DOCTOR OF PHILOSOPHY

Farm woodland design and landscape evaluation in Wales

Thomas, Alun Lloyd

Award date:
1999

Awarding institution:
University of Wales, Bangor

FARM WOODLAND DESIGN AND LANDSCAPE EVALUATION IN WALES

A Thesis Submitted to the University of Wales

By

ALUN LLOYD THOMAS

In Candidature for the Degree of Doctor of Philosophy

School of Agricultural and Forest Sciences,

University College of North Wales,

Bangor.

JANUARY 1999

SUMMARY

This study used Wales as a study area to discuss the subjects of farm woodland design and landscape evaluation. Chapter 1-3 introduce the subjects from the perspective of the landscape of Wales. Chapter 4 gives an account of the principles of landscape and forest design, with particular reference to planting on a farm woodland scale. Chapter 5 introduces the methods of landscape evaluation, whilst the following two chapters analyse the results of two landscape evaluation surveys for a sample of Welsh landscapes selected randomly through the ITE's land classification. It was thought that this land classification might be used as a predictor of landscape aesthetic quality, but this was found not to be the case. An initial survey was conducted by the author in the field, followed by a second survey involving the evaluation of the same points through a photographic slide presentation by university students. The results showed a strong correlation between the initial survey and the group means, supporting the argument for an evaluation by a single expert. Woodland designs were then drawn up for a selection of the evaluated points and values allocated for the increase in landscape value which could be ascribed to such tree-planting. The result was transformed via the travel cost method utilised by Bergin (1993) to give a mean monetary value for the proposed woodlands of £3.28 per visitor per day. This was then multiplied by the annual number of visitors to Wales to give a value of £157.3 million per year for Wales if tree-planting of equal landscape quality could be designed for each landscape in Wales. Chapter 10 uses the design prescriptions of chapters 3 and 8 and a 100% landscape evaluation survey of Gwynedd as a basis for an indicative forestry strategy for the county.

ACKNOWLEDGEMENTS

I wish to thank Professor Colin Price, M.A., D.Phil. (Oxon), my supervisor, for his guidance, advice and unlimited patience over the last few years and the last few weeks in particular.

I wish to thank Nia for her navigational skills during the periods of landscape evaluation work and for her patience, tolerance and belief, especially during the weeks approaching the submission date.

Finally, a wholehearted thanks to my parents, without whose support, both financial and emotional, this thesis would never have been written.

I TAID A SHÔN

CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Changes in agricultural production methods have meant that over-production is a major economic concern, both on the British and European levels. Alternative land-uses have been sought as a means of employing land diverted from the production of food. One use which is being made of such land is farm forestry.

The planting of woodlands and forests on agricultural units, whilst being potentially beneficial for farmers, has the capability of having a detrimental impact on the rural landscape unless planned and designed effectively. The purpose of this study is to utilise the principles of design by which planting would benefit the landscape of the countryside, and also a technique to predict the aesthetic contribution of new woodlands prior to planting. Wales was selected as the area for study.

The main objectives of the research were two-fold. The first objective was to provide an indication of the value of additional planting of trees on a farm woodland scale in aesthetic and, if possible, monetary terms. The second objective was to indicate policy guidelines, for where planting might be concentrated, and what design guidelines might be emphasised in selected locations.

To achieve the objectives set it is essential to call upon a number of geographical, aesthetic, agricultural and economic subject areas.

Firstly, there is a discussion concerning the present state of agriculture in Wales. This will provide a background as to why land is becoming available for tree-planting and timber production. There is also a summary of the types of schemes currently available to farmers who wish to enter farm forestry, as well as a glimpse at current uptake rates to planting schemes such as the Farm Woodland Premium Scheme.

Designing new woodlands for any landscape will depend, largely, on the existing landscape. It is, therefore, necessary to look at the different landscape types within the Principality. By studying the landscape classifications currently available, and giving a description of the past and current influences on the Welsh landscape, a clear picture of the country's aesthetic landscape will be given. The importance of regional character is discussed, as well as those elements which have contributed to the increased homogenisation of rural areas in recent years.

As important as the present landscape is to the woodland designer, it is also necessary to gain a knowledge of the general principles of landscape design. Landscape design is viewed in its historical context before the principles of forest design are introduced in greater detail. Learning from the aesthetic inadequacies of past planting is considered, as are elements of design such as shelterbelts and treeshelters, which may have particular relevance to farm woodland design.

An introduction to the field of landscape evaluation follows. This includes the methods available for the evaluation of woodlands. A technique is then selected for the evaluation of a sample of Welsh landscapes, and reasons given as to why this was the chosen methodology.

The results of a survey of 89 Welsh landscapes are then given. The survey aimed to provide a representative sample of landscape types throughout Wales, as classified by the Institute of Terrestrial Ecology. The results are also statistically analysed to gauge whether the Institute of Terrestrial Ecology's land classification may also be used as a predictor of landscape quality.

Following the initial landscape evaluation survey conducted in the field, the landscapes were evaluated by a group of university students by means of a photographic slide presentation. The results of this survey are given, along with an analysis to discover how these correlated with those of the initial survey. This would provide evidence as to whether or not the initial single – "expert" evaluation gave a valuation which was representative of those given by the group.

The next chapter utilises the design principles discussed in chapter 4 to design woodlands for a selection of the landscapes from the evaluation sample. Values are given for the increase or decrease in aesthetic quality resulting from new planting and new values allocated for the planted landscapes.

Chapter 9 is concerned with the monetary valuation of landscape quality. Comparisons are made with the results of Bergin's (1993) survey which used the travel cost method to allocate monetary values for elements such as recreation and landscape quality. These sites were among those evaluated in the earlier landscape evaluation exercise, and may be correlated with the results of Bergin's own survey. A strong correlation might support the validity of the initial survey.

The values allocated for the new planting in the previous chapter (8) are then transformed into monetary values, via Bergin's results, to provide an economic value for the aesthetic contribution which such additional woodlands could make to the landscapes concerned. Taking this a step further, figures are extracted for the value which planting of similar quality might have if translated for the whole of Wales.

Chapter 10 utilises the Harding & Thomas subjective evaluation scale to suggest a method by which it could provide a basis for indicative forestry strategies. A total land area study for the county of Gwynedd provides a "test-run" for such a method.

The thesis concludes with an evaluation of what has been achieved by the study, its strengths and weaknesses as well as suggestions for how the research might be developed further in the future.

CHAPTER 2

FARM WOODLANDS. WHO NEEDS THEM? AND WHY?

As the majority of this work discusses the merits and nature of farm woodlands and their design, it is important to set the scene, as it were, by identifying some of the reasons why farm woodland enterprises are becoming more desirable. This chapter looks at some of the problems associated with agriculture in recent years and some of the ways by which farm woodlands/forestry may provide an income.

Farmers have, over the years, been deeply involved with the improvement of the land which supports their industry. Developments in agricultural machinery and farming techniques have gradually brought more land into food production. Areas which were once believed to be unmanageable have been successfully cultivated into viable farmland as the boundaries of land regarded as uneconomic have been pushed further and further back. Such is the degree to which farming practice has advanced that today agricultural over-production is a threat to the livelihoods of many in the agricultural community.

For decades agricultural policy was aimed at increasing output, but the problem facing the policy-makers in recent years has been how to scale down production. Farmers have responded to price incentives, in the form of subsidies in particular, by increasing production in the knowledge that they could sell at a guaranteed price. This has created a massive problem of over-supply. The same is true throughout the European Union, to such an extent that there are persistent surpluses of foodstuffs, the legacy of which is obvious for all to see in the shape of the now infamous European food mountains. Finally it has become apparent to the E.U. that it is no longer necessary to continue farming the whole land area which is currently in use. According to the EEC's (as it was then known) own figures the amount of Community money spent on agriculture increased from 26 billion Ecu in 1988 to 36 billion Ecu in 1992. The European Union's commissioners also admit that whilst farm incomes remained constant during this period, "The extra spending has gone mainly on stockpiling surpluses and then paying subsidies to enable them to be sold on the world market" (Commission of the European Communities, 1993). Agriculture continues to be the major beneficiary of the EU budget. As Anderson & Muirden (1996b) explain, "The total EU budget in 1996 is estimated to be about 81.9 billion Ecu, of which half (40.8 billion) goes on the Common Agricultural Policy".

The 1947 Agriculture Act stated that the government's objective at that time was in "promoting and maintaining.....a stable and efficient agricultural industry capable of producing such part of a nation's food and other agricultural produce as in the national interest it is desirable to produce in the United Kingdom, and of producing at minimum prices with proper remunerations and living conditions for farmers and workers in agriculture and an adequate return on capital invested in the industry". The question today is whether or not a policy drafted as a consequence of food production following a world war can still be applicable half a century later.

Subsidising the Surpluses.

The example of dairy products more than adequately illustrates the inaction in cutting production levels. The Mansholt Plan suggested the need for redirecting resources away from milk production in 1968 and the over-production of milk and dairy products is still causing problems over a quarter of a century later. As Anderson & Muirden (1997) state, "Although quotas reversed the increasing trend in production, a structural surplus of around nine Mt still exists, much being exported through subsidies. A further 11Mt are used domestically, also with the aid of subsidies".

Whilst farmers in the US gain a higher rate of support than their European counterparts, "the way in which the European farmer is supported is much more protectionist", according to Howarth (1990). He cites the American agricultural policies such as acreage and marketing quotas on cereals, loans on security of farming produce and set-aside schemes such as rental payments for withdrawing land from production as examples of agricultural assistance which are not dependent on the subsidy of the produce. This strategy differs from European policy which "has encouraged increased output by maintaining high support prices which have for the most part been 'open-ended', that is, paid out whatever the quantity produced" (Howarth, 1990).

The US in particular, as a participant in the GATT (General Agreements on Tariffs and Trade) rounds, appears to favour the abolition of internal price support and export subsidies both of which have played a role in exacerbating the rate of agricultural over-production. The GATT is concerned with world trade in all produce, but whilst the US wanted trade in agriculture to be treated in the same way as trade in other products, the European Community was not convinced of this. As Tracy (1989) pointed out, "The Tokyo Declaration envisaged, as regards agriculture, 'an approach to negotiations which, while in line with the general objectives of the negotiations, should take account of the special characteristics and problems in this sector'. This text represented a compromise between the US insistence that agriculture must be included and the Community position that it must be treated as a special case."

It might be unjustified to blame the farmers for the present condition of the agriculture industry as government policies have played as large a part in the modification of the farming sector, as has the development of modern farm practices and mechanisation. Policies of price support and subsidies have only succeeded in aggravating the situation by pledging price guarantees to the producer. As a result farmers aiming to increase income took advantage of the situation by increasing inputs, and subsequently output and income. Large producers, in particular, have seized the opportunity of increasing revenue by increasing production. Such a policy has led many to argue against future support for the industry at present levels (Howarth, 1990). The case against support is particularly strong considering the plight of so many other businesses and industries. Other industries, coal in particular, were refused government support on the grounds that they were uneconomic, so why should agriculture be treated any differently? The opportunity cost of producing subsidised farm produce is itself a concern.

The main problem is that the demand for most agricultural produce is inelastic. As wages rise the consumer is not likely to purchase proportionately higher levels of dairy or cereal products for instance. Equally, although they may tend to spend somewhat more on meat as a result of an increase in their purchasing power their demand for this product will also be relatively limited. Due to the inelasticity of demand, when supply increases it has a strong adverse effect on prices.

The question of sustainability is also being raised. Agriculture has become increasingly dependent on chemical inputs, particularly nitrates and phosphates, in an attempt to boost levels of production, and their effect on both the land and consumer health is being questioned, today, more than ever. Agriculture has become such a high input / output enterprise that it is becoming increasingly clear that a change of direction is necessary.

Fig. 2.1. The Welsh agricultural landscape. But what use should be made of the surplus farmland?

Modern Agriculture – Over-specialised and Over-intensive?

It might be fair to say that agriculture, partly as a result of agricultural policies, has become excessively intensive, and that this is largely to blame for today's over-production. Farms which, in the past, supported a number of different enterprises and truly lived up to the term "multiple land use" were gradually streamlined, ultimately to produce one or two products. Units which might once have produced fruit, beef, wood coppice, eggs, milk and cereals were prompted by agricultural policy to rationalise by concentrating specifically on the production of products such as milk or cereals, though on a much larger scale (Gilg 1978). Economies of scale were successfully implemented as agriculture became increasingly productive. A major development has been the agglomeration of smaller units to form much larger estates as small family farms came onto the market. Not only was there an increase in product per unit area due to more intensive farming, there was also an increase in the area under production as modern fertilisation and mechanisation techniques were implemented, as well as in product per head of farm workers. Quotas were introduced to curb the over-production of some produce. It might be argued that "reform (of the CAP) began in earnest with the imposition of milk delivery quotas in 1984" (Tracy, 1996). This meant that farmers were restricted as to the amount of, for instance milk, which they would be allowed to produce. The simple answer for many units would, probably, have been to develop into other products. However, previous policies had tempted farmers to move towards the more intensive production of a smaller range of produce. Consequently, their ability to revert to the production of other goods had been greatly diminished.

Another factor is that agriculture is a highly capital intensive business. There might have been over-investment in the past in such items as machinery and farm sheds. Such moves have proved to be somewhat unwise as the changes unfolded and their potential uses for other enterprises have been found to be severely restricted. After all, if a shed has been designed and built as a milking parlour its application beyond this purpose will be extremely limited if a farmer decides it is no longer feasible to keep a milk herd.

It is possible to argue that agricultural over-capitalisation was partly a result of the agriculture policies which existed until the 1980's. This is a view echoed by Howarth (1990) in that, "It is common ground that farming has become over-capitalised. Capital grants have encouraged farmers to purchase buildings and fixed equipment on a lavish scale; and who can blame them for taking advantage of a system which at times reduced the effective cost to them of a new building to only 20 per cent or less of its full cost?"

Environmental Perspectives.

One of the major environmental influences on the landscape of agriculture has been the CAP itself. It is probably fair to identify the CAP as a significant instrument of landscape change. As Gaskell & Winter (1998) suggest, "In some instances agricultural policy has created entirely new landscape features. Arable set-aside is a prime example. For 10 years now set-aside has been a feature of the European scene." The increasing influence of agri-environmetal schemes is also worth noting, particlarly such schemes as the Environmetally Sensitive Areas and Tir Cymen in Wales (Gaskell & Winter, 1998; Winter, Gaskell & Short, 1998). The changes associated with de-stocking to prevent over-grazing have also had some influence.

There is clearly a strong economic argument against the continuation of agricultural subsidy at current levels, but there is also an equally valid ecological perspective which should be considered. Howarth (1990), Body (1987) and Bowers & Cheshire (1983) all consider the implications that current practices might be having for our natural resources. Allanson & Whitby (1996) provide a damning indictment of the effects of current farming practices on the environment. They argue that, "the intensification of agricultural production has raised a number of issues of environmental pollution, human health and animal welfare. In particular, the increasing adoption and use of fertilisers and other agrochemicals has been associated with the eutrophication of watercourses, damage to ecosystems and the contamination of drinking water and foodstuffs. The intensification of livestock production has led to: pollution incidents as a result of discharges of slurry and silage effluent; a number of food safety 'scares', of which bovine spongiform encephalopathy (BSE or 'mad cow disease') in cattle has been the most serious; concerns about the welfare of farm animals, such as battery hens and veal calves; and protests about the transport of live animals. More generally, the sustainability of current agricultural practices has been called into question by the increasing demands placed on the environment".

The MacSharry Reforms of 1993 and Onwards.

Whilst the European Union's policy makers and the CAP have been blamed by many for the current problems facing agriculture, it must be stated that continuing changes are being made to reform the CAP. The "MacSharry Plan" of 1992 recognised the need for changes to the CAP, and accepted the ineffectiveness of previous policies. As Tracy (1996) states, "the system's effect on farm incomes was unsatisfactory: it was reckoned that some 80% of support was going to 20% of the farmers".

The MacSharry reforms, closely followed by the GATT "Uruguay Round", set the CAP on course for a change. As a consequence, there would be price cuts for arable crops with compensation being paid to farmers. These payments would be conditional on set-aside. Another development would reduce beef intervention prices, with the premiums to producers being increased. This latter payment would be conditional on levels of livestock density per hectare. "These substantial changes in the support prices facilitated the agreement which concluded in the Uruguay Round" (Tracy, 1996). The GATT Uruguay Round itself set levels for cuts in agricultural support, though they were within the limits for cuts which the EU itself had set. The effect of the MacSharry reforms has touched many products, and "several changes have been made since 1993 to the regimes for several commodities. A common feature of these changes is to reduce price supports, with compensation to producers through direct payments" (Tracy, 1996).

The Case for Diversification.

It is clear that reforms to the CAP could be used to ease the problems of supporting over-production, and that the changes offered by MacSharry will go some way to alleviating them. However, it might be that agriculture and the CAP will need to undergo a much more radical change in the near future.

It has now become more desirable to move back towards diversification, though the restrictions noted above often hamper the farmer's attempts. One important development has been a return to organic farming as the public concern about chemical inputs seems to be on the increase. As well as reverting to more traditional farming techniques and practices there are some additional enterprises today such as farm tourism which were not common prior to the agricultural revolution. The Wales Tourist Board (1974) have, in the past, advised farmers to cater for such activities as fishing, pony trekking, farm trails, game shooting, and even sailing if the landscape lends itself to such enterprises. Other farmers have decided to diversify in to the production of different crops from those previously cultivated.

Another practice which has grown in prominence is farm forestry, and through methods of agroforestry and shelterbelt planting it offers both timber and non-timber benefits to the participating farmer. This may be through increased productivity due to the resulting shelter or as the result of additional income received from sporting revenue such as pheasant shooting. In the long term, the farmer may also benefit from timber sales.

Farm Forestry – The Green Shoots of Rural Recovery?

An excellent opportunity now exists to divert some of the improved agricultural land into timber production. Due to the low forest cover in the UK, currently 10% compared with the European average of about 25%, the country needs to import wood on a large scale. Imports will continue to be necessary, as much of the current stock is yet to reach maturity due to the relative youth of the industry in Britain, and even then we will only be 40% self-sufficient at current levels of consumption. After all, it is only really eight decades since the introduction of large scale forestry through the founding of the Forestry Commission in 1919. This is not to say that tree-planting did not exist prior to this date. The production of timber once played an integral part in rural life as farms produced a much more diverse range of produce such as coppice, hurdles and wood for fuel. The landed class also planted trees and employed such landscape gardeners as Brown, Evelyn and Repton to design their wooded parks and arboreta, but the main purpose of this planting was aesthetic or decorative and not for timber supply.

It might be somewhat optimistic to expect farm forestry to be able to be a substitute for large scale commercial plantations. Only 383.0 ha were planted in Wales under the Farm Woodland Scheme between 1988-92. However, 731.4 ha were approved for planting under the Farm Woodland Premium Scheme between 1992-4 (Price & Willis, 1995). If land such as this can make some contribution to Britain's timber production, then some areas of natural significance may be spared from forestry.

Fig. 2.2. Farm woodlands. The answer to all rural problems?

The Situation in Wales.

Areas of land under consideration for tree-planting will generally be of lower agricultural potential and may be of particular relevance to Wales where most of the land is of grade 4 or 5, lower quality agricultural land. The amount of woodland presently on farmland in Wales is, according to 1991 government figures, only 37,346 ha which translates to a mere 2.23% of the agricultural land area. However, there are some signs of interest in farm woodland planting in Wales as there had been a small increase in farm woodlands in the period 1987-91 (Welsh Office, 1992).

The Planting Schemes.

Schemes have been devised by various bodies seeking to assist farmers with the move towards planting woodlands on their land, as well as those looking for guidance on the management of existing tree stands. Some of these projects, such as the Countryside Commission's scheme for amenity planting and the former Nature Conservancy Council's nature conservation grant, differ slightly in their objectives from those of the Forestry Commission's own Woodland Grant Scheme and MAFF's Farm Woodland Schemes. Schemes designed by the Forestry Commission include provision for various types of planting for example broadleaf, mixed or conifer woods, coppice, with or without standards, agroforestry, decorative timbers and Christmas trees, though not all these schemes are eligible for grant aid. Grant aid will be varied according to species mix or whether the woods will be pure conifer or broadleaf plots. There is a presumption towards paying a higher grant for planting the latter, though some might argue that it remains insufficient due to the longer rotation of the broadleaf species and higher planting costs. Of relevance to Wales are the projects implemented by Coed Cymru, a body mainly financed by the Countryside Council for Wales, who will advise on the design, planting and management of farm forests as well as on conserving existing woodland. Assistance, both financial and practical, is also obtainable from MAFF and The Woodland Trust. Top-up payments as well as supplies of saplings may be forthcoming from the relevant National Parks for farms lying within their boundaries. Additional assistance may be available should a farm be located within a designated Environmentally Sensitive Area. The Welsh Office Agriculture Department's Farm Woodland Premium Scheme (FWPS) may also be of assistance as it pays the farmer compensation for lost agricultural income due to planting.

If it is decided that the farmer is to be paid for planting trees on his or her farm then the next consideration should be the level of assistance paid to the individual for doing so. This is of particular importance in those areas of lowland where the land may be of higher quality than that in the uplands. The Welsh Affairs Committee (1994) looked at aspects of planting lower down from the uplands and discovered that "Although foresters have expressed a preference for new planting 'down the hill', there is little evidence that farmers and landowners are making the necessary land available to them. Just as farmers stand to lose their extensification payments by fencing in existing woodlands, so would they by fencing off grazing land for new planting. The grants for new planting, although considerably higher than for management, are not in practice sufficient to compensate for lost agricultural production and payments." Another consideration of note may be that many farms in Wales are of the owner-occupied type and are often fairly modest in size. Consequently, the farmers of such units may be unwilling to sacrifice some of their land to put into a forest enterprise, especially due to the length of time associated with the forest rotation.

The Landscape of Agriculture.

The importance of rural landscape must not be overlooked amid the discussion concerning agricultural and timber production. The movement away from mixed farming towards more intensive production of large scale arable produce, for instance, has been the primary cause of the increasing homogenisation of the countryside. The loss of vernacular farm buildings and their replacement by large farm sheds has been accompanied by a decrease in regional character. There has also been a loss of regional vegetation character, particularly due to the introduction of exotic tree species and the improvement of semi-natural grazing land. All have contributed to the placelessness (Hough, 1990) of our rural areas. One widespread landscape change has been the result of hedge clearance. Though the various agencies may be supportive in the replanting of hedgerow trees it would, regrettably, take centuries for such hedgerows to restore the levels of flora and fauna which have been lost.

Imaginatively designed small woodlands offer the opportunity to return some of the lost regional identity to these landscapes, especially when species indigenous to the particular locate are utilised. It has to be noted here that there are those who are not pessimistic about the current state of the landscape of agriculture. Craig, Jollans and Korbey (1996) argue that, "There is a misleading tendency, for those who are critical of the landscape and wildlife changes brought about by modern methods to view the changes which have occurred in arable areas, particularly East Anglia, and then to generalise their comments to apply to all UK farming." It might be that the changes are even more pronounced in East Anglia, but as the Countryside Commission (1991) discovered in their study of the National Parks, landscape changes have been on a countrywide scale.

Set-aside.

Another recent development is the formation of set-aside schemes such as the Countryside Council for Wales' Tir Cymen scheme where farmers are paid for their conservation work. The thinking behind set-aside is that land should be left out of production whist the farmer is paid to cease production. There are certainly benefits accruing to the customer from such a policy. One is the knowledge that the rural landscape is being preserved for future generations. Another benefit to the consumer may come from increased public access. This means a far better use of public monies than the current food subsidies which are only, really, benefiting the producers. The current payment levels are £170 –£180 per hectare for set-aside of land under cereals compared with a £100 per hectare subsidy to produce these crops.

The Tir Cymen scheme in Wales, "aims to demonstrate how, by using a market-based approach, environmental management may be integrated with agricultural production on ordinary farms"(Countryside Council for Wales, 1992). It works as a voluntary scheme with the farmer being paid, should he or she wish to do so, "in return for positive management of their land for the benefit of wildlife, landscape, archaeology and geology, and for providing better opportunities for quiet enjoyment in the countryside" (Countryside Council for Wales, 1992). Examples of annual payments made under the scheme are a payment of £20 per hectare for the whole of the farm area, £100 per kilometre of footpath and £0.10 per metre for selected traditional field boundaries. From the point of view of decreased agricultural production, the scheme will require reduced stock numbers on certain areas of land if this should benefit the conservation plan. Incidentally, this scheme will be replaced countrywide in 1999 by the Countryside Council for Wales' similar Tir Gofal scheme.

It is important that any such scheme views the countryside as a living, working and, to a certain degree, changing environment rather than simply an area to cater for tourism. The purpose of such schemes is not to create a "countryside museum" designed for tourism, it is to assist and reward those farmers who are willing to make changes for the benefit of conservation and the landscape on their working farms. If such schemes are managed sensitively and sensibly they can make a positive contribution, particularly to landscape and nature conservation.

The CAP reforms of 1992 aim to assist farmers in their move towards less intensive and more diverse agriculture as a means of withdrawing land from cultivation. Further to this is the hope that farmers will, ultimately, be performing a wider range of tasks such as farm tourism, arts, crafts or even small scale manufacturing plants on farm units. It is also very encouraging to discover that the European policy makers recognise the need to safeguard regional diversity in food production. If they took a similar view where landscape diversity is concerned we may succeed in avoiding a bland "Eurostandard" where all regional character is lost.

Whilst the policymakers of Britain and Europe must accept much of the blame for many of the problems facing agriculture today this should not preclude them from future discussions. The influence of governments on agricultural and landscape change in the past has been great, and can continue to be so in the future for the benefit of agriculture if sustainable policies are pursued. As Allanson (1996) states, " the government may wish either to offer incentives for the presentation of good attributes, through mechanisms such as Environmentally Sensitive Areas schemes, or to preclude certain forms of development through regulation. Historically, parliamentary enclosures, and more recent modifications in fiscal provisions and security of tenure, have profoundly influenced the pattern of agricultural and rural change."

Rural landscapes and, similarly, rural communities can only be safeguarded by maintaining something of the industries responsible for their creation. Appropriately scaled agricultural and timber enterprises complementing well designed set-aside schemes should all contribute to a balanced, sustainable rural economy. It is difficult to envisage how farming could revert to the techniques of the past on a large scale, where shire horses would return to the fields to replace modern machinery, although there may be an opportunity for some units to do so as some have done already. Neither should it be assumed that we can roll back the years to recreate the landscape of past centuries. There is, however, scope for a return to a more multiple use approach to land and farm management and towards increased regional variation as a result of increased diversification, within which timber production can only play a part.

One change that is necessary is a shift in how we perceive rural change and the planting of woodlands. The reality is that "There is both the demand and the scope for agriculture and forestry to expand in the hill areas in this country, but the way in which this takes place affects both industries and the resulting landscape. The integration of the two land uses is seen as a means of avoiding the negative effects of expansion and of realising positive benefits such as shared road and fencing costs, shelter and raising farm capital through the release of land to forestry. Integration can diversify the economy, employment and the landscape and lead to more efficient land use" (Boon, 1981). The expansion of farm woodlands and forestry should be viewed as opportunity to put excess agricultural land to an alternative use which can be mutually beneficial.

