricultural training among the people of these areas could have an important influence on the rate of change. Vincent-Evans (19) quotes from data from the National Economic Development Office which shows that in areas where hill farming dominates only 7 - 9% of farmers and 9 - 12% of

agricultural workers have agricultural qualifications. We do not know whether those who have received an agricultural education run more profitable agricultural businesses but I imagine most people assume they do. Perhaps we ought to find out?

Figure 2. The real value of hill subsidies



Notes 1. Hill cow subsidy plus calf subsidy. 2. Winter keep supplement not included. 3. Deflated by Retail Price Index.

after Slee (1979)

The acceptance of technological innovation in hill farming in Scotland is not notably apparent, there being little evidence of many farmers following in the footsteps of the industry's progressive innovators. But uncertainty in the predictability of income, a fall in the real value of headage support (Figure 2), notably for cattle, and the recent cost inflation continue to detract from the confidence required for long-term investment. The majority of holdings in the uplands of Great Britain are farmed by owner-occupiers with an ageing population of farmers. In the uplands of Wales 60% of farmers are over 45 years of age (20). They tend to have their own 'viability concept' which may be different from that of the theoretical agricultural economist and sociologist.

Technical advance requires a deliberate decision to invest capital, not infrequently scarce in family farms, while a cautious approach to borrowing is widespread. A long-term socio-economic programme in areas where small farms predominate will seek to encourage the amalgamation of small farms into more viable units to correct the age balance and encourage young people to stay on or come into farming in remote areas. It is frequently argued that a locally based education, preferably with a rural bias, will somehow encourage young people to stay in agriculture. If size of school at some stages is related to educational opportunities then the retention of small rural schools is inequitable. I believe that increasingly with modern communications, the interests of children reared in a rural environment may be as diverse as those from urban areas.

Hill farms in Scotland employ more hired labour than other farm categories; there being only 60% with working occupiers as compared with 81% in upland farms. Because of the reliance on hired labour the high average age of employees is of concern (Table 7). Due to afforestation a gradual stream of workers has been released for re-employment and this will continue. Because the old system of boarding young trainees on the farm has virtually disappeared in hill areas there is probably an inadequate intake of young men. Certainly in agriculture in general the loss of young workers under 20 is very great indeed, approximately 27.0%, but those remaining could have much to contribute. Farm staffs are relatively small and unskilled youths are difficult to accommodate and the cost, £30/week as against £75/week for a skilled man, is undoubtedly a deterrent.

Apart from a few individuals the hill sheep industry has shown remarkably little concern or demonstrated any important initiative in tackling this problem. Could farmers not co-operate in setting up hostel accommodation for trainees?

Table 7. The age structure of full-time male workers by full-time type of farm. 1967 and 1975

Age group	Hill sheep 1967 %	Hill sheep 1975 %	Upland 1967 %	Upland 1975 %
16-19	7	7	9	9
20-24	9	10	11	13
25-34	19	20	20	24
35-44	22	21	22	19
45-54	(40	21	(35	18
55-64	(	17	(	13
65 and over	3	4	3	4
Percentage of family workers in full-time regular labour force*	10	11	17	26
Average number of full-time male workers per farm returning full-time male workers	2.3	2.1	2.1	1.8
Percentage of total number of male full-time workers	5	5	10	19

*1967 figures are for Dec. 1966 and include regular part-time workers. 1975 figures are for June 1975.

from Martin, P.C. Scottish Agricultural Economics 1977, 28, pp 87-91.

Might not some agency or other attempt to encourage farmers who employ labour to contribute a levy payable to those who accept, under suitable rules, a responsibility for training during employment? The facilities to produce a skilled and educated agricultural population are available in the Agricultural Training Board and the provisions of the local authorities and others for day, block release and other courses. While, as has been suggested (21), formal training courses may not reduce the tendency for young people to leave the industry it nonetheless has the potential to create a workforce more receptive to new ideas. In the longer term the industry will be best served by a cadre of proficient skilled and educated shepherds and farmers if the challenges of the future are to be met.

Throughout the last two decades labour costs have increased, in general, more rapidly than end-product prices. One solution, especially in the remoter and poorer areas, has been to shed labour and reduce costs. This may work if attention to nutrition such as feeding during pregnancy, animal health and the essential of good husbandry is practised.