Certainly, farm forestry is not a panacea which will single-handedly halt the decline of the rural economy. However, if implemented concurrently with the other enterprises noted above, and with due consideration to design, it can play an important part in the regeneration of rural communities which should, ultimately, benefit the resulting landscape.

CHAPTER 3

THE LANDSCAPE OF WALES.

The first step towards the restoration and protection of an area's landscape and regional character is to assess those elements which contribute to it at present and, also, to highlight those influences which can be detrimental to this character. This chapter looks at the landscape of Wales and aims to identify those elements which have negative or positive effects on the country's regional character.

"Here I turned and looked at the hills I had come across. There they stood, darkly blue, a rain cloud, like ink, hanging over their summits. Oh, the wild hills of Wales, the land of old renown and of wonder, the land of Arthur and Merlin."
(George Borrow's Wild Wales of 1862).

Welsh Landscape Character - Introduction.

The successful aesthetic integration of any additional element introduced into a landscape should require some degree of design. Practical considerations will often take precedence over those of an aesthetic or amenity nature. In forestry, for example, site elevation, climate, relief and soil type would probably enter many forest managers' calculations before they turned their attentions to landscape design. Effective management obviously requires detailed technical knowledge of the area to be planted in order to evaluate the land's capability for production. The same is equally valid during the process of landscape design. A mere grasp of design principles is not, in itself, enough. A knowledge is needed of the particular landscape involved in order to ascertain whether a plan may be suitable for a particular location or not.

This "understanding" of a landscape should involve digging deeper than the present physical landform, in a metaphorical sense, to view it in its fullest historical, cultural, geological and biological contexts. Only then can a landscape's true genius loci or sense of place, as expounded by Norberg-Schulz (1980) and endorsed by others such as Lucas (1991), be fully appreciated.

This chapter is therefore an attempt to place the landscape of Wales in its rightful context. This may provide an aid to the design process and a tool which may assist in the recognition of elements which contribute to regional character. In so doing we should also be able to pinpoint those influences which may have a detrimental effect on such diversity by homogenising our landscapes.

Landscape in Welsh Culture / The Cultural Landscape.

The landscape of Wales has for centuries been a source of great inspiration for artists, poets and writers alike. It was the subject on which both Thomas Pennant (1883) and George Borrow (1862) penned the vivid accounts of their tours of the land in the 18th and 19th centuries respectively. Both of these continue to be regarded as indispensable accounts of Welsh life which no student of Welsh culture could afford to overlook, though whether much of the Welsh landscape was indeed "wild" even in 1862 as described by Borrow is open to question.

Fig. 3.1. "Snowdon from Ty Obri." Kyffin Williams, c.1980. (National Library of Wales, Aberystwyth).

It was the country's high scenic value which tempted J.M.W.Turner, Paul Sandby and Augustus John to depict the area in paints, a tradition which continues today with the work of artists such as Kyffin Williams. James Dickson Innes who chose to paint views of Arenig in Snowdonia was apparently so bewitched by his subject that he "enter(ed) into an intense emotional relationship with the mountain" (Bogle, 1990).

The country was eulogized in the work of the beirdd of Wales such as Cynan, T.H. Parry Williams, T. Rowland Hughes and R.S.Thomas who has also published a diary depicting the landscape and wildlife during a year in Lleyn. Visiting poets also scribed their views of Wales and examples may be found of works by Betjeman, Shelley and Gray. The poem titled "The Prelude" to Snowdon by William Wordsworth is the cause of great mirth to some - Skidmore (1986) ascribed it the dubious honour of being the "worst poem ever" written in dedication to the mountain. Others have been more complimentary, Rees (1992) for example who said of this and his composition on the Wye that "There can hardly be two passages in any language so significant to the cult of nature". It was Gray's poem "The Bard", apparently, which tempted others to follow suit in seeking inspiration to write of the Welsh landscape (Skidmore, 1986).

Fig. 3.2. "Arenig." James Dickson Innes, c.1910. (The National Museum of Wales, Cardiff).

The Prelude

At distance not the third part of a mile
Was a blue chasm; a fracture in the vapour,
A deep and gloomy breathing-place thro' which
Mounted the roar of waters, torrents, streams
Innumerable, roaring with one voice.
The universal spectacle throughout
Was shaped from admiration and delight,
Grand in itself alone, but in that breach
Through which the homeless voice of waters rose,
That dark deep thoroughfare had Nature lodg'd
The Soul, the Imagination of the whole.

(William Wordsworth, from "The Prelude")

Yr Wyddfa

Y Wyddfa, noddfa neuaddfawr,
Hoywfalch ei phen uwch llen llawr,
Hen addurn, deyrn ar dir,
Orau iawndwf ar randir,
Clo Gwynedd rhag trymwedd trin,
A'r gaer orau i'r gwerin,
A wisgai erioed wisg o'r ia,
Yn glaerwyn dan gwl eira.

(Robin Ddu, c.1450)

(A translation of this poem is given in Appendix I).

It is the landscape which inspired many a fable and legend, the most important of which are bound in the mythological masterpiece, "Y Mabinogion". This affinity with the surreal and fantastic continued to more recent times with Lewis Carroll's tales of Alice as well as the Rupert Bear of the Bestall era which were both, apparently, partly set in landscapes based on the areas of North Wales which their authors knew so well.

Bourassa (1991) noted Wordsworth's relationship with the Lake District as an example of the contribution that poets and artists can have on what he termed "the cultural landscape". The same is certainly applicable to many Welsh scenes. Additionally, in Wales, the "cultural landscape" and the works of the bards which eulogised it are held in such high esteem that any development which may change such landscapes can expect to be fervently opposed. Some literary figures have become synonymous with the landscapes depicted in their works and vice versa. Y Lôn Goed in Llyn will remind many of the similarly titled poem by R.Williams Parry whilst Cwm Pennant is synonymous to many with Eifion Wyn's eulogy to the landscape. The furore at the National Eisteddfod at plans to close a footpath near Beddgelert, an area highlighted in the poems of T.H.Parry Williams, illustrates the kind of passions roused by the cultural landscapes of Wales.

(from) Cwm Pennant.

Yng nghesail y moelydd unig,
Cwm tecaf y cymoedd yw, -
Cynefin y carlwm a'r cadno,
A hendref yr hebog a'r dryw:
Ni feddaf led troed ohono,
Na chymaint a dafad na chi;
Ond byddaf yn teimlo fin nos wrth fy nhan
Mai arglwydd y cwm ydwyf fi.

Mi garaf hen gwm fy maboed
Tra medraf fi garu dim;
Mai ef a'i lechweddi'n myned
O hyd yn fwy annwyl im;

A byddaf yn gofyn bob gwawrfydd,
A'm troed ar y talgrib lle tyr,
Pam, Arglwydd y gwnaethost Gwm Pennant mor dlws,
A bywyd hen fugail mor fyr ? (Eifion Wyn,)

(A translation of this poem is given in Appendix I).

The above examples illustrate the importance attached to the landscape of Wales in the past and the high regard in which it was held by previous generations. They also highlight the inextricable link between the landscape and Welsh culture in general. Whilst the landscape of Wales is strongly linked to the past both physically and culturally it continues, today, to yield resources which are essential to the nation's well being. Apart from the obvious resource of providing an area for habitation it is an area mined for a variety of different minerals, utilised extensively by farmers and foresters and, not least, is the lynchpin of the country's thriving tourist industry which brings in an estimated annual revenue in the region of £1,287 million (Wales Tourist Board, 1993).

Fig. 3.3. Cwm Pennant. The inspiration for Eifion Wyn's work.

Landform, Geology and Geomorphology.

Landform is probably the most significant aspect of landscape study. It is the base on which all natural and human activity evolves. It is the basic "Foundation of Scenery" (Trueman, 1971). To understand fully the nature of the landscape of Wales is also to possess a basic knowledge of the processes which initially sculpted the geological forms we know today. There are various texts which ably describe and interpret the geology of Wales in far more detail than space permits here. Bowen (1977), Campbell & Bowen (1989) and the National Atlas of Wales (1990) offer a comprehensive insight into the processes which created the landforms of Wales. Additionally, Trueman (1971) approaches the subject with a greater degree of subjectivity, placing the geology of Wales (and England) in the context of the creation of scenery.

As Bowen (1990) explains, "Wales include(s) an immense variety of rocks of different ages, a circumstance entirely disproportionate to its size, it includes the classical region of Lower Paleozoic stratigraphy where names such as Cambrian, Ordovician and Silurian were first defined, then subsequently used throughout the world." This variety has contributed significantly to the diversity of landform which exists in Wales as indeed did the glacial periods which bequeathed to us the magnificent scenery of Eryri. What follows is a glance at the landform of Wales and some of the geomorphological processes which sculpted its face.

Fig.3.4. Nant Ffrancon, Snowdonia National Park. A textbook example of a glacially eroded U-shaped valley.

Bowen's (after Brown) simplified physical map of Wales (1977) illustrates the variation present in the Principality's landforms. Outsiders with a limited knowledge of the country might gain the impression that it is an area of rugged, mountainous scenery but in reality such forms are largely restricted to the county of Gwynedd and parts of south west Clwyd.

Snowdonia's dramatic landform is the result of the igneous rocks of the Ordovician period being carved by ice sheets during the Pleistocene. The abundance of cirques, troughs, ridges and moraines suggests that glacial erosion was at its most intense in the north-west (Campbell & Bowen, 1989). To the south of Snowdonia lies another belt of igneous rocks in the form of the Cadair Idris, Aran and Arenig ranges which meet the less rugged Berwyn range at the Gwynedd / Clwyd border. The mountainous area, Pumlimon in mid Wales, is composed of softer rocks and shales than those present in Snowdonia and their lower resistance to the ensuing glacial activity has resulted in a smoother, softer landform. The Radnor Forest area of Powys displays similar attributes. The final "mountainous" area of Wales is in the south and consists of the Black

Mountains and the Brecon Beacons. Their form and elevation varies with the slope of the Devonian cuesta which underlies them. The mid slopes of these mountains and other land between 700 - 2000 feet described as dissected upland plateaux (National Atlas of Wales) or dissected plateaux (Bowen) account for over fifty percent of the country's land area. These areas, from north to south, consist of the Clwydian Range, Mynydd Hiraethog, parts of the Berwyn Mountains, Pumlimon and Brecon Beacons amongst others. The fact that many are prefixed "mynydd" (the Welsh for mountain) should not be taken literally, it is probably due more to our propensity to exaggerate as a nation than a scientific measure of elevation. The overlying landscape could be said to be of moderate quality. As Bowen (1977) explains, "they form the basis of a monotonous upland landscape, with equally widespread moorland confirming and compounding such repetitive similarity."

Fig. 3.5. Crib Y Ddysgl. A view of the ridge from Snowdon's summit.

Fig. 3.6. Mynydd Hiraethog, Clwyd. It may well appear to be a rather bland, monotonous landscape as Bowen suggests of such Welsh upland areas, though whether such landscapes can be aesthetically improved by the planting of conifer forests (Clwyd County Council, 1974) is questionable.

The lower slopes (below 700 feet) which extend to the coastline predominate to the west, in particular to the Llyn Peninsula and the Dyfed coast, as well as Anglesey in the north. This area of dissected coastal plateaux is also apparent in the Gower and Glamorgan areas. Here the landform meets the sea as rock cliffs which contrast with the coastal lowlands of the northern and north eastern coast from North Llyn to Colwyn Bay which display sand or shingle beaches such as those of the resort towns of Llandudno, Colwyn Bay, Rhyl and Pwllheli. The same is applicable to the Carmarthen and Swansea Bay areas in the south.

There are two examples of coastal valley lowlands, one being the valley which accommodates the Conwy River, the other being the Vale of Clwyd down which the Elwy River flows. The land of the Welsh Marches is largely accounted for by interior lowlands which extend to the English counties of Cheshire, Shropshire and Hereford & Worcester.

The Welsh Landscape as a Resource.

All industry is obviously dependent on the availability of land as one of its basic factors of production. Manufacturing industry, for example, can only proceed if there is sufficient land available to locate a factory. However, there are certain industries where the landscape plays an even larger role though, obversely, they may also have a substantial effect on the landscape which accommodates them. These may be industries such as tourism where the appearance of the landscape can have a significant bearing, both positive and negative, on potential "consumers". Equally, there are industries such as the extractive industries, agriculture and, to a lesser extent in Wales, forestry, where landform and geological composition, among other factors, will have a limiting effect on an industry's capacity to produce. The following are examples where the land or landscape of Wales either in the past or the present has contributed significantly to the country's prosperity. Further analysis will then inform us of the effect that these activities have had on the Welsh landscape.

Rock and Mineral Extraction.

The land of Wales has over the centuries yielded a wealth of rocks and minerals. The Principality is probably most renowned, more recently, for the production of coal, predominantly in the south. The industry's production level peaked during the first three decades of this century, the peak year being 1913 when 60,336,000 tons of coal was produced. From an employment point of view this reached a climax in 1920 when 290,589 worked in the coal mines. In the north the extraction of slate at such quarries as Dinorwig in Llanberis and Llechwedd in Blaenau Ffestiniog provided employment for thousands. Both production and employment peaked in 1898 when 507,000 tons was extracted by 26,970 men. The only slate quarries which remain working today are Bethesda's Penrhyn Quarry which now operates with a much reduced workforce and the Manod Quarry at Blaenau Ffestiniog. There are also examples of granite, sandstone and limestone quarrying in Wales.

On a smaller scale, mineral deposits have also been unearthed. Copper was mined at Parys Mountain, near Amlwch, on Anglesey amongst other places. Disused lead and zinc mines are to be found throughout the Principality, though they were most prevalent in Flintshire, as it was known prior to 1974. Iron ore was extracted in Glamorgan in the late nineteenth and early twentieth century and was an integral part of the smelting industry in an area which was at the vanguard of the industrial revolution. Additionally, gold is mined on a relatively small scale at a mine near Dolgellau in mid Wales.

Agriculture.

Agriculture currently provides work for 52,658 individuals in Wales (excluding wives or husbands of farmers, partners and directors), (Welsh Office, 1992). Its importance from a land use point of view is undeniable. Some 81% of the Principality's land area of almost 2.1 million hectares is accounted for by agriculture in some form or other.

Due to the quite high elevation and steep relief of much of the land in Wales and the added problem of exposure associated with such areas it could not be regarded as ideal land for the production of crops. In his summary of the land quality of Wales for the National Atlas (1990) Taylor grouped land quality into seven "land quality evaluation categories" graded from the worst land of category 1 to the best land of category 7. Of the land area of 20,728 km^2 a mere 20 km^2 were classed in the highest value category 7 and almost half this land is on Anglesey. Most of the land is average quality, 66.7% of it being medium category 4 or 5. As a result the land itself is something of a limiting factor to farmers who must make the most of their limited resources due to these constraints. This is the reason why so much Welsh farmland is devoted to rearing livestock rather than producing crops. According to Welsh Office figures for 1991 only 13.1% of the Welsh agricultural land was described as "arable", with barley accounting for 52.7% of this sector. 53.4% of land was classed as "permanent grass" whilst a further 30.5% was given to rough grazing of either sole rights or common land. The types of livestock and their distribution are discussed later in this chapter as is the apparent relationship between land quality values and landscape quality scores.

Forestry.

As the landscape of Wales is under discussion the extent of land under forestry and woodland should also be noted, despite the fact that it makes a markedly lower contribution to the Welsh economy than the other industries noted here. The Forestry Commission had 492 individuals in their employ in 1994 (291 classed as industrial and 201 as non-industrial) which is less than one hundredth of the number gaining employment in the agriculture industry. Welsh Office figures for 1991 put the figure for afforested land at 12% of the land area of Wales. 37,346 ha of this woodland (2.2% of the land classed as "agricultural") is found on agricultural land though little of it is managed commercially. The merits, or otherwise, of forestry and woodland in the landscape of Wales are dealt with more extensively elsewhere in the text: suffice it to say that about 12% of the area of Wales as a whole is under cover of forest and woodland and the figure is slowly rising.

Tourism.

The tourist industry in Wales owes much of its success to the quality of the local landscape. A report commissioned by the Welsh Tourist Board in 1985 concerning "Attitudes to Wales as a Tourist Destination" based on public perception noted, "an overall appreciation and expectation of a distinctive natural and scenic grandeur and appeal" which created an "overall positive scenic image". The importance of high quality landscape should not, therefore, be underestimated especially where an industry which attracts an annual expenditure of £1.287 billion from visitors and provides employment for 95,000 individuals (9% of the total Welsh workforce during the mid 1980s) is concerned.

In order to succeed in the task of preserving the quality and diversity of the landscapes of Wales it is imperative that we adequately appraise, classify and evaluate this important visual resource. This should enable us to answer the questions, "What is the landscape character of Wales ?" and "What regional landscape variation exists within Wales ?" We may even be able to conclude as to whether George Borrow's "Wild Wales is still very much there" as Vaughan-Thomas and Llewelyn concluded in 1969 or indeed if even those areas of wildest Wales have now been tamed.

Landscape Designation.

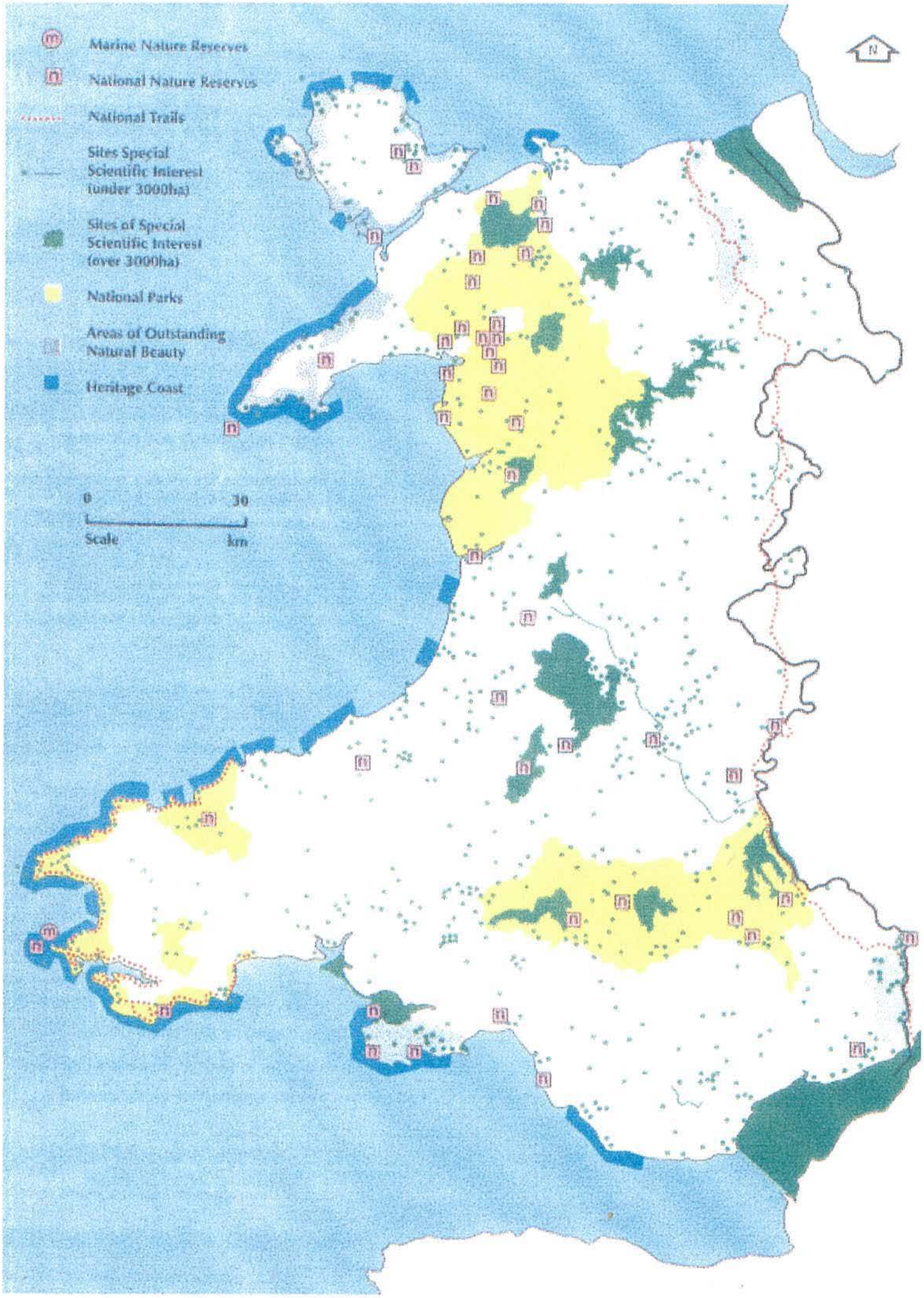
For a small country of a mere 2,100,000 ha Wales possesses a wealth of landscape, vegetational and wildlife variation. The mere fact that such a large proportion of its land is designated by various bodies illustrates the significance attached to Wales from both a landscape and wildlife conservation standpoint. From a landscape point of view the main designated areas are the National Parks, the largest being Snowdonia followed in area by the Brecon Beacons and, thirdly, the Pembrokeshire Coast Park of which much is also a designated Heritage Coast. Among other Heritage Coasts are the Gower and Llyn peninsulas along with sections of the Anglesey coastline. Areas of Outstanding Natural Beauty also feature prominently on the Welsh map. These are Countryside Council for Wales designated areas displaying exceptional landscape which lie outside the National Parks. These are located in the Gower, Vale of Clwyd, East Monmouth, Anglesey and along the Llyn peninsula.

Areas such as Snowdonia and the Brecon Beacons have been recognised for their high scenic value, and rightly so. However, the Welsh landscape has much more to offer than Eryri alone. There is a rich variety of landscape types, all of which contribute to the sense of regional identity which is regarded as so important in Wales. All these lesser aesthetic gems, therefore, deserve identification and recognition as they are as integral a part of the overall landscapes as the larger jewels in the Welsh crown such as the National Parks. After all, it is the varied character of the landscape, the ability to experience a mountain summit and a sandy beach within the hours of one day, which contributes so much to its charm.

Nature Conservation.

The importance of the Welsh landscape as a habitat is illustrated by the wildlife and ecological conservation areas dotted around the country. These are in the form of Sites of Special Scientific Interest, Local Nature Reserves, Special Protection Areas and Ramsar Wetland Sites. There is even an example of a UNESCO Biosphere Reserve, which is regarded as "being of importance in a world-wide context", nestled in the Dyfi estuary, ten miles north of Aberystwyth.

Fig. 3.7. Protected Sites in Wales (Map courtesy of Countryside Council for Wales).



In 1986 27% of the land surface of Wales had been designated as protected land. As Taylor (1990) confirms, it ensured that "over one quarter of the Principality has been designated....... and it is a tribute to the supreme scenic quality and diversity of many of the characteristic natural landscapes of Welsh mountains, moorlands, valleys and coasts."

It is impossible to single out one survey as providing a complete picture of the landscape character of Wales. Only two nationwide landscape classifications are in existence (Welsh Office, 1980; Bunce et al., 1996). In addition, there is a myriad of small scale studies evaluating and classifying smaller areas such as counties or National Parks. What follows is a review of the most important of these surveys followed by an attempt to collate the data in order to offer an overview of the landscape character of Wales.

Classifying the Welsh Landscape - Literature Review.

The most comprehensive classification of the landscape of Wales is that completed by Bunce et al. (1996) during 1990 as part of their wider coverage of the whole of Great Britain. This complete classification supersedes the smaller sample survey (Bunce, Barr & Whittaker) published in 1981.

These surveys utilised the Institute of Terrestrial Ecology's (1982) land class system. The system was created to classify land by its ecological resources. Land is classified by the land form, topography, landscape, land use, soils and vegetation of the area concerned. By using these parameters, the land of Britain was defined by 32 distinct land classes.

Fig 3.8 gives the land classes for Wales in descriptive and numerical form.

It was discovered that of Britain's 32 ITE land classes 23 are present in Wales. The most prominent land class is 17 (rounded intermediate slopes, improvable permanent pasture) which accounts for almost 42% of the total area of Wales.

As well as landform, topography and soil type, the types of land use and vegetation are also noted. The inclusion of the latter two illustrates both the magnitude and the importance of the human contribution to the regional diversity of Wales' landscapes. Varied agriculture contributes much to the sense of variation.

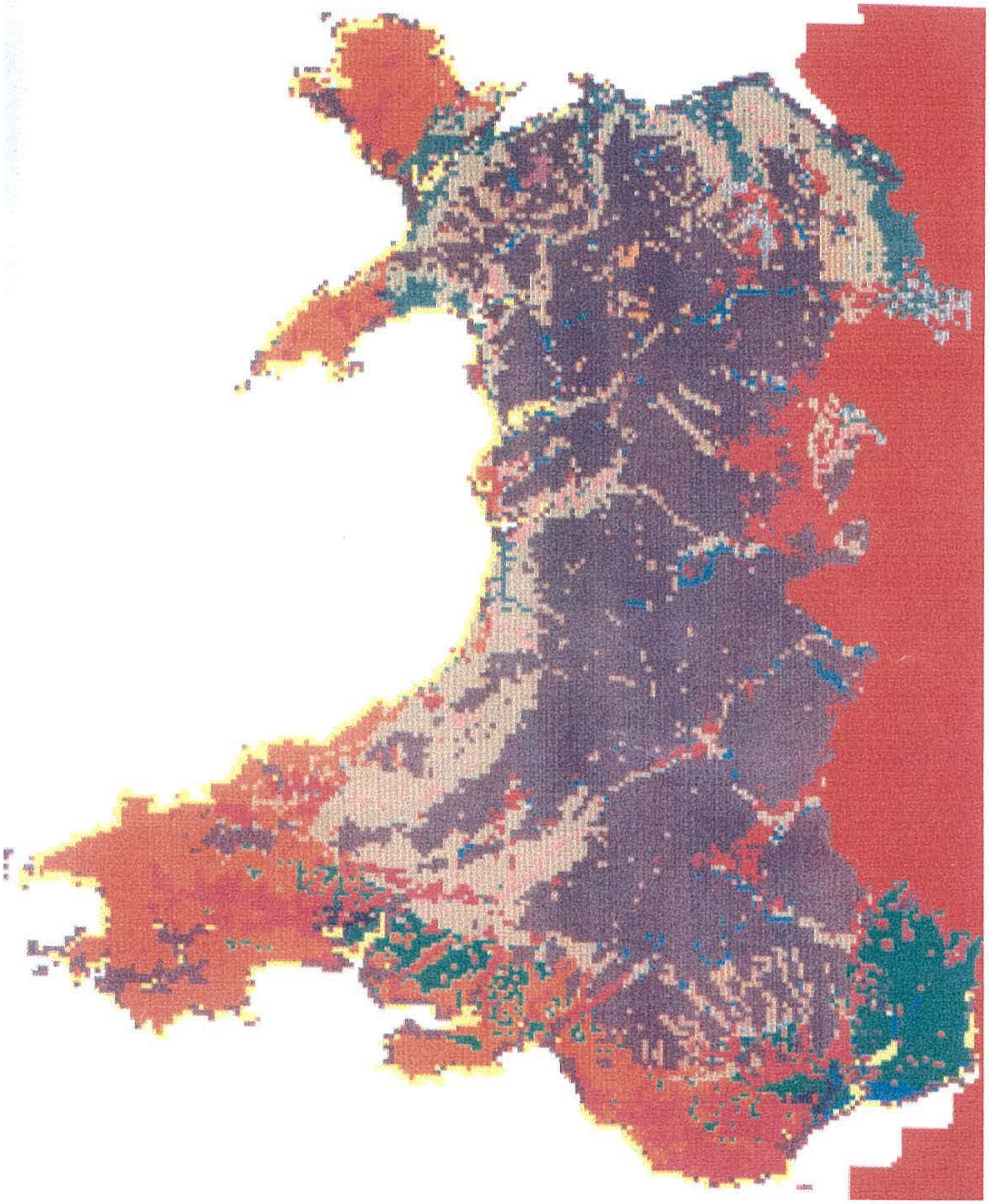


Fig. 3.8. The Institute of Terrestrial Ecology's land classes map for Wales (Courtesy of The Institute of Terrestrial Ecology, 1994).