In some instances failure to observe sound practice leads to a lamb crop at weaning of around 50-60%, a level at which breeding replacements cannot be obtained thus leading to the possibility of economic collapse. In contrast, an alternative approach is to invest so as to increase production. It has been argued, falsely I believe (22), that investment in this sector of agricultute, as has occurred in the lowlands, will necessarily lead to a fall in the rural population. The experience of the Highlands and Islands Development Board (23) indicates that on those farms using HIDB loans to assist development schemes, full-time labour (occupiers and workers) increased by 30% between 1969 and 1972 compared with a regional decline of 8% during the same period.

In Orkney, to which Slee (22) specifically referred as an example of the detrimental effect of farm investment, notably in buildings, HIDB-assisted farms have retained their full-time labour whereas on the island as a whole agricultural employment has declined by 9%. The increased output achieved on assisted farms has been 14% in cattle numbers and 27% in sheep numbers(23).

Government policies have been somewhat ambiguous. In one sense the headage payments are sometimes regarded as a social subsidy yet as Figure 2 illustrates they lack stability and responsiveness in regulating agricultural incomes and must therefore be considered also as vehicles for regulating agricultural production. Neither do they take into account the additional disadvantages associated with increasing remoteness, such as transport costs. However, the extent to which subsidies are not directly related to end production indicates an element of social support. The funds made available through the Farm and Horticultural Development Scheme will be a sound national investment but does it make sense to embark on a programme with a possibility that perhaps after six years the land might be allocated to forestry?

Agricultural development in the hills will create systems more sensitive to interference through public access and at the same time because of fencing, scrub clearance, land reclamation, etc., change the appearance and so increase the potential conflict for recreational opportunity on the one hand and improved viability of agriculture on the other. It is particularly in the National and Regional Parks which are areas of planning control that these issues come into sharper focus. It is therefore encouraging to note that the Tourism and Recreation Unit at Edinburgh University will investigate the effects which the aims and objectives of National Parks have on the life and economy of rural communities and the wider benefits of these parks.

The future pressures to constrain the improvement of hill land for agriculture will have to be assessed in relation to the declining area of hill land and the need for meat production from this resource.

INTERACTION WITH OTHER USES

Currently in Scotland around 30,000 ha per annum of hill land is afforested. The need for a greater degree of self-sufficiency in timber has been proposed as a national priority. It seems essential that critical studies should be undertaken to examine the consequences not only to agriculture but also to visual amenity, recreation, conservation, etc, of alternative afforestation strategies. Because of public reaction against large scale afforestation, the declining amount of readily available plantable land, and other factors, the idea of the integration of agriculture and forestry is more widely promoted.

There is, however, little evidence that integration as defined by Cunningham et al (24) is occurring in practice in Scotland or being implemented as a national policy. In many cases, nonetheless, it offers the best opportunity of optimising the use of hill land resources for the nation (25).

Although these techniques developed by Sibbald et al (25) using a computer programme to determine the optimum allocation of land to agriculture and forestry make it possible to reach a more objective decision about the allocation of land to agriculture or forestry in an integrated scheme we, as yet, know little or nothing about the impact of agriculture or forest development on rural communities. Because of economic constraints and the need to achieve cost targets, forestry has become increasingly mechanised so that its contribution to rural employment and local cash flow has been seriously eroded. There has been an increasing trend also for forestry workers to live in towns and be transported to work so creating further rural depopulation. Sociologists sometimes designate rural communities as being fragile. But we do not know, for example, the density of farms necessary in different hill areas which have to be retained to achieve the commitment to mutual support, the retention of service industries and the social cohesion which will ensure survival of rural communities. The expansion of forestry by means of a policy of attrition and isolation of farms is occurring but it is not necessarily a process which in the long term will lead to a reasonable balance of land use. Nor can the best overall decisions in the long term be achieved by considering piecemeal whether a particular parcel of land is allocated to forestry or retained in agriculture. Although

the agricultural departments may make competent judgements about the suitability of hill land for agriculture or forestry it is difficult to comprehend how they might also make an assessment of the potential wider impact of a change in land use without considerably more evidence than is currently available. There is an urgent need for more socio-economic information in this field to help set guidelines for the future.

There can be no doubt that pressures for more efficient use of our hill lands for food and timber production as well as towards safeguarding their unique contribution to other aspects of human welfare in conservation, amenity, recreation and other uses will continue to increase. This will demand continuous study of problems and assessment of trends so that we create a future in harmony with the needs and aspirations of future generations.

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