1. Undulating country, varied agriculture, mainly grassland.
2. Open, gentle slopes, often lowland, varied agriculture.
3. Flat arable land, mainly cereals, little native vegetation.
4. Flat, intensive agriculture, otherwise mainly built up.
5. Lowland, somewhat enclosed land, varied agriculture and vegetation.
6. Gently rolling enclosed country, mainly fertile pastures.
7. Coastal with variable morphology and vegetation.
8. Coastal, often estuarine, mainly pasture, otherwise built up.
9. Fairly flat, open intensive agriculture, often built up.
10. Flat plains with intensive farming, often arable/grass mixtures.
13. Somewhat variable land forms, mainly flat, heterogeneous land use.
14. Level coastal plains with arable, otherwise often urbanised.
15. Valley bottoms with mixed agriculture, predominantly pastural.
16. Undulating lowlands, variable argiculture and native vegetation.
17. Rounded intermediate slopes, mainly improvable permanent pasture.
18. Rounded hills, some steep slopes, varied moorlands.
19. Smooth hills, mainly heather moors, often afforested.
20. Midvalley slopes, wide range of vegetation types.
22. Margins of high mountains, moorlands, often afforested
23. High mountain summits, with well drained moorlands.
26. Fertile lowlands with intensive agriculture.

<u>Key to Fig. 3.8. (Courtesy of the Institute of Terrestrial Ecology, 1994).</u>

Another useful classification is the work produced by the Welsh Office Planning Services during 1980. The report was initiated as a means of classifying the country's scenery. It provides an overview of the previously completed landscape assessment texts and aims to evolve a method by which the Welsh landscape could be assessed.

Rather than naming landscape types, as is the case with the ITE classification, the landscapes types are depicted in the form of functions consisting of the five variables - relative elevation, slope break, fields, trees and woodlands. An additional variable, farmland type, is also included where appropriate. The function is given below.

$$\frac{\text{Relative Elevation / Slope Break}}{\text{Fields / Trees / Woodlands}}$$

The simplified sequence represents: $\dfrac{\text{Landform}}{\text{Surface Mantle}}$

The Welsh map was divided into 400+ landscape units and although many differed "by only one scale interval in relation to one Variable" (Welsh Office, 1980) there was a surprising diversity of units on the whole. On the basis of the 5 digit code (available for 296 of the units) 193 of the units were unique. Even the most prevalent code EIV/565 accounted for a mere 6 units and even then they vary slightly between farmland types as classed in the survey. The method differs significantly from the ITE classification. All Welsh landscapes can be grouped into one of the 32 pre-determined ITE land classes. However, a landscape's "grouping" in the Welsh Office study could be any one of thousands, bounded only by the number of possible combinations of the variables measured. It might be fair to say that the survey method is overtly detailed to be used as a means of pinpointing areas for conservation, especially if it concludes that more than half the units assessed were unique.

Another important work that studies the whole of Wales is the National Atlas of Wales which was published in 1990 by the University of Wales. The authors collated new and previously available data to produce a most exhaustive insight into twentieth century Wales. Sections 1 and 5 depicting "The Physical Environment" and "Land Use and Agriculture" respectively offer a useful overview of landscape and landscape change in the Principality. Whilst the ITE's survey is unquestionably the most comprehensive landscape classification yet compiled for Wales, this atlas provides an excellent framework of Welsh geographical, historical and cultural data which contributes to a greater understanding when attempting to classify or evaluate the landscape of the Principality.

In addition to the aforementioned countrywide surveys there have also been small scale studies on a regional level within Wales. What follows is a county by county review of the most important studies previously conducted.

Clwyd.

Clwyd County Council, in a joint initiative with the Landscape Evaluation Research Project of Manchester University, were responsible for a study of the county in 1974. It elaborated on the subjects discussed in the earlier study of 1972 as well as extending the size of the area surveyed (the previous study was concerned with the smaller county of Flintshire which became part of the county of Clwyd following the reorganisation of local government boundaries in 1974). The study mainly concentrated on the evaluation of the landscape as a scenic resource. Although some landscape assessment was involved at the initial stages of the study this form of appraisal was not completed in any depth but was mooted as a possible area for further research in the future.

The Clwyd study, nevertheless, offers an insight into the landscape of the county through the largely subjective analysis of its visual resource value. The landscape was graded into six arbitrary groups based on scenic value (although a seventh grade not present in Clwyd was regarded as necessary for valuing Britain's "superb" landscapes) and the following picture emerged:

Fig. 3.9. Results of the Clwyd study (1974).

GRADE	LANDSCAPE QUALITY	% AREA
1	Degraded	3%
2	Poor	6%
3	Moderate	29%
4	Good	31%
5	Very Good	18%
6	Excellent	8%
7	Superb	--

(From: An evaluation of the Landscape Quality of Clwyd. Clwyd County Council. 1974. p.9.)

Agricultural land accounted for 85% of the land area which explains the fact that so much of the county's landscape was valued at the mid scale "moderate" to "good" as opposed to the "degraded" or "excellent" and "superb" values at the lower and upper echelons of the scale. 60% of the land was categorised as Grade 3 and 4. This land was cited as agricultural, hilltop and moorland areas by "no means outstanding and could be said to be fairly typical of much of Britain". Examples were also noted of the edge landscapes at the Clwydian and Berwyn Ranges (Grade 5-6) and of the valleys, the Elwy Valley landscape in particular, valued at varying degrees between Grade 3-6. On the lower rungs of the evaluation scale the coastal belt and Wrexham / Queensferry conurbation were scored at Grade 1-2 due to their urbanised and rather flat, treeless nature. The only area of scoring which seems questionable today is concerning the values allotted to landscapes where there was a strong element of coniferous woodland. These were rated Grade 4-5 due to being "an improvement on the moorland or marginal farmland on which they have been planted". It is difficult to envisage that any of Clwyd's coniferous landscapes would merit Grade 5 (Very Good) if the area was re-evaluated today. Also questionable is the belief that the introduction of coniferous woodland does, in fact, improve the appearance of such landscapes although some areas of Clwydian post-industrial land would certainly benefit from such plantations.

Gwynedd.

According to Gwynedd County Council, there is no landscape classification in existence for the county (except as part of the Welsh and British surveys previously discussed). There is, however, a conservation map of Snowdonia. As a large proportion of the county does, in fact, lie within the Snowdonia National park boundary this work must be regarded as the most detailed study available thus far for Gwynedd. These so-called "Section 3" maps are to be produced for all Britain's National Parks.

The Statement defines those areas which the National Park Authority (NPA) recognises as being of higher landscape and/or wildlife and nature conservation values. Its application is, in the main, hoped to be of assistance in the formulation of planning policy and, also, to offer landowners aid in the management of these important conservation areas. The study complies with the Wildlife and Countryside Act 1981 and its Amendment Act of 1985 which stipulate that all the counties of Britain which contribute to a part of a National Park should produce a Conservation Map showing those areas of particular natural beauty. Grants will be forthcoming both in "recognition of existing land use practices" as well as for landowners "if they are prepared to alter their existing practices, thereby enhancing the semi-natural character". This study, therefore, has been commissioned in order to designate those areas cited as being worthy of aid.

A detailed landscape classification map of Snowdonia is to be produced in the future and the purpose of this earlier work is to provide a framework for this study. It does, however, shed some light on the areas within the Park which are denoted by the Park Authority as being of "the natural beauty of which, the Authority considers it is particularly important to conserve" as recognised by the Wildlife and Countryside (Amendment) Act of 1985.

The Park was divided as follows, although 26.5% of the land failed meet the necessary inclusion criteria:

Mountain & Moor 52.0%

Coast 1.5%

Woodland 4.0%

Wooded Areas 16.0% "areas with a wooded character"

(Snowdonia National Park, 1991)

This survey offers a slightly subjective view of the Eryri landscape though it gives little additional information to the average Ordnance Survey map. A landscape evaluation map was produced by the author for the forthcoming Gwynedd Atlas and is discussed at some length in chapter 10.

Whilst designation alone is not necessarily proof of an area's importance, the fact that so many areas have been recognised by different agencies illustrates the diversity of landscapes and habitats which exist in Wales.

The Landscape Character of Wales - Conclusion.

The landscape classifications / descriptions / assessments and evaluation studies outlined above offer illustrations of the landscape as it exists today. I have also attempted to place the landscape of Wales in its rightful cultural and historical context. What follows is my own brief landscape description of Wales and an appraisal of the variety of regional character within the Principality resulting from both differences in the previously landform and also in land use.

Land Use - The Changing Face of the Land.

Before discussing aspects of land use, particularly that of agriculture and its effect on the local vegetation pattern, it may be useful to note the location and proportions of areas of surviving natural and semi-natural vegetation. As a whole these areas are quite closely related to the areas of higher elevation, generally over 600 feet or about 200 metres: this probably results from such land being largely uncultivated, often put over to sheep which graze on the existing vegetation. Of this semi-natural vegetation there are four main categories; salt marshes and sand dunes, bogs, heather moorland, and grass moorland of which the latter is most widely abundant.

Agriculture.

I have previously discussed the importance of agriculture to the Welsh economy and, consequently, the potential impact which such a large scale industry, as a percentage of total land area, can have on the landscape as a whole. It is, by far, the major land user in Wales and has, as a result, become synonymous with the rural landscape. Therefore, agricultural developments have often resulted in a change in landscape and their possible aesthetic contribution must be considered in the future also.

The quality of the land has a significant effect on farming regimes and, consequently, on land use and vegetation patterns. The higher quality agricultural land earmarked for crop and cattle production prevails on the coastal plains and valley areas as well as the area straddling the English border. The land of highest production value is located in the Vales of Conwy and Clwyd, Glamorgan and Gwent. There seems to be something of an inverse relationship between agricultural land values and scenic values for much of Wales. It is the land of lower agricultural value, used for exclusive sheep or mixed sheep and cattle grazing, which is generally regarded as being of higher scenic value: Snowdonia, Berwyn Mountains and the Brecon Beacons. This might be due to such areas appearing more wild or natural than the crop landscapes of the lowlands. Another possible explanation is that much of the land of lower agricultural value is classed as such due to the unsuitability of the landform for crop planting. But it is often the case that areas of higher elevation and relief in the uplands are valued aesthetically for the very reason which devalues them agriculturally.

Industry.

The industrial era has also had a notable effect on many Welsh scenes. Almost invariably, extractive activity degrades the quality of the surrounding landscape. The slate spoil heaps of Gwynedd and the blackened coal valleys of South Wales bear testimony to their industrial heritage. It is difficult to envisage any such sites being conserved for their aesthetic value, even though they do convey a sense of regional identity, not least the respective North / South, slate / coal "divide". There is, however, a strong argument for the preservation of selected examples for their educational / historical value. It is interesting to note that the more antiquated examples of post-industrial sites are viewed with a certain degree of romanticism and their preservation is often seen as being worthwhile. Muir (1993) believes that "the older industrial landscapes are often visually attractive, almost invariably soulful and evocative". But he is disparaging of later industrial landscapes, citing them as being "clouded by the squalor and scenic obscenities of the nineteenth and earlier twentieth centuries". Many such areas of post-industrial land are today being redeveloped, as "Garden Festival" sites for instance and usually with a positive aesthetic result. However, caution must be shown when considering such developments that some of these sites are retained so that they may provide a historical record of industrial development for the benefit of future generations.

Fig 3.10. Llanrwst Lead Mine at Nant Bwlch yr Haearn, Gwynedd. Buildings from the disused mine add interest to an otherwise featureless forest scene.

Another impact on the landscape resulted from the way in which many of the mine owners disposed of their profits. They often invested in the building of grandiose country houses which were often accompanied by follies. The Gwynedd slate industry contributed to the financing of Plas Tan-y-Bwlch in Maentwrog for example. Similarly, the Ashton-Smiths' Vaynol Estate near Felinheli and Lord Penrhyn's eponymously named "castle" at Llandegai near Bangor were built with monies obtained from mining the Dinorwig and Penrhyn quarries, respectively.

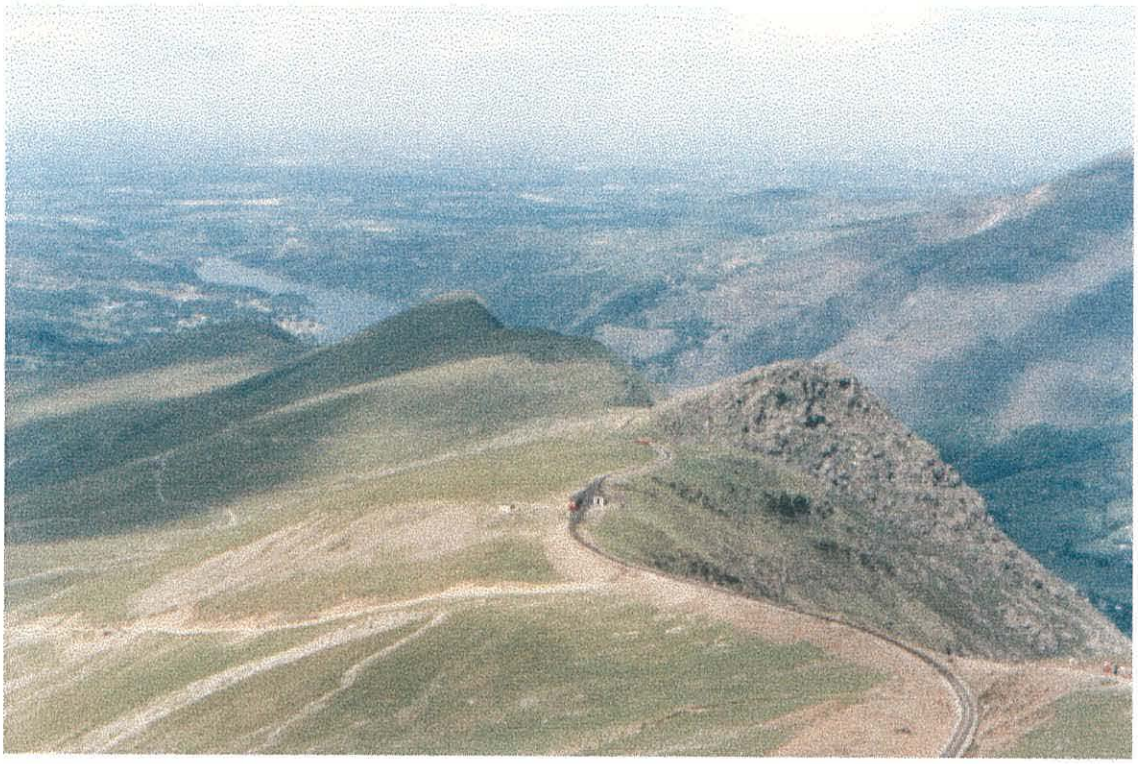


Fig. 3.11 Dinorwig Quarry near Llanberis. Terraces and unsightly spoil heaps significantly detract from this otherwise attractive view from Snowdon's Llanberis path.

The Taming of Wild Wales - The Homogenisation of the Countryside.

Agriculture is the major land user in Wales. Any marked change in the farming industry can, subsequently, have a significant effect on the landscape of our rural areas.

Landscape changes have been widespread in recent decades. There has been a general increase in tree planting, both small scale and in large plantation form. Hedge clearance has accelerated as fields are extended and cheaper fences erected. Vernacular farm buildings often lie in ruins in the shadow of breeze block sheds. More land is being cultivated as rural landscapes become more and more stereotypical.

Progress is obviously an inextricable part of the rural economy. Landscape change through land use development has been a centuries old phenomenon which has, to a large degree, continued in harmony with the landscape. Change, in itself, need not degrade the landscape. However, more recent agricultural practices appear not to have such a benign effect on rural views as those of the past. The problem today is that change can occur on such a large spatial scale and in such a short timescale.

Learning From the Urban Experience.

Excluding a few notable exceptions, modern cities in particular divulge little to the viewer of the vernacular forms of their past. The ability to transport raw materials relatively inexpensively as well as the wider application of similar architectural techniques has meant that cities vary little from region to region or even at the intercontinental scale. Often only the colour of the taxis betrays the fact that a street is located in London or New York, due to the similarity of their respective buildings.

The process seems to have reached a climax in the twentieth century with the emergence of the modernist architectural movement. Its innately functionalist approach to design, by its very nature, denies any cultural or historical ties which might otherwise be considered during the design process. Bourassa (1991) describes the objectives of "Functionalism (as) an international style that was appropriate universally, at all places and times, regardless of the cultural, historical, climatological or topographical context". He also highlights the "denial of tradition" as an important aspect of the modernist credo. This sounds as accurate a description of homogenisation as it does of modernism. The hope now, however, is that Cooper's (1987) vision of city design being guided by "a very powerful sense of regionalism" does, indeed, become a reality.

Urban Conservation.

There are examples throughout Britain where the preservation of regional identity has contributed to the economic prosperity of the area. Cities such as Chester, Cambridge, Bath, Oxford, York and Edinburgh owe much of their success in attracting visitors to the successful conservation of their vernacular structures. The Cotswold landscape is another example where legislation deems it appropriate to utilise local building stone where possible, thus reinforcing the identity of the region.

Rural Planning and Change.

Rural development, however, is far less controlled than that in urban areas. Whilst planning permission must be granted for houses or commercial enterprises there seems to be far less constraint on agricultural development. As a result, the outcome of policies to increase productivity have succeeded in creating not only a highly intensive, efficient industry but also a landscape which often lacks regional identity.

The removal of a few metres of hedgerow by a single farmer may seem trivial as an isolated incident. However, the cumulative effect of this nationwide is substantial. As Bunce, Peters, Barr & Howard illustrate, "Many changes in land-use are small individually, but together may often have significant additive effects on aspects of landscape and / or settlement patterns".

Landform is certainly the major landscape constituent, nevertheless we should not lightly dismiss the aesthetic contribution made by our use of the land. The use made of materials found close at hand has, in the past, made a vast contribution to the regional character of Wales as indeed it has to the rest of Britain and the world. The outcome of this was an increased sense of place in that the landscape constituents for a given area seemed to relate more closely to each other. The vegetation pattern, generally, was related to that of the surrounding landscape with tree species of local provenance being the most abundant. Farm buildings and boundaries were normally found to be built from materials available locally. This may have been in the form of locally felled timber (or standing in the case of hedgerow boundaries) as well as masonry extracted from the surrounding rock outcrops. The sense of place and visual unity was accentuated by such developments which were, in fact, merely elements of the surrounding landscape which had been rearranged by human hands. Today, however, the movement is towards the importation of materials and skills from other regions.

In 1904 Geddes declared that towns and cities should be developed as Eutopias (good place) as opposed to Thomas Moore's Utopias (no place). According to Hough (1990)

"Eutopia is assured when culture and ecology become part of the design thinking. Utopia is the consequence of ignoring them". Sadly, in many of our towns and cities Geddes' ideal seems to have been largely ignored over the ensuing decades. The task today is to seek to ensure that some local identity is preserved in our rural areas and that they do not become as standardised as the urban scene.

Examples of Homogenisation in Wales.

Boundary Features.

The Countryside Commission (1991) in their study of landscape change in the National Parks, discovered that similar land uses throughout the Parks of Britain were responsible for an increasingly uniform rural landscape. All three Welsh Parks saw an increase in coniferous forest cover and cultivated land / improved pasture. Similarly, they all sustained losses of upland heath, grass moor and rough pasture. The most disheartening statistics are regarding changes to the boundary features of each of the Parks. It may be surprising to discover that three areas in such close proximity have three different main boundary features (Fig 3.12). This may not be the case if current practices persist. Whilst Snowdonia, the Brecon Beacons and the Pembrokeshire Coast have all suffered losses in their walls, hedgerows and banks respectively, they have all seen an increase in fence length during the corresponding period.

As the data illustrate, the traditional features cleared have not been universally replaced by fence boundaries: many have simply been removed to increase field size, extend the cultivatable area or to facilitate such developments as roadbuilding. It does show, however, that where boundaries are laid today they are usually found not to be those traditionally associated with these areas. This is not a new phenomenon. The Clwyd County Council landscape evaluation of 1974 drew attention to "Road improvements generally lead(ing) to hedgerow removal and their replacement by various forms of fences".

Fig 3.12. Boundary Features in the Welsh National Parks.

National Park.	Boundary	Boundary Length (1980's)	Loss / Gain (1970's-1980's)
Brecon Beacons	Hedgerows	5375.7 km	-150.1 km
Brecon Beacons	Walls	574.1 km	-0.1 km
Brecon Beacons	Fences	152.0 km	+2.6 km
Pembrokeshire	Banks	3243.3 km	-66.4 km
Pembrokeshire	Hedgerows	1412.6 km	-58.3 km
Pembrokeshire	Fences	274.3 km	+9.2 km
Snowdonia	Walls	4914.8 km	-53.6 km
Snowdonia	Hedgerows	2030.2 km	-94.7 km
Snowdonia	Fences	1855.1 km	+40.9 km

(Source: Countryside Council for Wales / Countryside Commission, 1991).

The Suburbanisation of the Countryside.

There seems also to be a tendency towards the suburbanisation of our rural areas. According to Davies (1991), "Folk building was the last truly regional style of building in Wales. Culture, however is constantly changing......The danger, therefore, in relating to regional character is that the true basis for continuance of tradition has been lost, or has significantly changed, leading us merely into affectation or pastiche......Today, whilst we all recognise the beauty of our countryside, our buildings tend to reduce it to suburban mediocrity with catalogue housing, gnomes, ranch fences and other alien bric-a-brac". This is a scene all too often viewed in the rural Wales of the 1990's where trees and buildings usually associated with suburbia are often located without any regard for the landscape of the countryside.

This view of the loss of our indigenous landscapes is echoed by Hodge (1995) stating that "In the UK, highly distinctive regional landscapes have evolved over the centuries in response to the influences of climate, geology and patterns of land use. These landscapes are under increasing pressure, particularly on the urban edge, due to human pressure, changing land use patterns and the high cost of maintaining landscape features that no longer serve a practical function. With improving communications and mass production, regionally distinctive landscapes are being homogenised by a standardisation of materials and design in the land based industries. This influence is increasing as the means have become more readily available to modify patterns of land use on a large scale, for example through hedgerow removal, opencast mining and trunk road construction".

Trees and the Rhododendron ponticum Problem.

The planting of exotic tree species is also a cause for concern in many areas, especially if blanket Sitka spruce totally replaces the local vegetation pattern. The most pressing problem in Snowdonia, however, is another caused inadvertently by humans and one which is gradually replacing the indigenous vegetation pattern. Rhododendron planted, initially, for ornamental purposes in Gwynedd's gardens and great houses has spread outside the garden wall to become a significant element of the Snowdonia National Park landscape. Its spread throughout Wales is a concern but its dominance of much of the Snowdonia landscape is particularly worrying. A conference on the subject of the proliferation of *Rhododendron ponticum* in Snowdonia (Snowdonia National Park, 1987) estimated that it would cost upwards of £30 million to eradicate the plant from the Park as a whole. An earlier report (Gritten, 1986) also discovered that when the Park was divided into a grid by square kilometres that 28% of these squares had within them some *Rhododendron ponticum.* Whilst it was accepted (Snowdonia National Park, 1987) that some of the media coverage of the problem describing "Farmers in Snowdonia, North Wales, (are) using bulldozers and flame-throwers to battle a Triffid-like plague of wild rhododendrons" was somewhat over-zealous it was also noted that other introductions have already changed the ecology of Snowdonia. It is accepted that the eradication of the Rhododendron is accomplishable: the main question would be who will foot the bill.

There may be an argument for retaining the plant in some areas. Indeed, it may be regarded by some as a positive landscape feature, especially when in bloom. The main consideration in this context, however, is not that it decreases an area's aesthetic value, or that it is somehow an invader of foreign origin; it is that if it is left unchecked then it will replace the very localised flora which will be detrimental to the landscape's aesthetic diversity.

The Preservation and Restoration of the Welsh Landscape's Regional Identity.

It is easy enough to bemoan the changes in the landscape of the countryside, but what can be done to stop them? One possible step forward might be to seek to extend the town and country planning legislation to bring rural development procedure in line with that for urban areas. Whilst there are plenty of examples of bad planning in urban areas, there are also many success stories where planning regulations have been strongly upheld. Chester, Llandudno and the Cotswold villages testify to this success. However, the strength of the agricultural and land-owning lobby in opposing such moves is considerable.

It seems that the only avenue available is to offer farmers financial inducements in return for safeguarding those elements which contribute to the regional identity of their land. This is the main thrust of the Tir Cymen scheme currently being implemented experimentally by the Countryside Council for Wales (1992) in Meirionnydd, Dinefwr and Swansea. The aim of the scheme is to "offer Welsh farmers annual payments in return for the positive management of their land for the benefit of wildlife, landscape, archaeology and geology, and for providing better opportunities for quiet enjoyment of the countryside". It is understood that this pilot scheme will be replaced during 1999 by a new scheme entitled "Tir Gofal". This scheme will be similar in substance to its predecessor but will be implemented nationwide in Wales.

It is clearly apparent as we approach the end of the millennium that unless regional character is recognised by those involved in landscape assessment as a factor of great importance then even further homogenisation will ensue. When assessing landscapes for designation, for instance the Countryside Commission's mooted Areas of Great Landscape Value, we must realise that it is not only the Snowdonia and Lake District type high quality landscapes which are safeguarded, but also those possibly lower quality landscapes which possess a sense of regional identity. Landscape conservation and designation should stand for much more than the protection and stewardship of the National Parks.

In 1970 Fairbrother hinted at a "Country Code for Farmers", though it seems that the pace of change in more recent years probably means that stronger policies are required today. It may be that the only way to success is by statutory measures which stipulate that an area's vernacular development is a desirable planning consideration. Such a policy could then be adhered to by farmers, foresters, architects and designers alike who should, where appropriate, show an ability to adapt any development to suit local vernacular traditions and indigenous vegetation patterns. If the implementation of such a policy was found to be difficult then there may be a need, through such a body as the Countryside Council for Wales, to provide assistance. This might be in the form of offering financial inducement and expertise in assisting developers who are willing to make amendments to their plans but at the risk of incurring additional expense.

It may seem strange to some that farmers should be paid to look after the countryside. However, it is not enough to say that they own the land and should therefore be responsible for its upkeep. If we wish them to safeguard our rural landscapes then it may be that they should be assisted financially if they incur an economic loss for doing so. The Countryside Commission's 1983 upland study discovered that many farmers were willing to accept the responsibility for rural conservation but it may be that we should not expect them to do so alone or to leave it in the hands of those farmers who are willing to do so.

CHAPTER 4

THE PRINCIPLES OF DESIGN.

"Nature must be served rather than mastered, for man is a part of nature and his environment." (Colvin, 1970).

Successful landscape design is, to a large degree, predestined. It is a case of implementing a set of accepted design rules on an existing landscape. In the city or townscape, visual integration may not be of vital importance, though some might beg to differ (HRH Prince of Wales, 1990). Indeed there may be instances where the designer aims for contrast rather than unity in designing shop frontages and signs which attract interest. However, if such diversity is achieved within an unified framework the overall effect will probably be of higher aesthetic quality. There is a marked difference between rural and urban design, this being that usually, all rural plans should be drawn with one main goal in mind, to aim for a sense of "naturalness". Despite the fact that almost all of rural Britain is affected to some degree by human activity the countryside continues to be regarded as natural compared to the synthetic quality of the built, urban environment within which the majority of the population reside. The rural landscape, as a result, still dominated by the organic forms of nature, is seen as an antidote to the often severe, geometric forms which dominate the urban scene. Rural development, therefore, should always attempt to imitate or at least integrate with the patterns of nature.

Rural Landscape Design - A Historical Perspective.

The desire for naturalness in rural design is not a recent concept. Admittedly, commercial forestry may view it as a fairly new idea, largely due to the lack of consideration for aesthetics at the inception of the Forestry Commission in 1919. Others may yet not have grasped its importance but the awareness of the need for attractive, natural rural design is a centuries old tradition. Obviously, in 1919 the sparsity of British woodland cover ensured that timber production was to be the primary objective. In fact it seems to have been the only objective of the Commission at the time, who cited that their aim was to "promot(e) the interests of forestry, the development of forestry, the development of afforestation and the production and supply of timber". Prior to 1919 woodlands and forests had never been planted in such abundance and as there was no previous experience of bad or unsightly planting by which to compare, errors were made on a large scale. In fairness, timber was needed for strategic reasons at the time and the aesthetics of the forest design was secondary to achieving as much of a stock of wood as possible on the land. Consequently, as good landscape design was not within the remit of the Commission's early work "what may now be looked upon as poor design was really an effective answer at the time to a particular forest policy." (Hart, 1991)

However, landscape design itself was not unheard of in 1919. In Britain the first group of individuals to develop landscape plans with aesthetic principles in mind as well as, in some cases, timber production were the landscape gardeners. These were the pioneers of landscape design employed by the upper classes to design the gardens surrounding their country mansions. They also formed many of the impressive arboreta which heralded the many exotics which were imported into this country though lamented by some today. In 1664, two and a half centuries before the creation of the Forestry Commission, John Evelyn alerted landowners to the need for urgent forest planting to combat the declining tree cover. Simultaneously, he expounded the argument that trees should be planted for their beauty as well as their timber, subscribing to the view that the two are not incompatible. Evelyn's work, and that of Bacon (1612) four decades previously, epitomised the move towards an element of wilderness in the designs of the period. It was a movement away from the more formal towards a naturalistic, picturesque tradition. Colvin (1970) cites that "It was the coincidence of three movements (agriculture, timber production and landscape design) interacting at a critical time, when so much of the landscape was in the melting-pot, which gave us the rural scenery we so cosily take for granted today."

Might it not now be the case that late twentieth century rural Britain is in a similar situation as agricultural production is curbed and forestry is on the increase? It is simply a case of large scale land use change in the countryside of a scale not unlike that of the enclosures.

Garden design can be divided quite clearly into two distinct schools of thought. The first included Lancelot Brown, Humphrey Repton, Charles Bridgeman and William

Kent. These four, and others, recognised the importance of natural forms in garden and park design. Their informal gardens extended from terrace, through tree clumps (planted to replace the more formal avenues) and out via the ha-ha to the "wilderness" of the surrounding countryside, though whether much of eighteenth and nineteenth rural Britain was indeed "wild" is debateable. The invention of the ha-ha is accredited to Bridgeman himself, this being a device by which the garden was separated from the surrounding country by means of a ditch. This meant an open view of the surrounding landscape was possible due to the lack of a surrounding wall or hedge. The other, later group, was the formal movement which favoured the less naturalistic forms of the more geometrical avenues of which, among others, Reginald Blomfield (1856-1942) and Edwin Lutyens (1869-1944) were leading figures. In latter years Gertrude Jekyll attempted, and with some success, to find a measure of compatibility between the two opposing schools of thought, though it must be stated here that it is difficult to argue the case for formality in any rural design located outside the garden wall.

These luminaries of early landscape design started to make use of trees as objects of aesthetic value. However, the informal movement in particular also showed an early awareness for designs which allowed for visual unity and a measure of naturalness. These informal gardens were not planned as islands of formality in a sea of rural wilderness bounded by geometric hedges and topiary. They were now seen as a means of relating the garden to the surrounding countryside. Indeed the ha-ha was a device created to act as an invisible boundary when viewed from within in order to extend the view to the wider country. It enabled them to relate the in-garden forms to those in nature which surrounded them.

A Lesson Learnt the Hard Way - The Mistakes of the Past.

Forest design textbooks as well as the British countryside testify to the folly of some past planting. We are all aware of those block plantations which seem to hang precariously on some upland slopes or those forests where straight edges define the boundary between wooded and open land. Similarly, those "linear" plantations where a (possibly well meaning) forester has decided to create some diversity by selecting a mix of two species, but unfortunately decided to plant them in alternate rows rather than in groups related to landform. Examples also exist of the chess-board effect characteristic of plantations where felling has taken place in small, geometric blocks.

Forest design has come a long way since 1919. Foresters, through past experience, have learnt that landscape design must be an integral part of the forest design process as opposed to a secondary consideration which is pandered to where possible. The increase in non-timber benefits afforded by forestry such as recreation, wildlife conservation and sport has also led to an increased awareness in the aesthetic landscape of our forests. They are no longer simply crops viewed on the occasional hillside: they are also locations for specially designed walks, picnic sites, bicycle tracks, camping sites, pony trekking and often where the forest surrounds a reservoir or bounds a river there may be opportunities for fishing enterprises. Particularly with such widespread ownership of motor vehicles such rural areas have become increasingly accessible to visitors even for day outings. All these factors have contributed to the need for a heightened awareness in creating an attractive and pleasing landscape within which these activities may be accommodated.

The Forestry Commission have been widely criticised for their past failings in the field of landscape design but they have made significant strides in this aspect of forest planning, in the past three decades especially. This improvement came mainly due to the pioneering work of its landscape consultant between 1963 and 1976, Dame Sylvia Crowe, indeed the former year was the date when "environmental enhancement" (Price, 1987) became a policy objective for the Forestry Commission. The Commission's landscape design guidelines are based on Crowe's own principles of forest design (Mackie, 1978) which laid down the ground rules for today's design principles. Crowe identified the need for planting based on an assessment of the landscape character of the area in question. It might sound like rather an elementary principle today, but prior to 1963 such aesthetic considerations were not normally focused upon. Crowe recognised that "The visual character of a landscape is influenced by the configuration of the ground and the scale of its variations; the existing type and pattern of vegetation and land use and the prevailing colour of rock, soil and structures. This character determines the extent and pattern of the forestry which will look right in any given landscape" (Crowe, 1978). This heralded a whole new approach to forest design in relation to the wider landscape and a policy of visual integration rather than imposition.

Others have also contributed to the forest design discussion, not least Simon Bell and Oliver Lucas who both currently work in the employ of the Forestry Commission and have published texts dealing both with the principles governing general landscape design (Bell, 1993) and with particular aspects of forest design itself (Lucas, 1991). The Forestry Commission's own "Guidelines" text on the subject of forest landscape design was also a product of their work and will be referred to widely in the following text. The following principles of landscape design are discussed under the headings utilised in Price (1994), whilst a review of landscape books is provided in appendix 2.

THE PRINCIPLE OF NATURALNESS.

"No man ought to attempt the laying out of land who is not naturally possessed of good taste for that sort of landscape scenery which is based upon the laws of nature." (Brown, 1882).

It might be said that the task of the rural landscape designer is a thankless one. A bad design will invariably draw the eye and the wrath of the viewer, whilst the successful design which adheres to the principles of naturalness and appropriateness to the scene should blend into its setting by creating the illusion that it is of nature rather than man-made. Consequently, the work of the successful rural designer will, hopefully, go unnoticed. Hackett (1979) uses the term "natural simplicity" for those landscapes which appear to be of nature, though creating a view which appears to have been born of the forces of nature is in reality no mean feat.

The importance of achieving naturalness in forest design should not be underestimated. Much of rural Britain testifies to the mistakes foresters made in the past. It is often said that British forestry, in general, has learnt the hard way about the merits of good practice in landscape design. It has been a lesson learnt through the bitter experience of past mistakes (McCluskey, 1986; Williams, 1990), the legacy of which may still be witnessed in many rural areas. This belief that it was only possible for the Forestry Commission to learn by its own early inadequacies could lead us to believe that interest in landscape beauty is a phenomenon peculiar to the mid and late twentieth century. However, as Downing (1972) explains, this is not the case.

When designing a forest with naturalness in mind the main consideration should be whether the shape/form of the plantation appears to result from nature or is more akin to a man-made feature. This is seen at its most obvious at the edge of a plantation. It may be viewed from afar in the form of a geometric boundary or at close range where the vertical edge to a conifer plantation has not been designed to appear natural.

Plantation Shape.

No-one with the slightest awareness of past practice in British forestry could deny the importance of shape and form in the design of plantation forestry. The unnatural, geometric forms which all too often have become synonymous with traditional forestry highlight the negative effect which such forests can have on the aesthetic landscape. Such geometric forms are obviously of significance in the process of farm woodland design and, if anything, may be of even greater relevance than in what may be termed high forestry. After all, the landscape of agriculture is often seen to be defined by a geometric enclosure pattern which might tempt some to simply plant up a field with this "new" crop of trees. In some circumstances, such a practice may be acceptable, most notably in lowland landscapes and preferably where they can not be seen from viewpoints of a higher elevation. However, in upland landscapes such forms invariably appear intrusive, particularly when located on hillsides where what would only be seen as an aerial view in other landscapes becomes the view from the surrounding landscape.

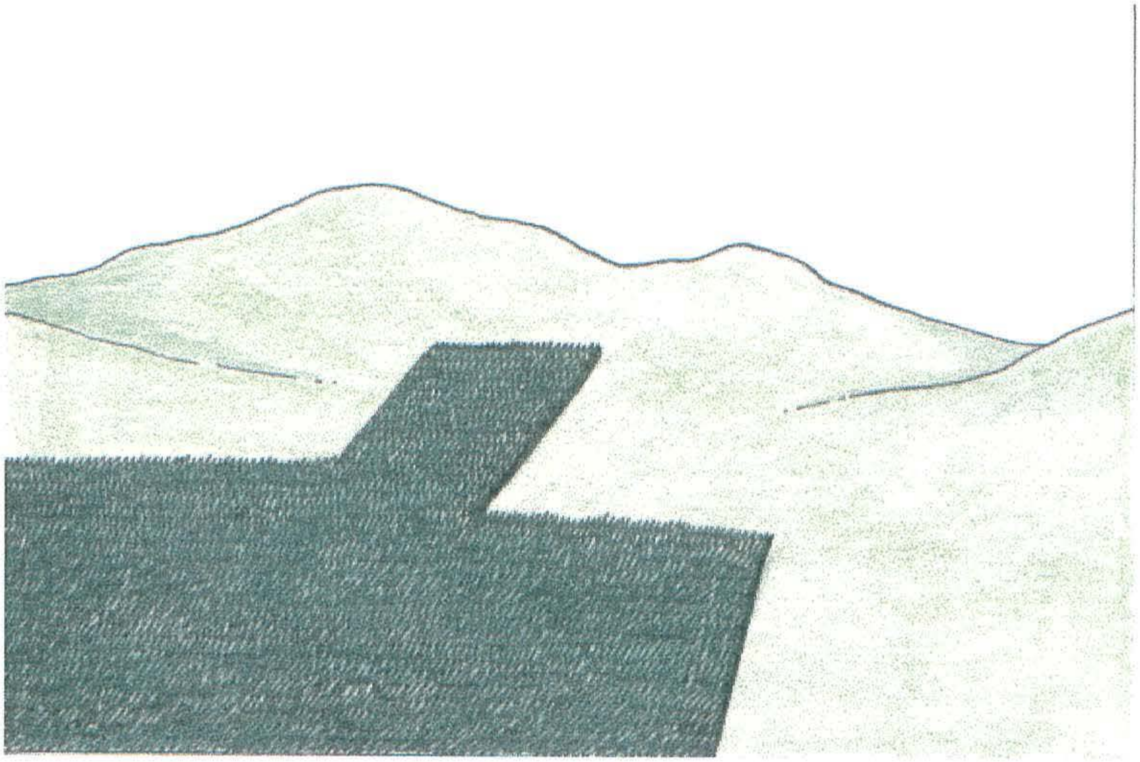


Fig 4.1. A geometric, straight edge plantation which has been located without any regard for landform or visual forces and is, consequently, totally at odds with the surrounding landscape pattern.

Whilst it is easy to decree that geometrically shaped plantations are not suited to the natural landscape it is also necessary to decide on forest forms which are acceptable.

Despite large scale human interference, namely that resulting from the enclosures of the countryside, rural Britain continues to be dominated by organic forms and landforms which is probably why it is still perceived by many to be a result of nature rather than man's work. Consequently, it is these irregular, natural or organic forms (Lucas, 1991; Bell, 1993) which should predominate when forests are to be designed for such areas. The main component of form should be that the forest edge is of an irregular rather than straight quality. Those who have viewed the straight edged plantations of the past would probably agree with Colvin's (1970) assertion that "Nature abhors a straight line".

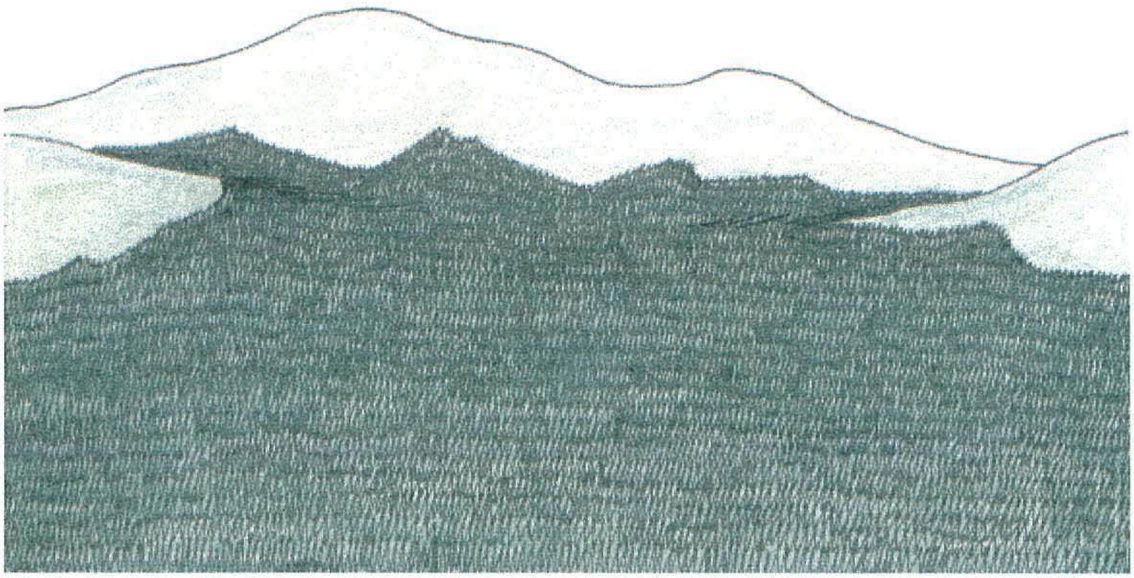


Fig 4.2. A large scale plantation designed to conform with the shape of the landform. Planting downwards on the spurs (to the left and right of the view) allows for some open space to be retained in the middle ground. Additionally, the upper forest edge to the background is shaped to mirror the surrounding landforms.

Linear elements may also affect landscape patterns. In most British landscapes straight lines, for instance roads or forest rides, will appear at odds with the irregular, organic forms of the surrounding landforms and vegetation patterns. However, in landscapes which are predominantly geometric or even grid-like in nature, such as those of agricultural Denmark or the farmed American plains, this is contradicted as, from a visual integration standpoint, linear landscape elements designed in anything other than straight lines would be unacceptable. In rural Britain, however, it is advisable where possible to design linear features to follow changes in the landform which should assist in the visual integration of such features.

Edge Form.

The vertical form of the forest edge is also a consideration in the process of design. Plantation edges are often typified by a straight wall of conifers which rises abruptly from the field to the treetops without any intervening layers. This effect can appear extremely drastic from close range though it might appear insignificant when viewed from further afield. To remedy this problem it is desirable to create a more layered effect at the forest edge which allows for a more gradual development from grass layer to forest canopy. Depending on the particular circumstances it might be possible to add three additional layers at the edge rising from a herb to a shrub layer which then rises to a layer of broadleaves planted as a counterfoil. Where such edge planting is to be added to existing plantations it is advisable to select shade tolerant broadleaves such as beech. In the farm woodland situation a farmer wishing to utilise his or her woodlands to provide game cover should certainly see sporting as well as aesthetic benefits from such practice (this subject is discussed in greater detail under the heading of "shelterbelt design" later in this chapter). The design of farm woodland edges is of even higher priority where such woods are to be sited close to the farmstead itself or to transport routes. Edge form is probably of greater significance here than in traditional forestry as many such plantations are in less accessible areas and may usually be seen from further afield.

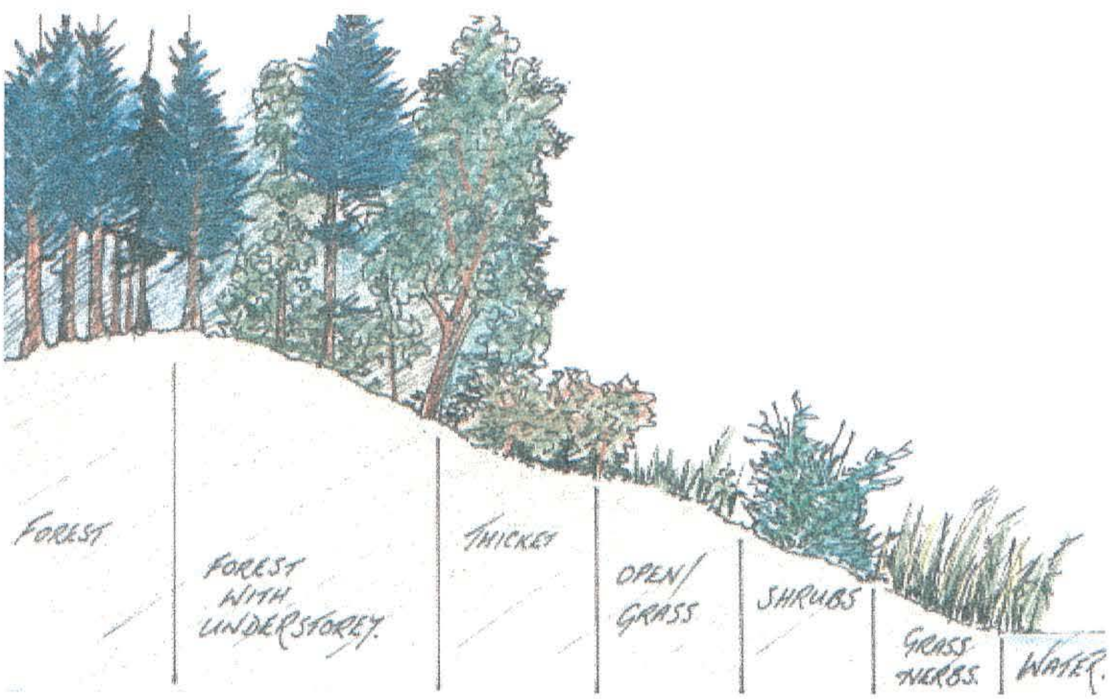


Fig 4.3. Graduation of layers from the water surface to high forest acts as a buffer and gives increased aesthetic value. (Adapted from: Forestry Commission, 1991, "Forests and Water Guidelines".)

Where edge planting near water courses is concerned then a graduation in planting from the water surface to high forest is desirable both in acting as a physical buffer between the two (Forestry Commission, 1991) and enhancing the aesthetic quality of the forest edge.

THE PRINCIPLE OF EQUILIBRIUM.

This element of forest design could be described as the landscape itself assisting the designer in his or her plan. It entails designing to conform with cues present in the landscape. These may be termed as the visual forces and they can help in deciding the shape of the woodland or forest which is to be planted. If planting does not reach a state of equilibrium with the visual forces which are at work then the forest will often sit rather uneasily in the landscape.

Visual Force.

This element of forest design is closely related to that of form discussed previously. Visual force is an important aspect when relating forests or woodlands to landform. Visual force can be described as that factor of landscape which contributes to "sensations of movement......present in static images" (Bell, 1993). Visual force can provide a useful aid in integrating development into the existing landscape. A design which does not consider the effect of visual force will often appear at odds with the landform thus creating a rather disjointed view which can lead to aesthetic disunity. This element of visual forces in planting design is originally attributable to the work of Campbell.

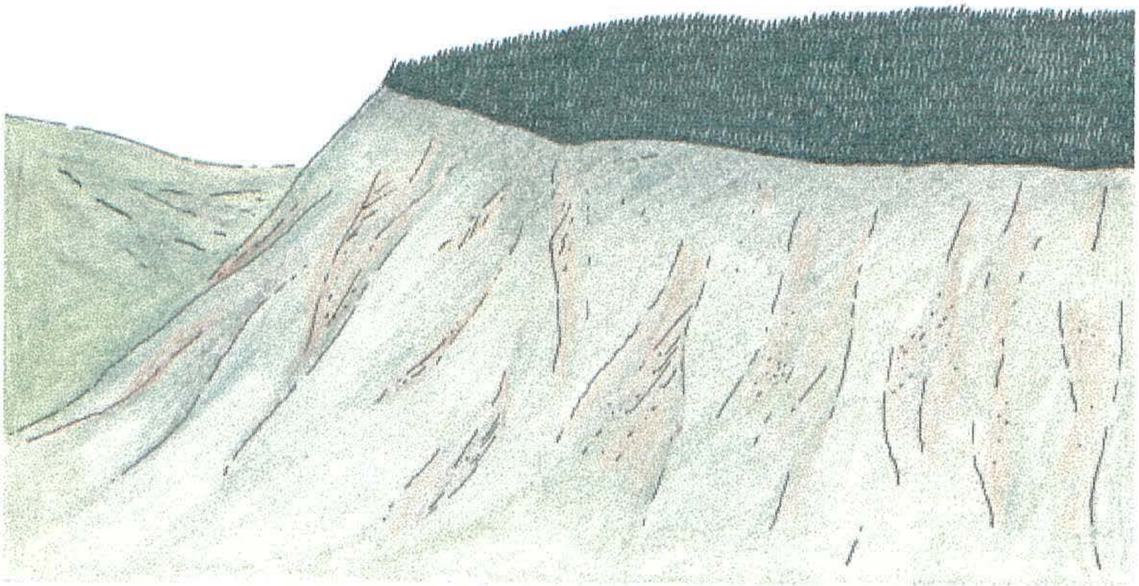


Fig 4.4. Plateau planting which fails to take into account the influence of visual forces. Consequently the plantation appears top-heavy in relation to the landform. Such plantations tend to give an "inversion effect" and where such plantations appear to slightly spill over the edge of the plateau a "treacle" effect may also prevail (Price, 1994).

The main consideration for designers in the uplands concerns planting on spurs and hollows. Bell (1993) asserts that visual forces tend to draw the eye downwards on spurs or convexities and upwards into hollows or concavities. Any planting should follow this rule. The plantation edge should be designed to rise upwards into the hollows and to fall lower down on the spurs. This rule is often related to a landform's drainage pattern where water gathers in basins and the damper hollows whilst running off the more exposed spurs. Replicating this through the use of trees may well be the most appropriate means of design for example in such landscapes as Snowdonia. The result of this should be to achieve a stronger sense of bonding between open and afforested land as well as to ensure that the landform remains dominant.

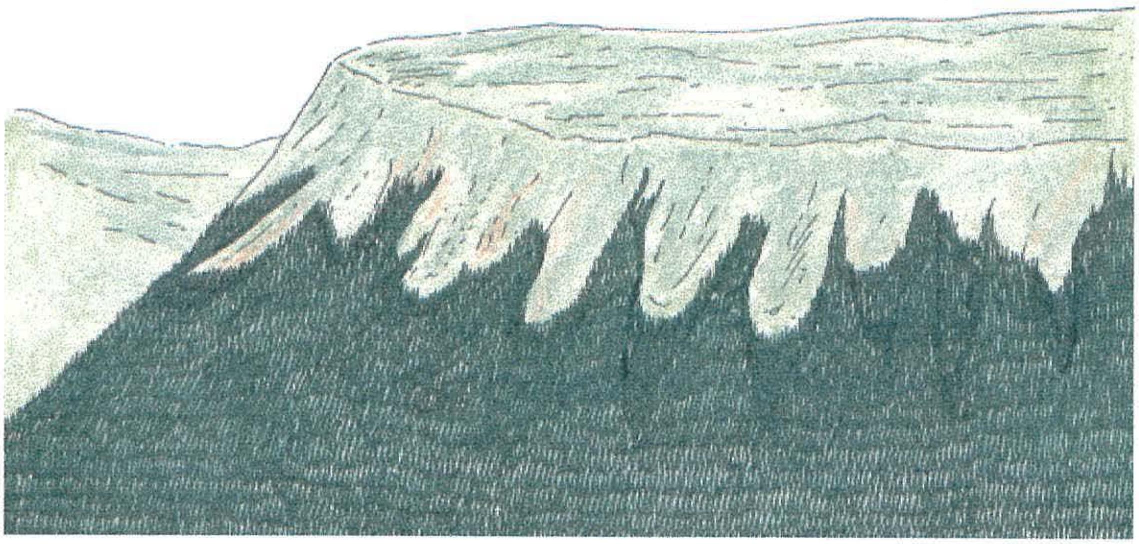


Fig 4.5. The forest edge here is dictated by the visual forces at work in the landform. By planting downwards on the spurs and upwards into the concavities there is a greater sense of balance between the planted and unplanted areas. Even though the forest is of considerable size it still seems that the landform and natural forces dictate the edge shape.

Pillars and Pegs.

Where small woodlands are planted in upland areas, if they are inadequately married to the hillside they may suffer aesthetically. They may appear unstable as visual forces drag them downwards. This is due to the optically heavy nature of woodlands. Such woodlands need to be anchored in some way to the landform. This may be remedied by extending the woodland into an indentation in the landform at the skyline to create a pegged effect (Price, 1994). One important consideration here is that, if possible, such woodlands should not cross the crest of a hill as they may dominate the skyline.

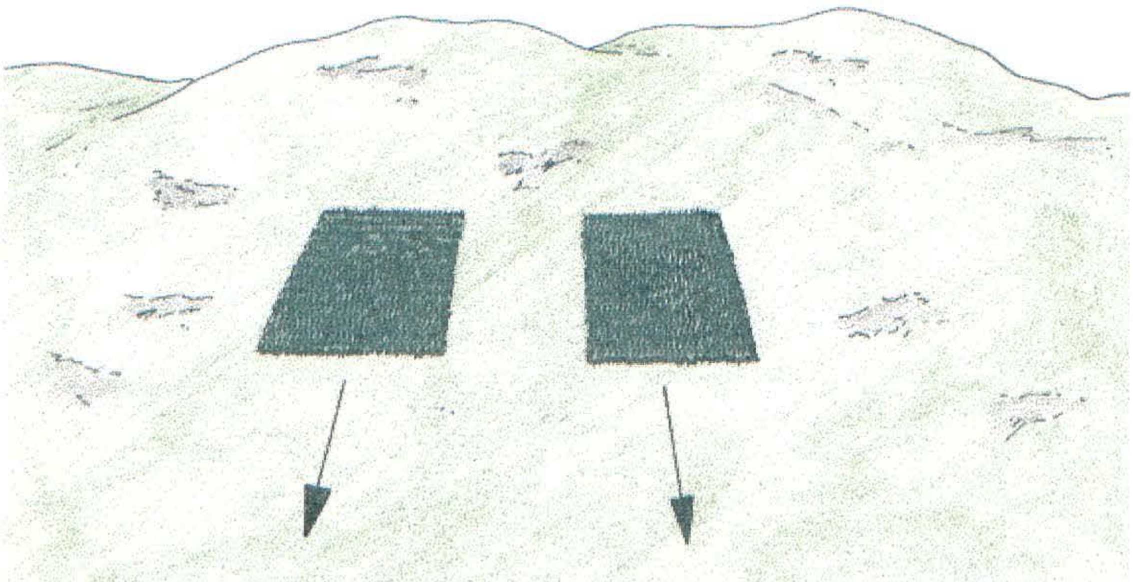


Fig 4.6. Visual forces at work. These geometric block plantations are not sufficiently anchored to the landform and, consequently, the visual forces appear to pull them downwards. There are two solutions to such a problem, one being the pillar technique, the other being the peg.

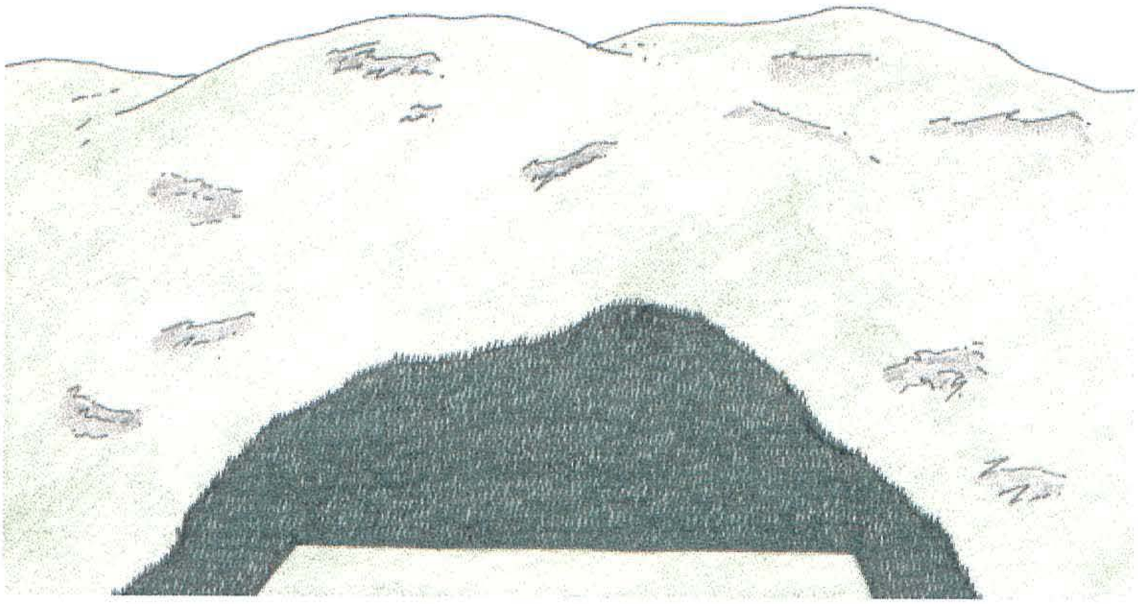


Fig 4.7. The pillar solution. Locating forest "pillars" at each side, beneath the plantation can assist in propping up the forest from below to act as an anchor. However, as can be seen here, there is a tendency for the pillars to appear obtrusive unless they are well related to landform. A more effective solution to this problem may be to hang the forest or woodland from the landform above to anchor it more effectively. This so-called "peg" method will often provide a more aesthetically acceptable design though either may be appropriate depending on the landscape concerned.

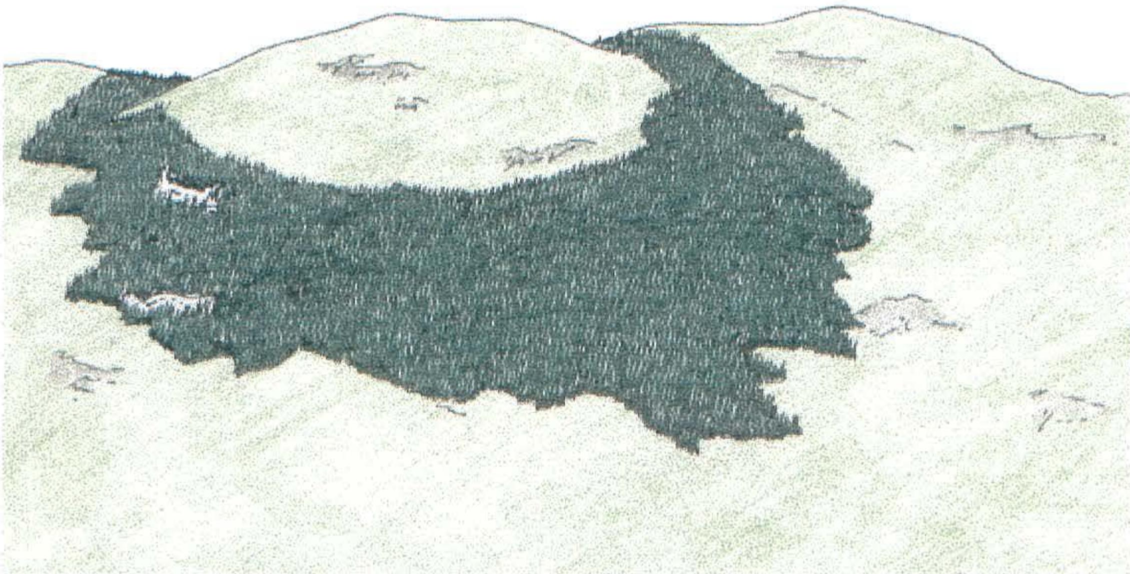


Fig 4.8. The peg solution. The forest is suspended from the indentations in the landform ensuring that it remains the dominant feature. The rock outcrops once again allow for some visual interest within the plantation.

By reacting to and following visual forces the designer can create a plantation which is far better suited to the landform than might be the case were he or she to impose a forest of inappropriate form on the view. Designers who recognise visual force as a help rather than a hindrance should ultimately benefit when designing forests for such landscapes.

Skyline Planting.

Skylines offer something of a challenge to the forest designer, as the following pictures illustrate.

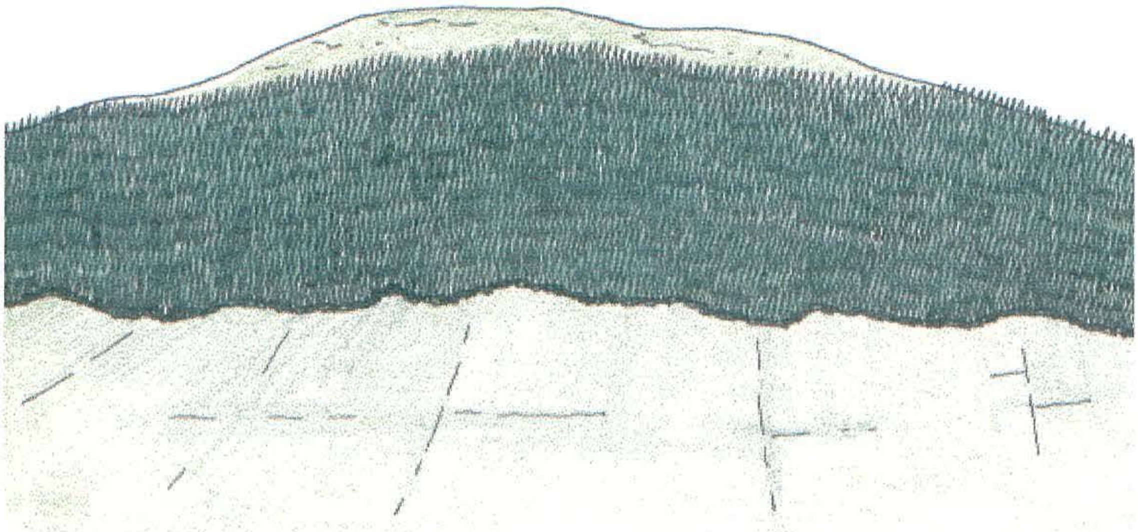


Fig 4.9. Planting too near the skyline can create a narrow strip of open land above the upper margin which creates an unnecessary distraction. This will be particularly relevant in the case of shelterbelts (this is discussed at further length later in this chapter under the heading "shelterbelts"). An additional consideration in the above example is that there is no gradual development from open land to forest.

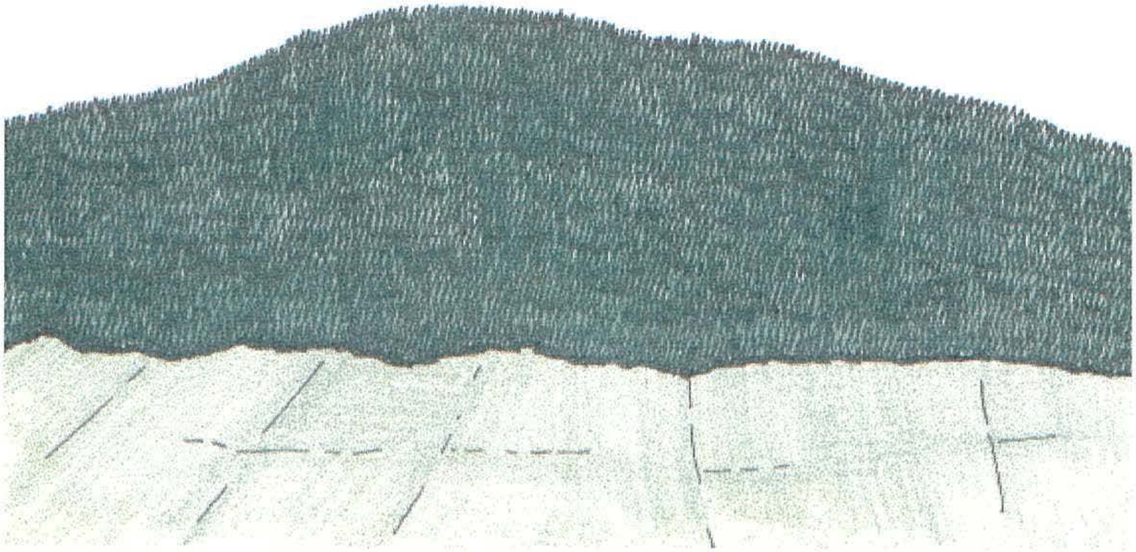


Fig 4.10. A slight improvement on the original forest design. Planting over the skyline removes the intrusive tract of open land at the upper forest margin. However, this produces another problem in that the effect on the other side of the hill must also be considered. It may be that planting over the opposite side of the landform can create a sliver of forest on the crest of the hill at that side which can appear as intrusive as the band of open land which was illustrated in the initial example. Additionally, the severe open land / forest boundary problem remains the same as there are no broadleaves, hedges or shrub layers which might allow for a more gradual development from field to forest canopy. The following scene illustrates how a conifer strip might appear on the other side of an afforested hillside.

Fig 4.11. An intrusive strip of conifers on a hillside in Coed y Brenin.

The solution (below) is to lower the upper forest margin to create a better sense of balance between the two areas of open land. Additional aesthetic diversity is also created by increasing the irregularity of the forest edge both by means of modifying its form and by utilising broadleaves along sections of the lower boundary. It should be noted that the broadleaves have been planted as a counterfoil rather than as a plain screen. Single trees and broadleaf groups planted at field edges and corners allow for a more united overall woodland pattern and a more gradual change from the grass level to the forest canopy.

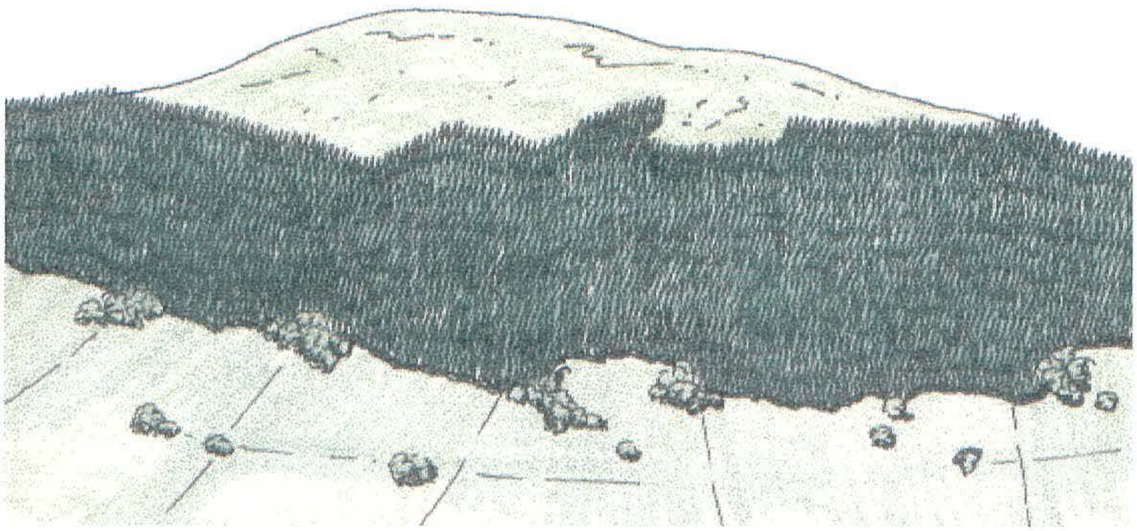


Fig 4.12. A solution to skyline planting.

THE PRINCIPLE OF INTEGRITY - HARMONY.

Designing a forest to achieve aesthetic harmony requires the planting to appear at one with the existing landscape. This means that the forest should strengthen and emphasise present landscape features rather than to mask them as blanket afforestation can do. One of the most important elements to safeguard is an area's spirit of place.

Spirit of Place.

This concept of spirit of place is also referred to as genius loci (Norberg-Schulz, 1980). Of all the aims of landscape design this would probably be the most difficult to achieve successfully. Perhaps it is better viewed as an aim of good design similar to "naturalness" more than a means of designing. It is the peculiar character of the site which is partly the result of the elements within the landscape and the interrelation between these features, but may equally result from historical or cultural ties related to the landscape. Some areas may have a strong spirit of place, for example a view of snow capped Snowdon from Capel Curig. Other areas may not appear as dramatic and may possess a weaker genius loci, though this is not to say that their spirit of place is not equally worthy of preservation. It is an aspect of the aesthetic landscape which is far easier to conserve than to create. Landscapes which convey a strong sense of place instil a sense of wonder in the viewer and, possibly, a higher emotional reaction than the landscape elements alone would extract. Such landscapes certainly live up to the adage that the whole is significantly greater than the sum of its parts.

It might be fair to say that a site's unique genius loci is as much emotional as it is visual. The landscape might not be of exceptional scenic quality but might create an impression due to its particular location. This might be the case for instance when an individual might discover a pleasant tract of open land whilst walking through an otherwise dense conifer forest. A relatively insignificant feature can convey a strong genius loci even in intimately scaled landscapes. Whilst out photographing parts of Snowdonia I happened to stumble upon a small waterfall and stream enclosed by broadleaf woods on the outskirts of Llanfrothen. It is not a spectacular landscape by any means but the interplay between the elements and the sunlight filtering through the canopy all contributed to create a rather pleasant small scale landscape which conveys a real spirit of place.

Fig 4.13. Llanfrothen, Snowdonia. A small scale, intimate view which, nevertheless, possesses quite a strong genius loci.

Lucas (1991) cites the ability of features of great age to strengthen the sense of genius loci, for instance mature trees or rock outcrops. A waterfall is a fine example of how water can heighten the spirit of place.

Man-made features may also contribute to genius loci. As a child I happened to come across a magnificent picture of Carreg Cennen Castle near Llandeilo in a book on Welsh castles by Ambrose Bebb. It is a dramatic picture which captures the majesty of this, one of the most magnificent of the castles of Wales. On visiting the site in later years this increased my pleasure on finally viewing this scene. The area itself is not of particularly high quality but the view of the castle itself when viewed from the south seeming to balance precariously on the cliff edge, certainly contributes much to the sense of place of the area as a whole.

Fig 4.14. Castell Carreg Cennen, near Llandeilo. This picture from Ambrose Bebb's "Llywodraeth y Cestyll" (1941) gives the view a certain mystical aura creating a strong sense of place.

As both Bell (1993) and Lucas (1991) explain, due to the highly subjective nature of sense of place, it is probably the artist or writer who captures the essence of genius loci most successfully. Both cite the work of Thomas Hardy and JWM Turner as examples of individuals particularly adept at conveying a landscape's spirit in script or on canvas respectively. It is also interesting to note that landscapes depicted in literature or art often benefit in that their genius loci is strengthened as a result. The current furore at plans to erect an electricity generating wind farm on the moorland surrounding Howarth in Yorkshire which inspired Emily Bronte's classic "Wuthering Heights" epitomises the contribution of literature to an area's genius loci. This landscape of moderate aesthetic appeal attracts thousands of visitors annually to view the moors which the Brontes once walked. The influence of literature on landscape is not a recent phenomenon however. Even the early landscape gardeners such as Alexander Pope and William Kent were influenced by literature and Aristotle's sense of order in particular when planning their gardens (Arnold, 1993).

Having discussed what constitutes this "spirit of place" and recognised its undoubted fragility, it might also be desirable to cite some means by which it can be safeguarded when development such as forest or woodland planting is imminent.

Where large scale plantation forestry is being considered, the main concern should be that existing elements which contribute to landscape character are provided for in the developed landscape. Spruce forests in particular can convey a strong spirit of place though it may not be the spirit present before planting took place. Personal preference can certainly contribute to how genius loci is perceived. Some may view blanket conifer plantations as majestic, dominant, awe-inspiring forests whilst others might regard them as dark, brooding alien battalions to which the countryside is gradually succumbing. Where such forests are concerned it is often inevitable that the existing genius loci will be transformed to a greater or lesser degree. Such forests may occasionally prove beneficial to an area's spirit of place, especially where the pre-afforested landscape was viewed as being rather featureless, for example where derelict land is concerned.

Preserving the Genius Loci.

Where there is a strong genius loci those elements which contribute to it should be accommodated visually within the new design. If there are features of historical interest such as burial mounds they should be allowed sufficient space within the confines of the forest area in order that they may be viewed. Trees should, where possible, be kept away from features such as rock outcrops in order that they continue to create points of interest even though the surrounding landscape may have been significantly altered. The same is applicable where waterfalls are present. The aim, therefore, should be to ensure that any planting does not impinge on the view of the waterfall from nearby viewpoints. Another consideration would be that of species selection. If a landscape is dominated by a particular species, oak for instance, which makes a contribution to the spirit of the place then it may be more desirable to extend the oak woodland than to introduce further species which might negatively affect the genius loci. Even in those landscapes where few or no trees presently exist genius loci may aid the designer in selecting species and in the woodland design. Lucas (1991) notes the example of the landscape of Glencoe, sixty miles from the city of Glasgow, for its strong sense of place derived from both the "brooding magnificence" of the landform and the historical context of the area which recalls the massacre of members of the McDonald clan by the Campbells in 1692. Lucas proposes that although extensive woodlands or forests would not be appropriate here "some planting with sombre evergreens, particularly indigenous Scots pine, would be in keeping with the genius loci".

Where the designer is unsure as to which species to utilise or faces a dilemma as to how the woodland may be shaped, the genius loci may provide cues which can aid the forest planner. A landscape's spirit of place is an element which should, when possible, be preserved or even strengthened by sensitive design. Where there are obvious features which add uniqueness to the scene attempts should be made to ensure their conservation. By relating any developments to the landscape's existing landform and also considering the influence of cultural and historical ties with the area the designer can prove successful in preserving this most fragile element of the aesthetic landscape.

Influences on Visual Harmony.

There are many influences which can have a detrimental effect on an area's visual harmony. As we discussed on the role of genius loci, even a small change can be to an area's aesthetic detriment. However, there are some major influences which are of particular relevance to rural Wales today. There are some trees which have become synonymous with the suburban landscape, the Leyland cypress and the Lawson cypress are two "suburban" species in particular. Such trees, when planted in the countryside, can have a detrimental effect on the rural genius loci. The same is applicable to the spread of Rhododendron in Snowdonia, an attractive ornamental plant in formal gardens but a garish invader of the otherwise restrained hues of the National Park vegetation pattern.

Designing to Preserve Harmony.

Whilst there are detractors from harmony which should be controlled, the designer also has the opportunity to plant in a way which preserves visual harmony. When designing a forest for a particular landscape cues must be taken from that which exists there already. The major consideration would be the form of the land itself and how it may affect the shape of the forest which is to be introduced.

More natural, organic forms are normally desirable in the rural scene, but these forms will need to be modified to suit the aesthetic conditions of the landscapes concerned. Forests which appear to replicate forms viewed in the landform itself, through repetition and complementary shapes, can greatly assist in creating visual unity, but this is only possible where existing forms are considered in the design. The landscapes of the Snowdonia National Park in Gwynedd and the forms in the Vale of Clwyd exemplify this contrast. The jagged, rugged landforms of Eryri lend themselves to plantations with spiky (Lucas, 1991) or serrated edges, and taking this a step further may be more aesthetically accommodating to the pointed, conical outlines of conifer species. Conversely, the less severe, more rounded, flowing forms of the Vale of Clwyd require that a forest edge should be fashioned in a similar way and of a more curved nature. The latter landscape type may also be less suitable, visually, to conifer planting than the more rounded broadleaves.

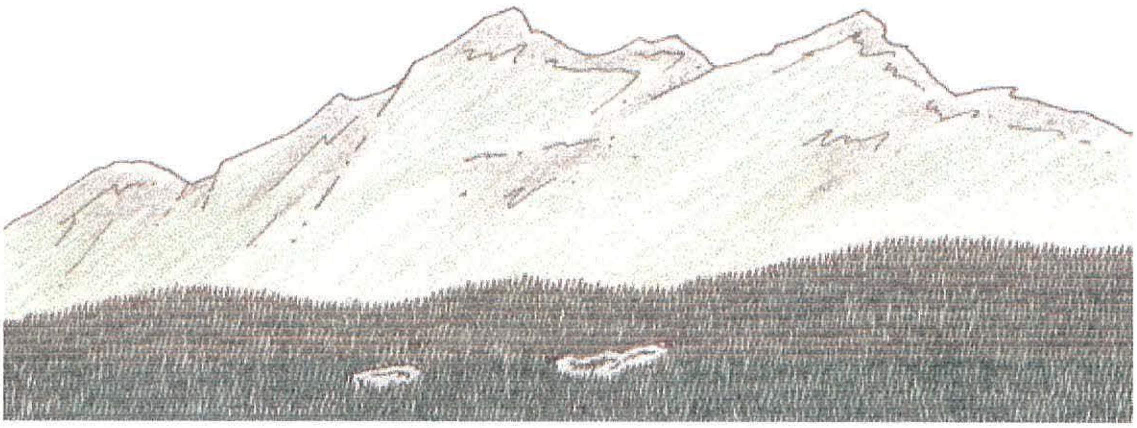


Fig 4.15. This forest edge is not geometric and might be quite acceptable in lowland landscapes where the landforms are less severe and more rolling in nature. Here, however, the spiky landform is of a more serrated quality which calls for plantation edges to display similar forms.

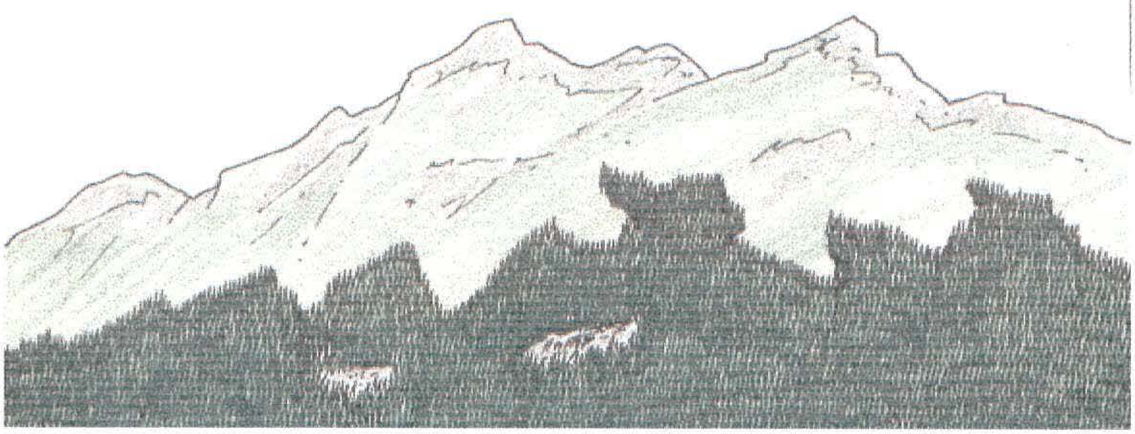


Fig 4.16. The forest edge is designed to replicate the forms of the surrounding landscape, the spiky, serrated shapes of the mountaintops. Note that the forest is still kept well clear of the skyline to ensure that the landform continues to dominate. The rock outcrops within the plantation allow some increased visual diversity.

The task of the designer should be to utilise other species by which the underlying forms may be accentuated. Planting a different species along indentations in the landform can highlight their existence. This was a view espoused by Crowe (1978). She used the example of a predominantly spruce plantation, and believed that larch was a useful selection to plant in order to accentuate the shoulders of the landform. This was based on the lighter tones of the larch contrasting with the darker spruce. Such a design is based on the theory that lighter tones appear to rise and float whereas the darker colours appear heavier (Bell, 1993) and more visually inert. Similarly, broadleaves planted in an indentation can accentuate the appearance of a valley within a plantation but the choice of foliage shade must be considered to avoid the aforementioned floating effect. The use of local broadleaves would contribute to the diversity within the conifer plantation as well as adding to the sense of harmony between the forest and the wider woodland pattern.

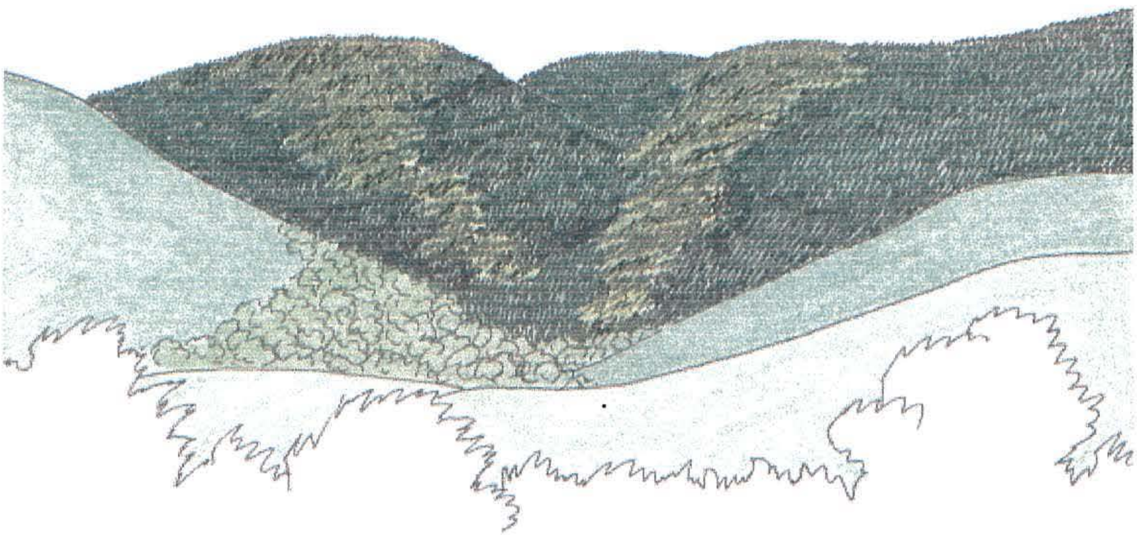


Fig 4.17. By planting the lighter coloured larch on the shoulders of the landform an appearance of "lightness" is given which seems to raise these undulations from the darker spruce of the surrounding plantation.

Harmony may also be increased by planting which provides for the retention of features of interest in the view. This may be by keeping planting away from rocky outcrops or by accentuating features such as old vernacular architecture or at least allowing ample space so that they may be visible from nearby viewpoints.

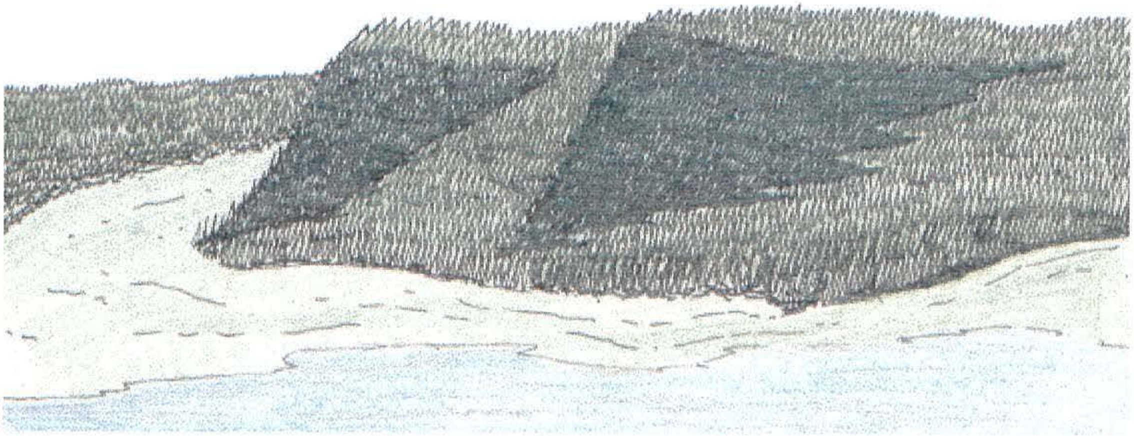


Fig 4.18. Large scale blanket afforestation is often accused of masking landscape features. However, with sympathetic design features can be accentuated by means of species selection. The illustration above shows, for instance, how the darker pine may be used to emphasise the scarp slopes in an otherwise spruce dominated plantation. (Price, 1994).

THE PRINCIPLE OF INTEGRITY - UNITY.

The principle of unity is concerned with the relationship between different land uses. It is aimed at integrating new planting into the present land use pattern in the same way that the principle of harmony integrates new planting with the patterns in the landform.

By the selection of different species forests can be planned to mirror and accentuate underlying forms and patterns, thus creating increased unity. Many landscapes contain varied colours in accordance with variations in the natural vegetation cover of the area. The forms are natural and organic and planting different tree species such as larch to break up the uniformity of a spruce plantation, for example, will allow for a more natural view. Using the aforementioned vegetation pattern as a rough guide should also provide an element of naturalness in the design. After all, when viewed from afar this is simply a case of duplicating the existing forms though on a slightly higher plane.

Even when natural vegetation patterns are used as a basis for forest design there should still be some sense of proportion in the planting plan. Helliwell (1993) offers the following as an example of proportionate species selection for a predominantly pine forest: Pine 55%, oak 25%, rowan 10%, birch 5% and juniper 5%. He also suggests utilising some shrub planting on a small scale, noting that it would colonise naturally as long as the woodland was thinned effectively.

In the enclosed agricultural landscapes of the lowlands, new planting in block form may fit quite acceptably into the existing land use pattern. Whilst such geometric forms would appear at odds with patterns in the uncultivated uplands, the organic shapes utilised in such upland areas may appear equally at odds with the patchwork, enclosure landscape.

THE PRINCIPLE OF INTEGRITY - DIALOGUE.

Another aspect of the principle of integrity which is closely related to that of unity is dialogue. Dialogue is concerned with how landscape elements interact between each other. A geometric block of conifers and a clump of broadleaves on a hillside may appear divorced from one and other with no apparent dialogue between the two. This might be remedied by extending the broadleaf planting towards the conifers, planting a broadleaf counterfoil to the redesigned conifer edge. Dialogue would then be created between the different elements.

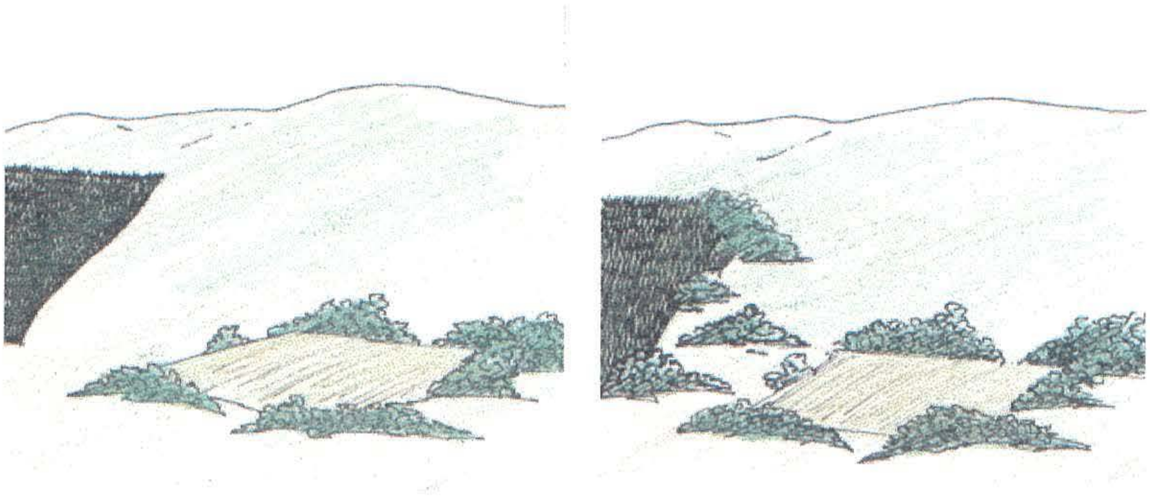


Fig 4.19. No dialogue. Dialogue between elements.
(Source: Price, 1994)

Tree-planting can be used to create dialogue and unity in many features of the farmed landscape. Quite apart from being a consideration for woodland design itself, planting provides a means by which an otherwise discordant and somewhat chaotic landscape can be better integrated visually, and thus of strengthening aesthetic dialogue and unity. In landscapes where small woodlands or single trees already exist, strengthening the hedgerow pattern and joining small woodlands and spinneys by means of additional planting can unite features into a larger woodland pattern whereas previously they may have been viewed as single entities. Where the enclosure pattern does not dominate, a scatter of sporadic planting could be used to create dialogue without the woodlands actually being joined by means of hedges or hedgerows.

Similarly, in agricultural areas, farm buildings can create a rather chaotic scene. Farm buildings are often a confused collection of architecture constructed at various stages in the life of the farm and are, in many cases, built in various styles using different materials. This lack of interaction may be heightened where such buildings are not sited closely to one another. Whilst it may be advisable in extreme cases to screen unsightly rural architecture, a collection of discordant buildings can be unified quite successfully by planting a backdrop of trees. If these trees are well related to the local woodland pattern both in design and species selection then a better integrated composition should ensue.

Dialogue is, probably, one of the most important principles of farm woodland design. It is a means by which some order can be created between elements which may otherwise appear chaotic, by relating them to one another.

THE PRINCIPLE OF CONTRAST AND VARIETY.

Forests can appear rather featureless and uniform unless a design makes provision for adding some elements of contrast to create some variety and interest. This can be within a forest, on the roadside or along footpath level. Internal forest roads can appear monotonous and whilst car drivers may not be able to take in much of the detail which surrounds them, some variety should be achieved to create interest and stimulus (Forestry Commission, 1991b; Price, 1994). This can be achieved by cutting back sections of the forest at the roadside to leave some areas of open land for variety. Excessive diversity should be avoided, and "for reasons of safety landscape must be simple and undistracting at junctions, sharp bends, steep hills and blind summits" (Forestry Commission, 1991b).

In other landscapes, features can be utilised to emphasise elements such as landscape scale. Buildings or tree clumps, when viewed from afar, create contrast and emphasise "the vast horizontal scale" of landscapes such as the Fenland (Price, 1994).

Repton's Rule.

Humphrey Repton, when working in the area of garden design, favoured the the idea of contrast between architecture and plants. The rule was to utilise rounded tree shapes to contrast with spiky architecture and spiky trees with architecture of a flatter, less conical form. This adds interest and variety to a garden design but may be less suitable for use in the countryside as a whole. For one reason, it is at odds with the principle of integrity and unity where the ideal is to aim for complementary rather than contrasting forms of forest shape. Whilst it may be acceptable in the garden environment, the idea of contrast also seems at odds with the principle of naturalness in the rural scene and must usually be avoided where plant/land form is concerned.

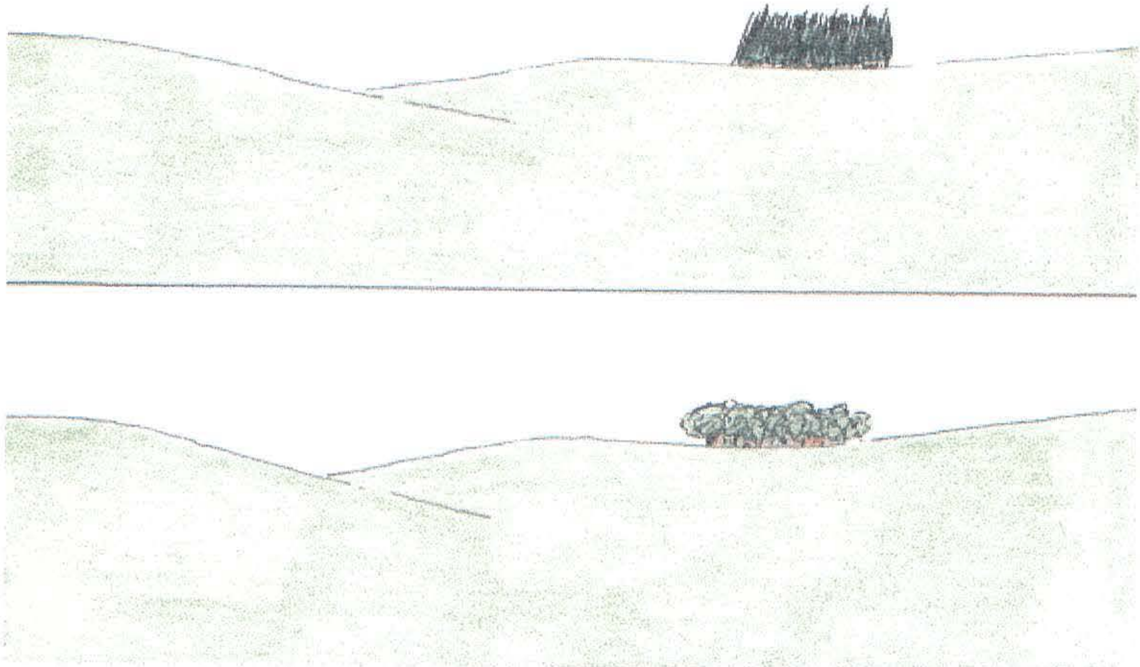


Fig 4.20. Plant form. Humphrey Repton advised that plant form should be opposed rather than complementary to nearby architectural forms. This, however, is not the case where landform is concerned, particularly where the design aim is naturalness. The examples above illustrate the unsuitability of spiky, conifer forms in rolling landscapes which are more suited to the rounded shapes of the broadleaves.

Diversity.

Under a previous heading we discussed the merits of aiming towards unity in rural design but it is also important to allow for sufficient diversity as well as unity in the landscape.

Landscape diversity exists in two main forms. Firstly there is the diversity which exists between landscapes in different areas, and secondly that which is seen within individual landscapes. Diversity is an especially important consideration when discussing Welsh landscapes. Variations in climate, exposure, geology, landform and vegetation patterns have all contributed to create a wealth of landscape character and diversity all within a relatively small geographical area. However, there seems to have been a recent trend, particularly through agriculture and forestry, away from this diversity and regional character towards a more uniform and homogeneous rural landscape. Consequently, unless human activity is varied within different landscapes an increasing loss of the vernacular is the inevitable outcome.

Where the landscapes of Wales are concerned, the Institute of Terrestrial Ecology's landscape classification and George Borrow's "Wild Wales" offer a scientific / objective and a subjective / literary insight respectively into the diversity of landscapes within the Principality. The Institute of Terrestrial Ecology's classification of landscape types gives a scientist's assessment of the different types of landscape which may be found in Wales. Borrow (1862), on the other hand, views them from the human perspective, from within. The preservation of features which contribute to this diversity is an essential part of safeguarding regional character and should be addressed by any individual seeking to play a part in rural landscape change.

Diversity and unity are obviously closely interrelated. When discussing the interplay between these two elements within individual landscapes the most satisfying aesthetic effect will result from the two elements acting in a compatible and complementary mode. In the urban landscape, where there will often be a plethora of features and elements, many designed at different periods in time and by different individuals, the overall effect can appear chaotic and disunified by virtue of excessive diversity.

However, if a landscape is planned effectively then such aesthetic chaos can be avoided. One means by which this is achievable is through the repetition of similar forms throughout a design. This may be less difficult where the whole design is to be implemented in one stage, as opposed to the more conventional form of piecemeal urban development. Normally, buildings are erected at different periods in time and this is where the problems of excessive diversity and lack of unity are most likely to arise.

The main shopping centre in Llandudno's Mostyn Street illustrates how diversity may be accommodated within a well unified townscape. Individual shopkeepers, wishing to attract the prospective customer, require that their signs and window displays are varied as well as eye catching. Over-elaborate variation can take diversity into the realms of disunity but this is counterbalanced by an overall well unified framework in that the buildings themselves are all either of the same era or if built in more recent years have tended to respect and replicate the existing architectural forms. The result is a townscape where there is diversity and individuality but also a sense of overall unity to the design through adherence to the architectural patterns of the Victorian era.

This is also illustrated in the terraced miners' cottages of the South Wales valleys which are all united to some degree by their architectural similarities but, equally, they show signs of diversity and character by means of the colours the householders have chosen in external paintwork.

Diversity, however, is not a consideration peculiar to urban design. It is also relevant in the design of rural landscapes.

Whilst treeplanting can create both unity and chaos it is also capable of producing either diversity or blandness. The large scale single aged and single species plantations are capable of masking features of individuality in a landscape to create a rather bland scene bereft of any diversity. Species selection and design can remedy this but excessive diversity should be avoided rather than threaten the aesthetic unity of the landscape.

Unity and Diversity. Getting the Right Balance.

In the wider sense of the word the principle of unity raises an interesting question, particularly in relation to another element of landscape design, diversity. The question here is precisely where is the boundary between unity and uniformity or conversely the line dividing disunity and diversity? On the one hand single aged, single species blanket plantations may well be unified with the landscape but only by drowning all other features to create a rather bland and monotonous scene. On the other, an over-elaborate mix of species within one forest can create discord through excessive variation. A well balanced design should allow for sufficient diversity within a unified framework.

Bell (1993) argues that natural landscapes are, by their very nature, usually well unified resulting from the natural processes which created them. This is illustrated where natural forests are located in upland or mountainous areas. The forest will often be closely related to the drainage pattern and landform, tending to grow in the less exposed areas and also being closely related to the visual forces discussed previously. Consequently, if the designer can achieve a high degree of naturalness in his or her plan, with regard to the aforementioned points, then the resulting design should be well unified. The conditions of the particular site, the existing vegetation pattern and landform should be an intrinsic part of the design process, guiding all design decisions and increasing the degree of unity. As Colvin (1970) argues, "No amount of fanciful invention applied superficially will ever give that appearance of inevitability - of essential rightness - or that innate, natural and functional individuality which are the hallmarks of good design."

It is not merely the number of elements within a landscape which affects the degree of overall unity. Dunn (1975) highlights the importance of the interrelation between landscape features in producing an aesthetically satisfying view. A set of elements may appear either chaotic or complementary in the same landscape depending on how they relate to each other, to existing features such as buildings, to the vegetation pattern and, of course, to the landform itself. It is not simply a case of certain elements creating an attractive landscape or otherwise: it is rather a case of how these features are assembled and how they interact to create the landscape image. The most aesthetically successful landscapes will result when unity and diversity are both accomplished.

THE PRINCIPLE OF HONESTY.

The art of rural design is to create a landscape which appears as natural as possible. Occasionally, in order to achieve the most natural or indeed the most attractive result, there may be a need to hide or screen some landscape features. However, if this is not done effectively then the result may be to draw the viewer's attention rather than to mask the offending article as was intended.

Screening.

The intention may be to hide an unattractive agricultural building or to blend a conifer edge, but almost invariably a screen which aims to fool the viewer will fail to do so. As Thomas (1983) says, "While it is perhaps more pleasant for the eye to light on a row of any sort of greenery than on a set of ugly walls, roofs and chimneys, it is equally true to say that nothing calls attention more to the fact that there is something to hide than such a row. It is foreign to the landscape, and therefore cannot really be considered as landscape planting."

Counterfoil Planting.

Rather than total screening, the aim should be to decrease the visual impact of features such as grain storage towers. This can be done by some smaller scale planting around the lower sections of the tower rather than seeking to conceal the construction as a whole. As Price (1994) puts it, "Ineffective concealment invites suspicion." Honesty should be the best policy under such circumstances. The same is true when seeking to screen plantation edges. Using broadleaves to screen the edges of conifer plantations cannot succeed in the long-term. The conifers eventually outgrow the broadleaves and are clearly visible in later years. The solution here is to use a counterfoil planting where sections of the conifers are hidden by broadleaf planting but others are left in view. The result is to break up the monotony of the conifer edge without giving the unnatural appearance of a straightforward screen.

Fig 4.21. A broadleaf conterfoil for a conifer edge.

THE PRINCIPLE OF PATTERN.

Patterns exist throughout the natural world. They are found in the webs of spiders, leaf and branch form and drainage patterns. The same is equally true of the aesthetic landscape. By following patterns in the landscape, visual integration is assisted.

Following Patterns in the Landscape.

One example of following landscape patterns can be found in the work of Crowe (1966) who, in upland planting, suggested "Inflecting the forest boundary to the contours" (Price, 1994). This ensures that the planting integrates into an existing pattern of landforms.

Patterns in the man-made rural landscape can also be followed as a means of visual integration. We have previously discussed the unsuitability of geometric block plantations in the uplands, but in lowland landscapes dominated by the patchwork of the enclosure pattern "it is relatively simple to integrate suitably shaped and scaled additional woods which will reflect the existing patterns" (Forestry Commission, 1992). The main consideration when planting in such landscapes should be to allow for sufficient interaction between open and planted land by means of visual interlock. Interlock allows planted and unplanted sections of land to overlap visually.

Visual Interlock.

Visual interlock of woodlands is particularly relevant to the farm woodland designer. It is a case of seeking to achieve sufficient balance between open and enclosed sections of land (enclosed here meaning land surrounded by trees with no openings as opposed to the landscape associated with the enclosures). The series of diagrams below from Lucas (1991) illustrate this point. From an aesthetic standpoint the following designs illustrate what might be termed the visually ideal design but they fail in that they are impractical for farming among them. The task here is to find an aesthetic balance between open and enclosed land but the result may be to overplant and to create slivers of land which handicap the land as a farming entity for either livestock or crops. The real balance that should be found, therefore, should be between aesthetics and a practical, farmable solution.

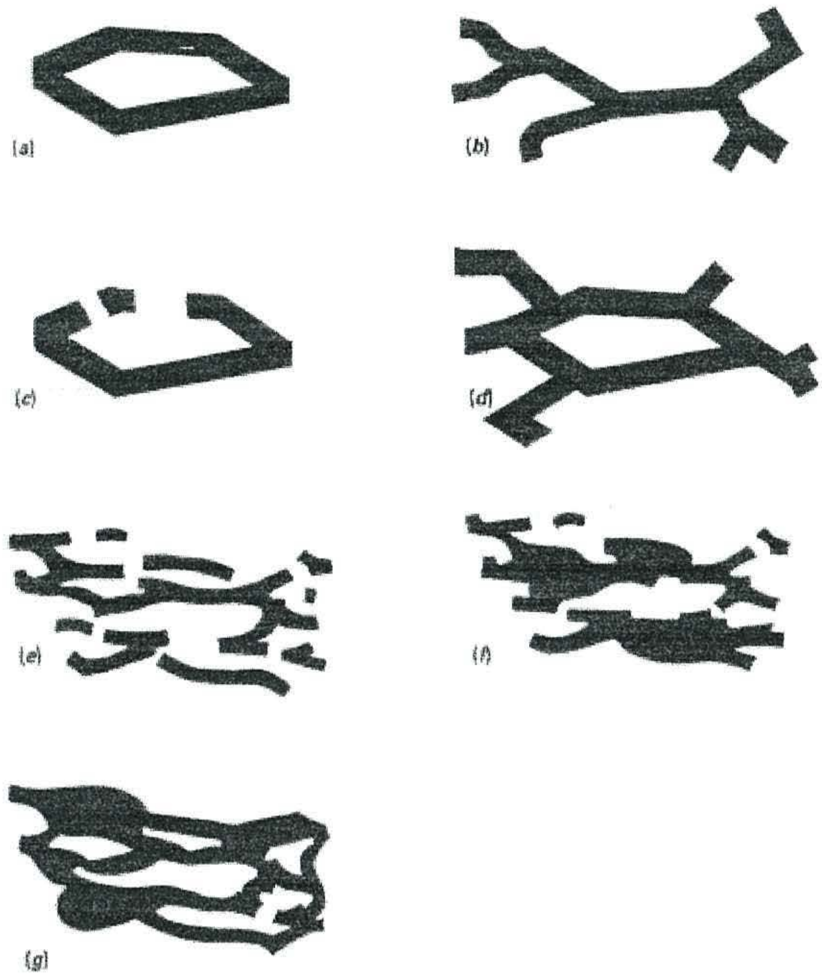


Fig 4.22. Diagram (a) illustrates complete containment with no sense of interlock whatsoever. By breaking the boundary along one section (c) there is a slightly greater sense of openness. Creating a more branched pattern (b) and combining it with enclosed spaces (d) adds to the feeling of interlock. Opening the enclosed space further (e) allows for greater balance between the different planted and unplanted sections. Such a woodland could still accommodate further planting without decreasing interlock (f) unless all open spaces are enclosed at the edges. (Source: Lucas, 1991).

THE PRINCIPLE OF PLEASANTNESS.

The principle of pleasantness includes those elements within the landscape which, though not as obviously aesthetically displeasing as geometric planting or acre on acre of conifer blanket, can have a detrimental effect on the view if they are not considered. They may be minor considerations compared with some of the other principles but they have a propensity not to appear "quite right" and give the appearance that something is amiss in a design. This may be in the form of the location of a woodland, the division of open to afforested land or even the texture of the plantation.

Plantation Proportion and the Golden Section.

Plantation proportion is concerned with the proportion of the landscape or view to be planted and that which is to be left open. The scale of planting within a landscape is clearly an important consideration but a simple 50/50 planted/unplanted design may not be the aesthetic ideal.

By dividing open land / forest by a ratio of about 33% : 67% (or vice versa) one becomes slightly more visually dominant whilst the other is viewed as being subservient. If a 1 to 1 or 50%:50% ratio was applied then both elements are of equal aesthetic importance and consequently visual tensions would be unresolved due to a lack of dominance by either of the elements. Less than 1/3 forest would probably appear as a distraction. This ratio is an approximation of the ratio known as the Golden Section. Originally utilised by the ancient Greeks the ratio 1:1.618 which was widely used in architecture has been changed for the 1/3 and 2/3 open ground and forest ratio which forest designers use today. The planting of 50% of a landscape might not appear unsightly as might a block plantation on a hillside but it would appear uneasy, as might a sliver of open land between the plantation and the skyline (Price, 1994).

Texture.

Another element which may affect the pleasantness of a scene could be the texture of the forest itself. This is not the edge form of the plantation but the texture of the trees and branches when viewed as one mass. The texture of some conifers, spruce in particular, can appear rather harsh and repetitive which can have a detrimental aesthetic effect. The solution might be to plant another species such as larch, with its more wispy and lighter form, in order to break up the monotony of the spruce texture.

DESIGNING TO DIVERSIFY THE AGRICULTURAL LANDSCAPE.

The rise in interest in farm woodland enterprises also offers the opportunity for increasing the aesthetic diversity of some agricultural landscapes. Landscapes where little or no woodlands currently exist may profit visually from the introduction of trees. However if widespread use is made of a few select species then there is a real threat of increased homogenisation in the long term and this should be avoided. The opportunity offered to the rural designer and planner of making use of what is becoming increasingly homogenised land in agriculture and reintroducing or diversifying regional character through the use of forests and small woodlands is a chance which must not be missed. For once, the importance of the aesthetic landscape is being considered on a par with the other aspects of forest and woodland planning. However, the success of such plans will only be ensured if different species, designs and woodland types and enterprises are utilised in different areas to ensure diversity.

Aesthetic diversity has a two-fold effect on the landscape. One the one hand, there is the diversity which exists within one landscape or design. The other type of diversity is that which exists between different landscapes and different areas. However, if forestry and other forms of developments are planned with local vernacular patterns and forms in mind then the national landscape should see a resulting strengthening in the sense of regional character and variation.

The effect of a small scale woodland can be every bit as influential on a landscape as that of a large forest. Traditional plantations or what might be termed high forest are often of such a vast scale that they dwarf all other landscape features, hence the well used phrase "blanket afforestation". Farm woodlands, on the other hand, are usually of such insignificant scale that one might expect them to integrate quite unobtrusively into the pattern of agriculture. This is not the case. As Price (1987) points out "an assertion that small is beautiful and therefore that farm woodlands will inevitably enhance landscape would be based more on hope than on experience. The first need is to accept that visual mistakes are possible. The second is to discover how to avoid them."

The guiding principle with regard to scale is that the woodland or forest is of an appropriate size in relation to the scale of the surrounding landscape. Whilst large scale forests can appear "monotonous and brutal" in a smaller landscape (Lucas, 1991) it is not necessarily the case that dividing such forests into smaller segments will solve the problem as this may result in a rather "busy" (Lucas, 1991) appearance which can lead to aesthetic confusion and disunity. When seeking to break the monotony of blanket afforestation the planted area should be in the form of overlapping, interlocking forest parts rather than harshly divided sections of forest to open land. The aim should be a compromise between the dreaded blanket forest and the busy, fragmented effect associated with a plethora of small woodlands.

We have previously discussed the ratios for planted and unplanted land and in small scale agricultural landscapes it may be that the farmer can achieve such a balance by means of planting small interlocking woods which are related to the hedgerow pattern where present.

Where large scale sprawling landscapes are concerned, particularly in the uplands, the aim should be to avoid creating small dense blocks which are of insufficient scale compared to the wider landscape. If there are any existing woodlands then the designer should relate to these by means of the new planting either by overlapping, again to create interlock, or by adding clumps of trees between the larger woods. This will give an appearance of greater scale to the woodlands and, hopefully, allow the woodland cover to be of sufficient size to sit more easily in the landscape. This will be easier to accomplish in enclosed landscapes as it will be possible in such circumstances to slot new woodlands into the existing tree pattern, though excessive planting which destroys the interlock between woodland elements should be avoided.

In summary, the main principle regarding the scale of farm woodland enterprises should be that the planner recognises the possible influence of even a small scale plantation on the surrounding landscape. Although the visual effect of such woodlands has nowhere near the influence of large scale plantation forestry in its capacity to change the whole appearance of an area they may have a disruptive influence on the wider view if located or shaped inappropriately. Consequently, although there can not be a strict rule governing what size of forest is desirable for particular landscape types the important point is not to underestimate the aesthetic effect of smaller scaled woods.

There are other design considerations which are largely peculiar to small scale or farm woodland planting. One such consideration is the aesthetics of tree-shelters, the use of which may often be economically feasible for such enterprises. Stock exclusion methods will also be an issue. Selecting species for planting near buildings on the farm raises both aesthetic and practical questions. These and other design issues such as methods of shelterbelt planning are discussed at greater length in the next chapter but they will all, to some degree, be affected by the principles outlined previously.

Conclusion.

The above text aims to give an insight into the principles guiding the design of small and large scale forestry. However, they are not merely rules which can be used universally in all landscapes. They are principles which should be utilised at the discretion of the designer depending on particular circumstances especially the landscape itself and the remit that he or she has been given. Not all rules will be applicable to all landscapes. Planting in geometric shapes, for instance, would invariably be abhorred in the uplands but might prove to be quite acceptable in certain lowland areas.

The task of the rural landscape designer is to apply the relevant principles to the landscape in question. The most satisfying composition will often result from a design which is dictated by the existing landscape (unless of course the aim is to improve a tract of derelict land or to screen features which are unsightly).

Despite all the rules and principles highlighted here there are two considerations which should guide small woodland design. The first is that naturalness is of paramount importance. The second is that the designer recognises the possible aesthetic influence of even the smallest plantation. Only then can farm woodland designers learn from the inadequacies of traditional forestry in the past and avoid having to do so from its own mistakes in the present and the future.

OTHER DESIGN CONSIDERATIONS.

Apart from the guidelines previously discussed, which are common to both large scale and small scale forestry, there are certain considerations which will be peculiar to farm planting. Shelterbelts are an example of this, as is the use of treeshelters, which may be feasible in the case of these relatively small woodlands.

AGRICULTURAL SHELTERBELTS.

Carroll (1978) states that, "Multiple use of woodland can be defined as the carrying out of several uses concurrently on the same area of woodland". Shelterbelts are a classic example of such multiple use, which may offer some if not all of the following:

1. Shelter / Windbreak
2. Wildlife Conservation
3. Sporting Value / Game Coverts
4. Improving Landscape Aesthetic Quality.
5. Timber

Most of the above will provide the farmer with the opportunity to increase the revenue of his or her unit either directly by renting out the land for shooting, income from timber production, or indirectly from increased crop production or savings in livestock costs due to the provision of additional shelter.

The objective of shelterbelts must be to provide shelter on the farm. It is, therefore, a useful starting point at which to begin studying shelterbelt design.

The Provision of Shelter.

The first consideration when planning a shelterbelt is the type of shelter which is needed. Once this is agreed, the degree of permeability can then be decided. Permeability is one of the decisive factors regarding the effectiveness of the belt. As Thompson and Cumming (1983) offer, "A permeable shelterbelt reduces the speed of the wind over a wide area but a dense belt produces a relatively small but calm area directly behind it". This suggests the use of the former for crop protection with the latter being the more desirable technique where animals are concerned. This is due to the need for the sheltering of a more extensive area where crops are concerned whereas a smaller but more effectively sheltered plot will suffice for livestock use as they will gather at such areas when weather conditions are inclement.

Fig 4.23 shows the differing effectiveness of (a) an impermeable shelterbelt and (b) a permeable one. As Fig 4.23a illustrates, a small area with a high degree of shelter for animals is accomplished by planting a very dense barrier which allows less wind to permeate. The problem a pure conifer belt (such as the one illustrated) is that it will, in the long term, tend to become thin and open thus continuing to provide some overhead shelter but becoming of little use against the wind.

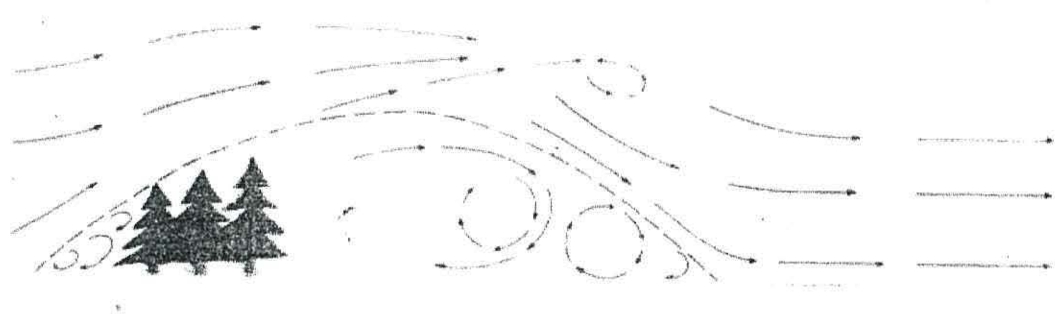


Fig 4.23a. Windflow pattern over an impermeable shelterbelt. Large standing eddies create only a short zone of shelter of the type favoured for use with livestock.

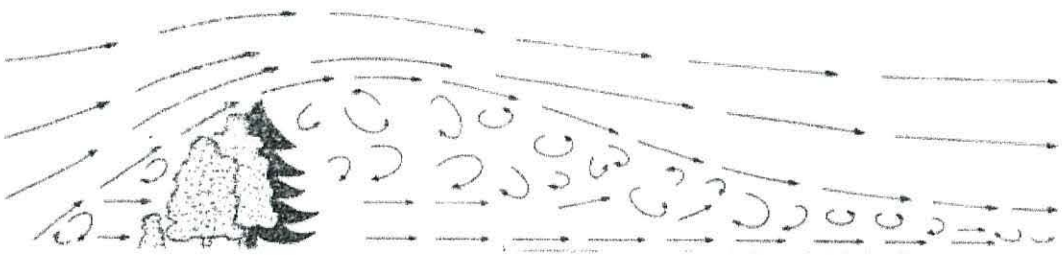


Fig 4.23b. Windflow pattern over a permeable shelterbelt. Small rolling eddies account for a long zone of shelter which is better suited to crop protection. (M.A.F.F, 1988).

Belts for crop protection, on the other hand, should favour technique 4.23b of planting. This would be a belt of around 40% permeability which is planted in order to create a long, though less effective, zone of shelter. The borders of the belt should be vertical rather than a pitched roof shape, to allow some wind penetration. Planting a shrub layer on the windward side is also desirable, firstly to prevent excessive windblow through the area beneath the canopy, and also to increase the wildlife conservation and sporting value of the stand.

Design for Nature Conservation and Sporting Cover.

Where wildlife conservation is concerned the Nature Conservancy Council have discovered that nearly 1,000 of Britain's native plant species are represented in shelterbelts or hedgerows. They are also habitats for wild animals. Planting a shrub layer creates a more desirable habitat for birds, e.g. pheasants which "are birds of the woodland fringes, being found within 30 metres of the woodland edge during daylight hours. The long edge to area ratio provided by small woods and shelterbelts is ideal", (Crabtree and Cumming, 1989). This view is echoed by Robertson (1992): "Pheasants are birds of the woodland edge. Studies of radiotagged birds have shown that during the winter they spend the majority of their time within 30m of open ground." This suggests that for sporting cover purposes, the most desirable form would be "Irregular or long, thin woodlands (which) have an increased length of edge and hold more birds." (Robertson, 1992). The woodland or forest edge is, therefore, undoubtedly the habitat for such birds (McCall, 1988). Consequently, there seems little use for the farmer wishing to provide game cover to plant a large, wide block of trees if the birds only inhabit the peripheral 30 metres of the woodland.

Fig 4.24 A good edge design for a woodland or shelterbelt. (Adapted from: Crabtree & Cumming, 1989)

Fig 4.24 illustrates the type of shelterbelt or woodland edge which offers increased scope for wildlife and sporting value. The game cover in particular may offer opportunity of extra income to the farmer. The former Nature Conservancy Council suggest a low cut strip of grass outside the shrub layer. Fig 4.25 shows an NCC plan for a small woodland for a field corner which would be beneficial both for windbreak and nature conservation.

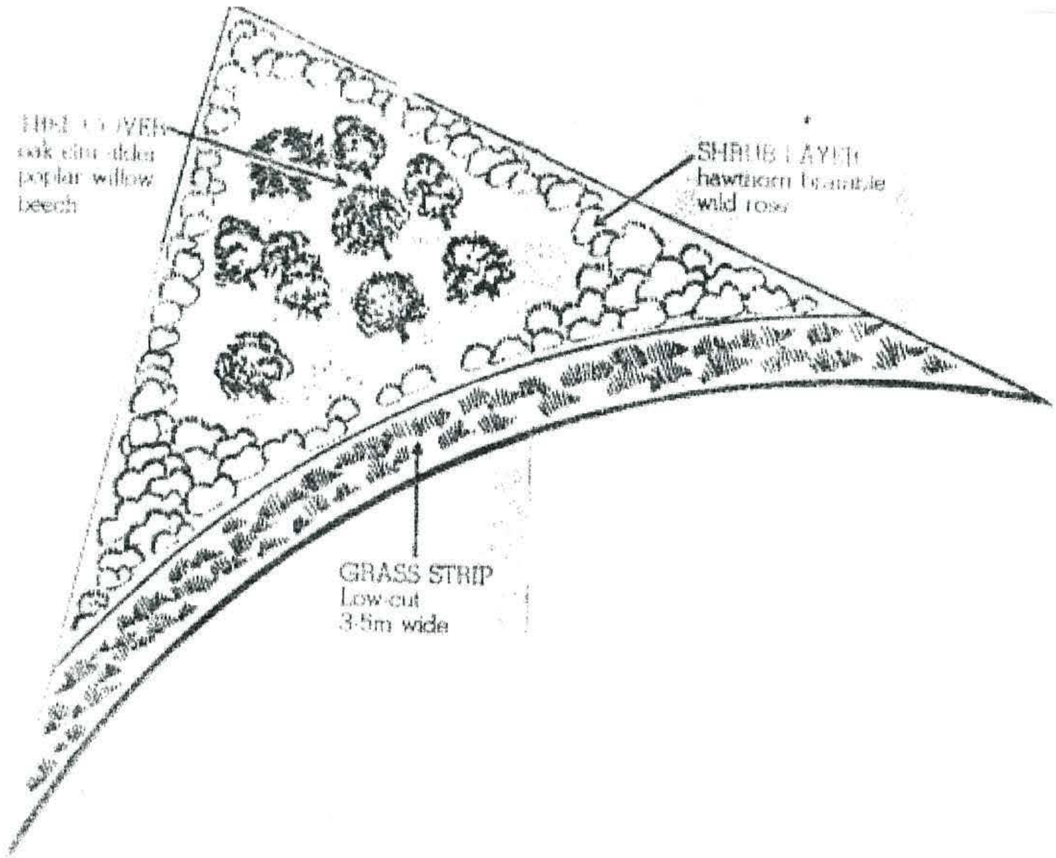


Fig 4.25. A Nature Conservancy Council design for planting a field corner, with the planting of a shrub layer apparent once more, this time for its nature conservation value. (Nature Conservancy Council).

Species Selection.

Another design consideration is plant species selection. Whilst soil and climate will have their effect on the final decision, tree species should also be selected for their permeability and their shade tolerance.

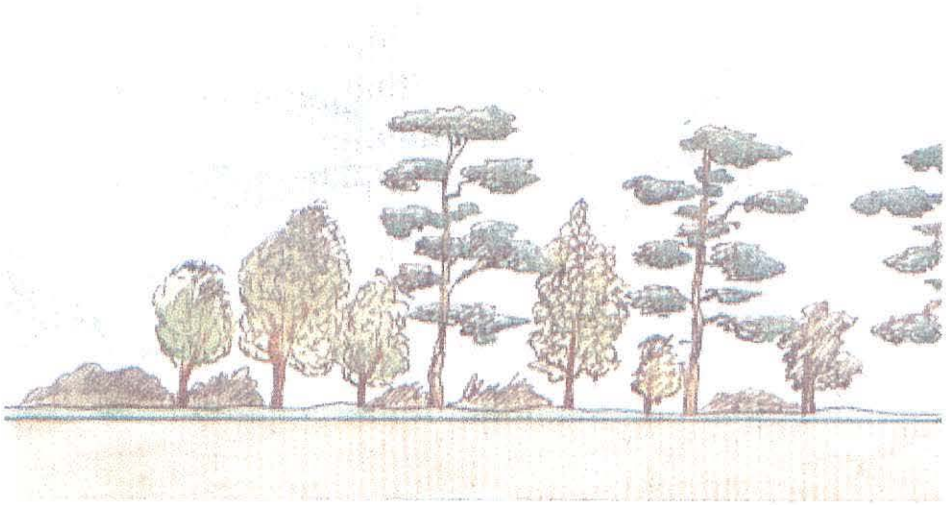


Fig 4.26a. A shelterbelt comprising light demanders.

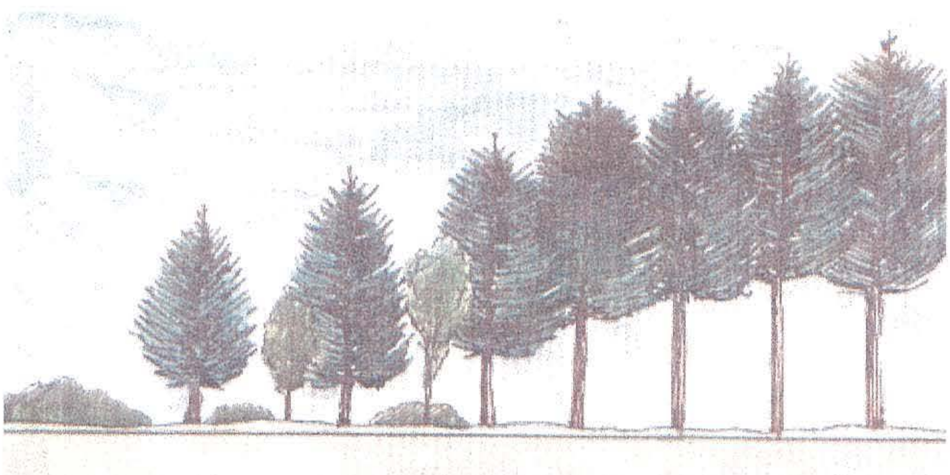


Fig 4.26b. A shelterbelt consisting of shade bearers.

Fig 4.26 illustrates shelterbelts containing both shade tolerant and light demanding trees. For the provision of shelter, wildlife conservation and sporting value MAFF suggest that "It is generally advisable to mix light demanding species with shade bearing ones." The examples above also illustrate the differing landscape aesthetic impact which different types of shelterbelt planting may have. Although both designs include some species mix and allow for shrub and herb layers, there is no doubt that example 4.26a is far more natural in appearance than its conifer counterpart. Obviously, there is an opportunity for farmers to plant shelterbelts which have the primary purpose of adding to the aesthetic value of their holdings. Perhaps in such a case example 4.26a might be the most desirable option with the landscape in mind, bearing in mind also that such a shelterbelt as this would also tend to tempt more wildlife than might be the case in one consisting of predominantly conifer species. What is certain is that the goals of planting a wood which gives effective shelter and one which adds to the farm's visual quality are not incompatible. Another reason why the use of broadleaves may be preferable is that their lower branches tend not to thin as quickly, as is the case with many species of conifer.

Fig 4.27 gives an introduction to the shade tolerance or otherwise of useful shelterbelt trees. As well as planting trees it may also be beneficial to plant some small trees and shrubs, particularly shade bearing ones such as blackthorn, snowberry, hazel, cotoneaster, lonicera and hawthorn. Rhododendron ponticum is also shade tolerant, though its extensive regeneration and domination of landscapes such as Snowdonia, may cause people to think twice before utilising it in rural areas in the future.

	Light demanding	Shade tolerant	Wind firm	Frost hardy	Commercial timber
SPECIES TOLERATING MODERATE EXPOSURE					
Broadleaves					
Common Alder	***		**	***	Yes
Aspen	***		**	**	No
Wild Cherry	***		**	**	Yes
Sessile Oak	***		*	*	Yes
Red Oak	***		*	*	Yes
Norway Maple	**	*	**	**	Yes
Blackthorn	***		**	**	No
Hazel		***	*	*	No
Holly		***	**	**	No
Conifers					
Japanese larch	***		*	*	Yes
Western red cedar		**	**	***	Yes
Western hemlock		***	**	***	Yes
Scots Pine	***		***	***	Yes
Norway spruce	**	*	**	*	Yes
SPECIES TOLERATING SEVERE EXPOSURE					
Broadleaves					
Beech		***	**		Yes
Birch	***		***	***	Yes
Sycamore	**	*	***	**	Yes
Rowan	***		***	***	No
Hawthorn	**	*	***	**	No
Goat Willow	***		***	**	No
Bird Cherry	***		**	**	No
Conifers					
Mountain pine	**		***	**	Yes
Lodgepole pine	***		**	***	Yes
Noble fir		**	***	***	Yes
Sitka spruce	**	*	*		Yes

Fig 4.27. Tree and shrub selection according to shade tolerance. (ADAS 1988)

Timber Production.

Thompson and Cumming (1983) designed a shelterbelt primarily for shelter but one that would also, "provide some small roundwood for sale or for use on the farm."

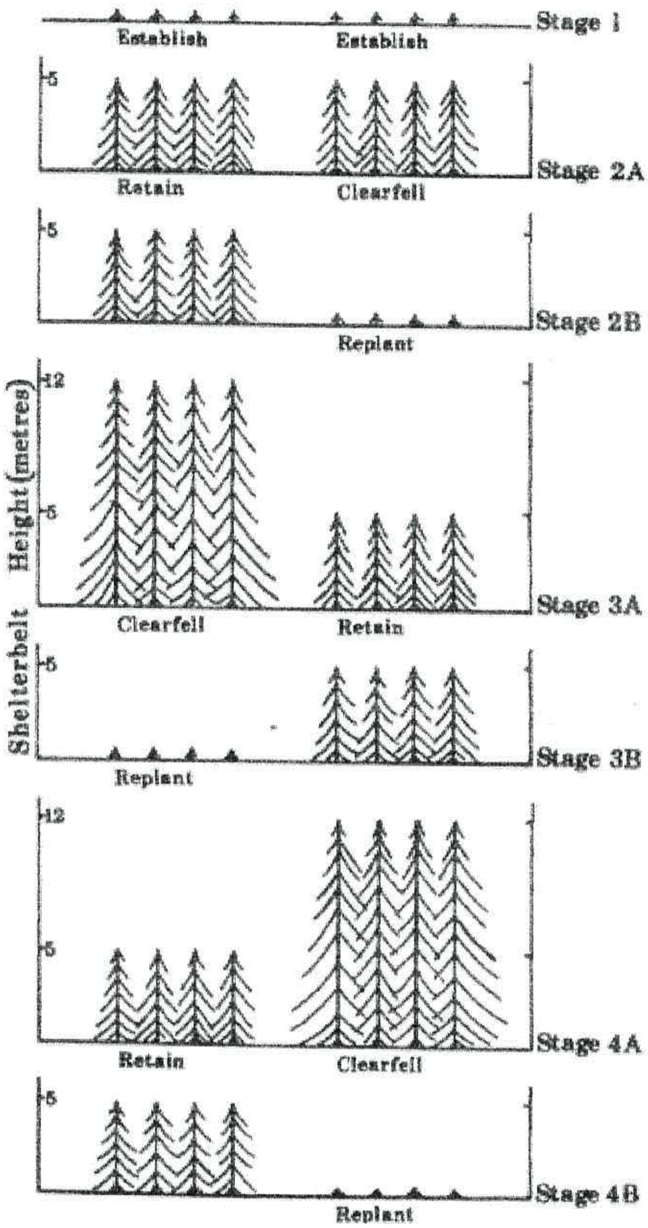


Fig 4.28. Thompson & Cumming's step by step diagram of a management cycle for a timber producing shelterbelt. (Thompson & Cumming, 1983).

Fig 4.28 is a diagram of Thompson and Cumming's proposed shelterbelt design. Two belts are planted side by side with an unplanted central strip 4 metres wide. The belts are felled alternately, thus continuing to provide shelter whilst providing some revenue from timber production and sale.

Having outlined the multiple uses of such woods and glanced at the design considerations involved, it is imperative that we discuss the aesthetic considerations involved in shelterbelt design.

Aesthetic Design.

Fig. 4.29 illustrates some of the theoretical designs for shelterbelt planting. Whilst they would not appear to be of the forms which one might expect to be suited to the natural landscape, they can add to an area's visual interest. An example of (d) may be viewed above Aber in Gwynedd, a belt which due to historic connotations is something of a local landmark, though hardly a victory for landscape design. Where such designs are indigenous, there may be an opportunity to plant new shelterbelts following the same forms. Although they may not appear organic or natural they do, nevertheless, contribute to an area's genius loci and are a feature of an area's vernacular identity worthy of preservation.

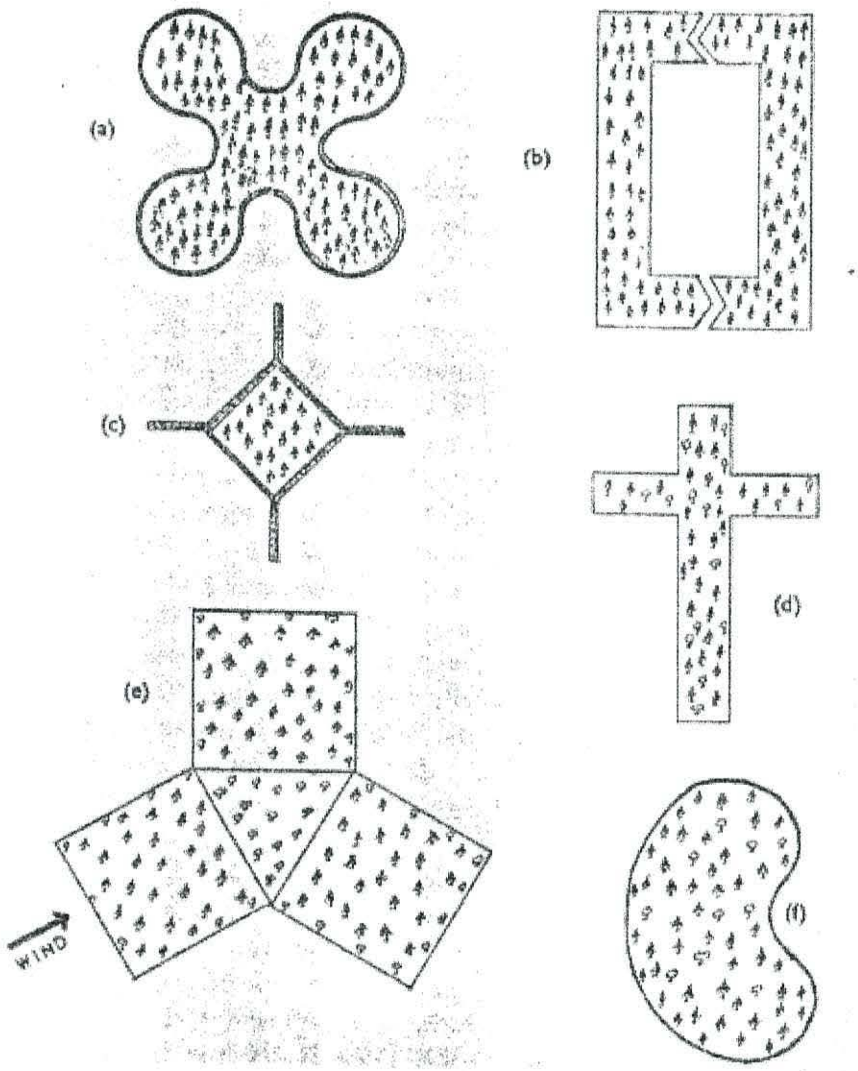


Fig 4.29. Some traditional designs for shelterbelt layout. (a), (b) and (c) are 19th century Scottish examples. (d) and (f) are designs for hill planting. (e) Cadman's Manx leg design (J.M. Caborn, 1965).

Where there are no vernacular designs which can be copied shelterbelts should be designed, like other plantations, with due consideration given to the effect upon the surrounding landscape. They are, by their very nature, relatively thin tracts of woodland, especially in the lowlands where a narrow band will often provide sufficient shelter. One design element which may need to be employed is that of visual diversity. This may be increased by varying the width of the belt.

Whilst the general rules of forest design should be considered when designing shelterbelts, e.g. planting in relation to local landform and vegetation patterns, there is one point in particular which really should be heeded. This is probably the most influential effect that a shelterbelt can have on the landscape, this being planting in relation to the skyline. The work done by Bell and Lucas (1989) illustrates both the undesirable and desirable locations for shelterbelts when relating to the skyline. The Australian author van Pelt (1950) pointed out that "visually, the most critical areas are those occurring on an interface, for example sky/land." The main areas which should be avoided are:

-They should not end abruptly on prominent skylines.
-They should not frame the skyline.
-If planted too near the skyline they can produce intrusive slivers of open land on the skyline.

Certain rules should therefore be adopted where the skyline is concerned. If shelterbelts are not planted on the skyline with supporting woodland down the front slope, they should either be kept well clear or they should be planted to curve around a feature such as a pronounced landform on the skyline.

Fig 4.30c by Bell and Lucas (1989) indicates the dislocated effect which can occur when the unsympathetic planting of a shelterbelt can appear to form a border between two elements, sky and land in this example.

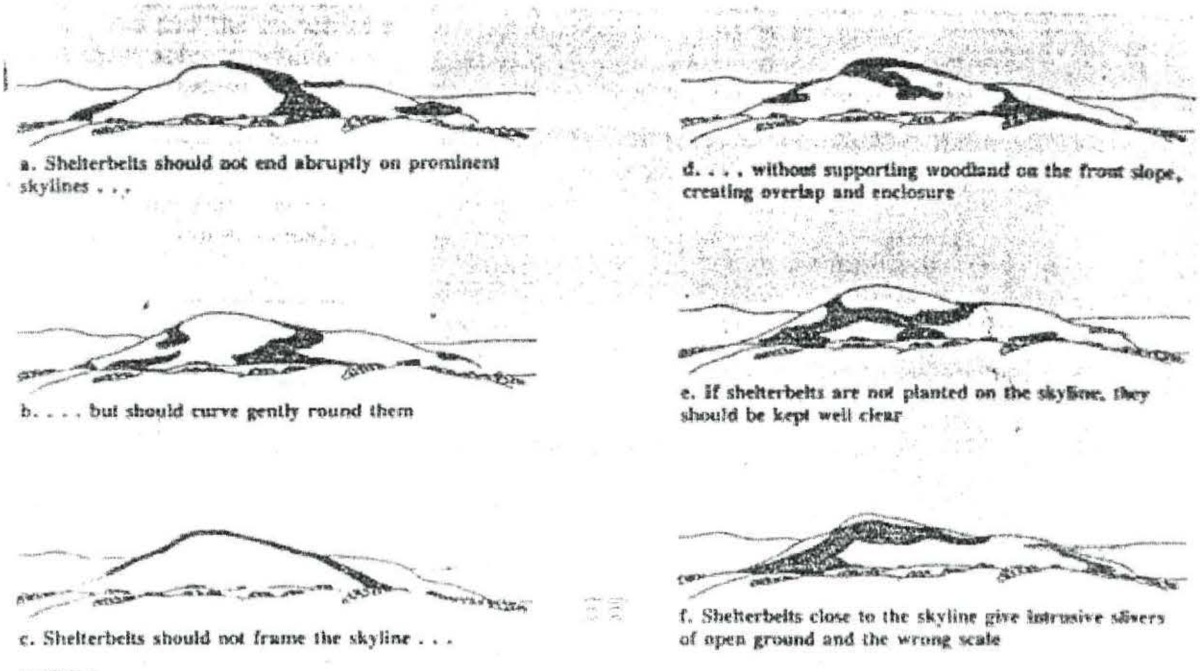


Fig 4.30. Location of shelterbelts in relation to skylines (Bell & Lucas, 1989).

THE AESTHETICS OF TREESHELTERS.

In 1979, Graham Tuley designed what are now regarded as the first treeshelters. They were simply polythene sleeves which encompassed the young tree thus providing a microclimate which would promote tree growth and would therefore have a similar effect to that of a greenhouse. Today the use of what were originally known as "Tuley tubes" is widespread. So much so that their visual effect must now play a role in their design and location. Treeshelters must not be confused with tree guards, which are mesh guards constructed of either plastic or wire designed specifically to protect the young trees from animal browsing damage. Similarly rabbit guards may be confused with treeshelters, particularly when viewed from afar. These rabbit tubes, however, are not cylinders but loosely coiled plastic tubes often with ventilation holes. As they appear similar to treeshelters in the field, then the design considerations concerning the latter will also be valid in designing the former as well.

Treeshelters for the Farm Woodland.

With farmers today being urged to plant trees on surplus agricultural land, treeshelters may be the answer to their fencing costs. Treeshelters may be of particular relevance to anyone considering planting trees on farms. Stock exclusion can be expensive, especially when fencing off irregularly shaped woods. Treeshelters may often provide the farmer with a cheaper solution. By planting young trees in such shelters their greenhouse effect (for want of a better term) is beneficial to the growth of the plant. They also provide the means by which the trees are protected from grazing animals without needing totally to exclude the livestock from the area in question, for example in agroforestry. Graham Tuley cited this as one of the main reasons for developing what were originally only tree guards but are now, due to their wider application, known as treeshelters. In Tuley's own words, "To reduce costs the trees were planted at wider spacings and this led to the development of individual plastic mesh tree guards as a cheaper alternative to fencing for small areas."

Fig 4.31. A so-called rabbit guard which is, in fact, a length of plastic wrapped around the lowest 0.6 metre or so of a tree. Such guards may appear not dissimilar to treeshelters in long views and may benefit from design revisions in common with the latter.

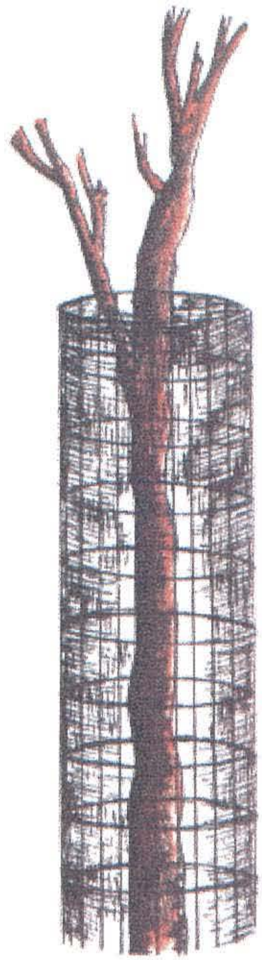


Fig 4.32. The term treeshelter has become synonomous with tubes designed to promote tree growth rates as well as guarding against browsing animals. They should not be confused with the older "tree guards" (above) which are constructed entirely of mesh and satisfy only the former objective. Their effect on the landscape may be regarded as less obvious than that of treeshelters due to them being largely transparent.

Treeshelters have proved to be extremely beneficial for tree establishment, both for stock protection and by creating an environment within the tubes which encourages tree growth.

Visual Impact. - Layout.

Treeshelters are not devoid of aesthetic problems. If anything could appear as visually intrusive as a regimented block of Sitka spruce planted on a hillside, then a similarly designed block of trees housed in white treeshelters would come very close. Treeshelters, by their very nature, appear artificial in their surroundings. They are synthetic objects within an environment which many still perceive as being natural. Geometrical planting should, therefore, be avoided whenever possible as there is some risk of emphasising the already unnatural appearance of the treeshelters themselves. The Forestry Commission advise that care should be taken when using treeshelters especially when many trees are involved. They conclude that "Even when used with care, they appear artificial, particularly in large numbers. Temporary fencing to exclude browsing animals and correct herbicide treatment to secure rapid early tree growth is cheaper and looks better on larger areas."

However, as we are concerned primarily with the establishment of farm woodlands the areas to be planted will generally be smaller than those planted by the Commission themselves. Whilst artificiality must be avoided where possible, it may not be economically feasible to fence such woods due to irregular form e.g. shelterbelts with their large edge to area ratio which could leave the farmer facing large fencing costs. In many cases, therefore, treeshelters may be the most cost effective form of protection.

Planting in irregular shapes is one means by which to integrate treeshelters into the landscape aesthetically. As Potter (1991) argues, "The artificial appearance of treeshelters is unneccessarily emphasised by planting in a precise geometric grid. Unless mechanical weed control is employed there is little need to follow rigidly straight lines."

Of course, when designing a woodland numerous factors need to be considered besides the visual effect of the treeshelters. Whilst it is a perfectly legitimate design consideration it should be inherent that a well designed woodland would appear natural as opposed to geometrical and the fact that the crop should be housed in treeshelters would be of little relevance. After all, a woodland should be designed bearing in mind its probable visual effect and development over a rotation of 100 years or more if broadleaves are chosen, not only its first 4-5 years in shelters.

Fig 4.33 A beige treeshelter housing a young oak.

Fig 4.34. When viewed from even relatively close these dark brown spiral rabbit guards are hardly noticeable.

Visual Impact - Litter.

Whilst the effect of new treeshelters on the landscape is a concern there is also the question of how they will fare in the longer term and their littering effect. Most treeshelters today are made of polypropylene which will start to decay in sunlight after a period of approximately 5 years. Some shelters will decay into relatively small pieces, but flat sided ones in particular tend to split into larger strips thus causing something of an eyesore. As Potter (1991) suggests, "the proliferation of fragments of plastic in the countryside could do much to provoke opposition to their use unless a little effort during the quiet days of winter is devoted to maintaining the appearance of young plantations."

Another point is to seek to ensure that the shelters are erected upright as "a collection of plastic tubes leaning at various angles will create visual confusion as well as giving an impression of incompetence or neglect." (Potter, 1991).

This view is supported by Browell and Mead (1987), who offer the opinion that, "One of the most common failings of tree shelters and their staking is to achieve vertical alignments. Where several are planted together, the strong vertical lines are dominant and any leaning ones are aesthetically jarring."

Visual Impact - Colour.

The most influential factor concerning the aesthetics of treeshelters is their colour. The white treeshelters of the past are now regarded as something of a mistake, due to their inability to blend effectively into the surrounding vegetation pattern. It is believed today that "The original white shelters are among the most harsh and should generally be avoided, though they are useful in underplanting or other situations where light levels are low. (In full light they may increase plant stress by admitting more light and creating higher temperatures.)" (Potter, 1991).

Although they are not generally in use today, due to their unnatural appearance, there are some circumstances which may merit their use. The Forestry Commission, although they accept that they are not aesthetically ideal, have discovered that they are advantageous to tree growth particularly in situations where light levels are low.

Evans' view of the subject (1985) suggests that concerns about the colour of treeshelters are a more recent development, "There appears to be little preference for colour. Shelters arouse interest which is almost wholly favourable because they show that tree planting is being carried out."

Whilst public acceptance is likely to be somewhat similar today there does seem to have been a distinct change since 1985 in preferences for treeshelter colours.

Treeshelter colour is probably the area where further development would be most beneficial. Whilst there has been a marked movement away from the use of the white shelters of the past, which were blighted by their so-called "gravestone appearance" (Tuley, 1985), more could still be done in this field.

Fig 4.35. These beige treeshelters blend relatively well into the surrounding vegetation pattern. Mixing shelter colours would not be appropriate on an area of land such as this where the surrounding vegetation colour is relatively uniform.

An effort should be made to employ treeshelters which blend effectively into their surroundings. Greens and browns are therefore the most suitable colours for use in the countryside. However, care should be taken when choosing particular shades as the darker greens and browns may be unsuitable in the majority of situations. The shades which are most widely used are pale brown, khaki and olive green which blend into most landscapes. As Hart (1991) explains, "In landscape sensitive areas, an unobtrusive colour should be used to blend with the surroundings; russet browns or olive greens are usually best, and white or garish greens should be avoided. Hence there is need for due consideration being given to the nature of the site and the managerial implications before treeshelters are employed."

The correct choice of shelter colour will be of particular relevance in sensitive areas where the location of the planted area is especially obvious, for example on a hillside.

When a relatively large area is to be planted there may be different shades or colours in the existing vegetation pattern. This gives an opportunity to vary treeshelter shade or colour according to the particular vegetation colour. Whilst scattering too many colours will create a distraction, careful division of the planting area according to vegetation and choice of shelter colours in accordance with this should improve the "naturalness" in the appearance of the site.

The choice of shelter colours is now much wider with an emphasis on blending into the local vegetation pattern even though their "lifespan" is quite short in comparison to that of the trees they house. However, there may still be some room for improvement. The design of shelters to match the surrounding vegetation pattern of a particular site may prove to be visually beneficial. This could possibly be achieved by using dappled shelters or even designing shelters of a similar pattern to that of the surrounding vegetation pattern. Taking this a step further the shelters could be designed in a pattern similar to or complementary to the trees which are being planted, either to the foliage or even the stem colour of the planted species.

Arrangement and Planting Area.

The scale of the area to be planted will clearly have some bearing on the overall effect of the shelters. Even using them on a small scale can have an obtrusive effect and this would be multiplied in large scale plantations. Lucas (1991) also suggests that varying treeshelter colour can be aesthetically beneficial. He is of the view that brown shelters alone may not alleviate this problem, "but the large scale can be reduced by changing the colour to olive green in selected places. On steep slopes groups of shelters in brown and olive should be laid out in irregular shapes in scale with the landscape."

Such a policy should have a similar effect to that of species mixture. Species mixture is generally used in order to give some relief, rather than planting a large area with one species. Employing a similar method with shelters of varying colours has also proved beneficial.

Another useful technique is to utilise different shades of shelter in order to draw the eye in a particular way. For example, if an area is to be planted with trees it may be possible to use light coloured shelters in the foreground from a particular viewpoint and to use darker coloured shelters for the trees in the background. The lighter coloured shelters, whilst looking somewhat more obvious than the others, should have the effect of drawing the eye away from the majority of the trees which are housed in the darker shelters.

Whilst numerous types of treeshelter are in use today varying in colour, form and size (ranging from 0.6 metres for protection from rabbits to the suggested 1.8 metres if deer are present) there is plenty of scope for further development where the effect upon the landscape is concerned.

The acceptance of treeshelters within the landscape has already come a long way since they were first used. As Brown says, "Our earliest problem was not of design and use, but of acceptance. We had been struggling for too long with plastic mesh, spirals and fences.........Slowly, with better design, longer life and muted colours, acceptance gathered momentum until landowners are welcoming them. It was considered a bonus if the public could see that planting had been done."

Fig 4.36. Any man-made object can appear artificial in the natural environment. As a result, the effect of the colour of treeshelters and similarly tree guards and spiral rabbit guards on the landscape must not be underestimated.

Treeshelters could be regarded as something of a panacea to many of the forester's establishment problems. Their acceptance has been widespread, with some putting up with their appearance because of the long term landscape benefits they should bring. After all, they are usually used to nurse new broadleaf planting. Consequently, their negative short-term aesthetic impact may be accepted as the price to pay for the long-term benefit accrued from the broadleaf woodlands, which they assist in establishing. There is, however, plenty of scope for development in the quest for the aesthetically acceptable treeshelter.

CHAPTER 5

LANDSCAPE EVALUATION.

"A landscape is not an area but our vision of that area".
Fairbrother, 1973.

Landscape Evaluation and Perception.

As the evaluation of a landscape's aesthetic quality is such a subjective task, it is imperative that we begin by discussing those elements which contribute to and mould our perception of the experience of viewing a view.

As Fairbrother (1973) pointed out, a landscape is the result of our perception on viewing a piece of land, not merely the area itself. This is a view echoed by Macia (1979) who noted that "The environment is not landscape until people perceive it". If this is to be believed then the viewer is as important a constituent of landscape as the land area itself. Therefore, those factors which influence an individual's perception of the aesthetic landscape cannot be ignored.

Whilst there may be a general consensus about what is regarded as an attractive landscape, or otherwise, various so-called internal factors will affect how different individuals react to different landscape types. Similarly, external factors such as diurnal or seasonal changes can have a crucial bearing on how we view particular landscapes. Climatic variation, for example, can affect the viewing experience which may ultimately affect our own valuation of that which is being viewed. Consequently, the appreciation of a landscape is the result of both internal and external factors, which interact to contribute to the perception of landscape and to our experience of viewing it.

EXTERNAL FACTORS.

Seasonal Change.

Probably the greatest external factor influencing our perception of an area is that of seasonal variation. A hillside partly wooded by broadleaves may appear rather uninspiring during most of the calendar, but can evoke a particularly strong positive response when clothed in blazing autumnal colours. Similarly, whilst many landscapes benefit visually from a fall of snow, mountains are particularly enhanced by snowy, wintry conditions which seem to contribute to the genius loci. However, during rain or even snowfall visual impairment may negatively affect the value of a landscape.

Conversely, there may be a positive input by rainfall at other times, for instance, when it contributes to a waterfall or to the water volume of a river thus adding to the effect. Certain coastal landscapes, especially those where bare, rocky cliff faces are prominent, may appear more dramatic or rugged when the weather conditions are stormy and the sea thrashes against the shoreline. The sound of water can also contribute to the overall landscape experience. The dynamic quality of water and the variation of sounds which it is capable of producing add to its charm. A relatively short walk from Pen-y-Pass above Llanberis, along the Miners Track up to Llyn Glaslyn illustrated this point. The sound of the water varied from the silent, motionless lakes to the busy, rush of sound of the waterfall as Llyn Glaslyn empties its contents furiously over a mass of rocks. The intervening journey was interspersed by the babbling sounds of nearby streams and the pattering of thawing snow. All testify to the fact that the experience of landscape is not an exclusively visual one. If this "soundscape" is to be considered during landscape appreciation then there may also be a case for considering the "smellscape" in the same context (Porteus, 1985; Porteus & Mastin, 1985).

Fig. 5.1. Llyn Llydaw, Snowdonia in February. The effect of snowfall adds to the genius loci by seeming to accentuate the scale of the surrounding peaks. Visitor numbers are markedly lower during the colder months though a surprising number of individuals defy the snow and frost to view the scene in its winter grandeur.

It may be feasible to allocate seasonal values for aesthetic landscape quality or even to calculate a mean score for an area based on evaluations conducted at seasonal intervals.

Fig.5.2. Llyn Llydaw and Snowdon in daytime. This is a high quality landscape scored at about 23 or 24 and probably among the most attractive views in Wales. Of the estimated 1/2 million people who annually scale Snowdon a large proportion will follow this route along the Miners Track.

There is a strong argument for noting a landscape's highest seasonal value, particularly if development is under consideration. After all, it is a landscape's highest seasonal score which is most likely to give the most pronounced measure of landscape devaluation in an environmental impact assessment. The main consideration here would be during which periods of the year the view might be most viewed and visited.

Diurnal Change.

External influences will not be confined to the seasonal cycle. Diurnal effects may also affect how we perceive an area of land on a daily basis. A sunset can transform an otherwise uninspiring landscape into something visually breathtaking. Similarly, that fleeting sight of a well defined skyline silhouetted against the backdrop of a crimson sky at dusk can add significantly to one's experience of landscape. A misty dawn may also evoke a positive response in the viewer, particularly in lakeland scenes.

Fig. 5.3. Llyn Llydaw, early evening, late summer. The diurnal change as dusk falls and a glimpse of Snowdon silhouetted by a sunset sky.

The element of transience probably contributes somewhat to the pleasure derived from such views, in the knowledge that they must be enjoyed for the brief time that the particular conditions will last. However, such short term changes are not confined to the natural landscape, as the built environment may also experience a similar phenomenon. Bell (1993) notes the diurnal effect of late night neon street lighting as a positive factor "where the(ir) glamorous effects transform the street into an exciting place."

The Cultural Landscape.

A further factor which may affect our perception of landscape is the influence of the so-called cultural landscape (Bourassa, 1991). This involves an interaction between internal and external factors. The cultural landscape itself is an external factor, confined to the pages of prose and poetry or to artists' canvasses or tales of folklore spread by word of mouth. It has no influence on the landscape itself but may have a significant effect on how people perceive it. Beddgelert, in Snowdonia, is a prime example of such a phenomenon. There are a number of more attractive landscapes in the surrounding area and numerous towns and villages which boast equal if not better facilities for tourists. However, Beddgelert thrives during the tourist months simply due to a folk tale depicting the slaying of a dog after which the town was supposedly named. The effect of this factor on an individual's viewing experience will probably depend on whether he or she has knowledge of the works depicting that particular area. The internal factor may have a two-fold effect. Firstly, there may be differences between those who are and those who are not familiar with the works concerned. It may be that if a person is aware of the folklore then his or her enjoyment of the landscape is greater as a consequence. Secondly, individuals' varying responses to the works themselves may also prejudice their perception of the landscape. This bias may result in a negative or positive response. In the case of Beddgelert this may be affected by whether you believe the story to have some basis in reality, or know that it is a common folk tale imported in Victorian times to boost the area's tourist value.

INTERNAL INFLUENCES.

Most of the influences noted above are external in nature. There are, however, additional influences which may be described as internal or personal influences which can affect the experience of landscape, as indeed they may influence other subjective experiences, for instance the appreciation of art.

Insiders and Outsiders.

The first of these internal influences is the difference in perception between insiders and outsiders. Individuals who are familiar with a specific landscape or with certain landscape types will often react differently in their evaluation from so-called outsiders. Familiarity may extract a positive response, due to the generally held view that we as a species tend to spurn change whilst holding the familiar in high regard. Price (1978) notes that, "When a landscape is habitually experienced, especially at important and formative stages of a consumer's life-cycle, additional value is drawn from its familiarity. Partly, this may be attributed to deeper insights into the landscape (a four-dimensional knowledge); partly to associations built up with the landscape, so that on each visit the consumer partakes of happy events of the past. There are, of course, landscapes with sad associations; but, if these fail to mellow to bittersweetness, the consumer can avoid further visits." There is a dichotomy here in that there is a danger that we may become desensitised or indifferent to fine landscapes if they are part of our everyday lives. This is an important consideration for those involved in the fields of landscape evaluation and design. Even an experienced evaluator should, if possible, aim to divorce his own personal experience from the valuation when evaluating familiar landscapes.

Where landscape evaluation is concerned this argument lends itself to the view that familiarity with a landscape type is an important aspect when selecting an expert to give representative values for a landscape's aesthetic quality. This view is echoed by Bourassa (1991) who states that "the aesthetic values of existential insiders should have priority, if only because the regular inhabitants of a place must experience their surroundings on a daily basis, while the experience of the tourist or other outsider is only temporary". This raises another interesting argument. Whilst there may be a general consensus that an expert insider or "native" (Bourassa, 1991) (Price, 1991) would probably give the most accurate evaluation, who would be the most qualified to fulfil the task if the choice was either an expert non-native or an non-expert native? This aspect is discussed in further detail through the comparison of expert and non-expert evaluation results in chapters 6 and 7.

Other Influences.

There is reason to believe that other psychological factors affect how we perceive our surroundings. The level of a person's gregariousness may contribute to his or her perception. Some may show a preference for viewing a landscape alone and may regard fellow viewers as an intrusion or an unnecessary distraction which detracts from their enjoyment of the view. Others may regard co-viewers as a bonus, especially if, subconsciously, they regard mountainous or wild landscapes as a threat. Similarly, responses to open or enclosed landscapes may be negative if a person displays agoraphobic or claustrophobic traits respectively. Some may favour the security offered by walks along forest rides, particularly during rainfall, whilst others may view the sense of enclosure as being too confining and may yearn for the wide, open spaces outside the forest boundary.

Bourassa (1991) also cites the influence of various "biological laws" on perception. Firstly the effect of the Habitat Theory where landscapes are, apparently, preferred on the grounds that they "appear to enhance survival", for instance in the desire to live near a source of water.

Appleton's (1975) Prospect-Refuge Theory, the crux of which is the ability to see without being seen, may also affect one's perception of a view. Bourassa (1991) states that the, "Prospect-refuge theory describes a mechanism that protects individuals from hazards". He continues by saying that, "The ability to see without being seen is particularly important both in pursuing prey and avoiding predators, two important biological needs of early man". The theory dates back to the time of early man and the necessities for survival, but it can be questioned as it excludes other elements which are necessary to support life, such as water.

The Processing Theory (Kaplan & Kaplan, 1989) is concerned with the human trait of the need to seek knowledge. Consequently, landscapes which stimulate knowledge acquisition are viewed positively. This is an argument which supports the provision of focal points in the landscape or points of interest which stimulate this need for the acquisition of knowledge and satisfy our inquisitiveness.

All these complex factors may contribute to an individual's perception of his or her landscape view but the main influence must be his or her personal taste. As Price (1978), discussing the use of willingness to pay in the evaluation of landscape, puts it, "Where, as is normal, evaluation is required of landscape in different states, the decision may be likened to a choice between jam doughnuts and cream doughnuts, to which different prices are attached. If the change is represented as from jam to the (say) higher state of cream, willingness to pay for the change is technically appropriate; if from cream to jam, the required compensation for giving up the cream. Of course, some people prefer jam doughnuts to cream; so it is with the two states of landscape." This last sentence in particular reminds us of the similarity between landscape and other goods in that personal taste will play a role both in summing up the merits of different landscapes as well as in assessing the relative merits or otherwise of planned landscape change.

Whilst there may be general agreement about what constitutes a truly high or low quality view, personal preference and taste may often play a larger part in the evaluation of those of a more moderate standard. It might be that personal preference and our own, individual perception of landscape will have a greater influence on how we place a value on these moderate landscapes.

Selecting a Method of Evaluation.

In order to perform any landscape evaluation work it is necessary to select the most appropriate valuation technique for the task. As there is no one universally accepted evaluation method it involves sifting through the available methodologies. As so many different scales and evaluation methods are currently being exercised, comparison between evaluation conducted using differing scales does raise problems. However, until the one definitive technique is devised landscape evaluators will continue to utilise the scale which best suits their own purpose for any particular study.

Defining "Evaluation".

It might be useful to start by defining the term "landscape evaluation" and seeing how such work differs from landscape classification. Landscape classification is concerned with grouping landscapes by their similarities. It might simply be a means by which to describe and group landscapes of similar landform or land use (or both as in the ITE's land classes). The purpose of such work is simply to describe and group landscapes and no value judgement is involved.

Landscape evaluation, on the other hand, is concerned with valuing aspects of landscape such as aesthetic quality. It is, by its very nature, subjective and involves comparing different landscapes on the basis of visual quality.

The Techniques of Evaluation.

Rather than producing a case-by-case review of the vast array of evaluation methods here we shall take an overview of the methods available and look more deeply at those which are most appropriate for the purposes of this study (note that those techniques concerned with evaluating aspects of forest amenity can be found later in the text). It is an extensive field which has previously been summarised, by Swanwick (1991) and Price (1991) among others. What follows is an introduction to the field of landscape evaluation and a critique of objective / subjective approaches, aimed at justifying the choice of method for the ensuing evaluation of Welsh landscape types.

The methods of landscape evaluation may be broadly divided into two categories, these being the "objective" or "components" approach and the "subjective" or "holistic" approach. The former is dependent on the measurement of landscape features which are then combined to give an estimate of landscape value. The latter, the subjective method, involves simply the allocation of aesthetic values for landscapes based on the overall subjective impression gained by an observer or observers for particular sites.

The Subjective Approach.

The inability of the objective approach to landscape evaluation to produce a conclusive measure of aesthetic landscape value has made it necessary to search for an alternative approach. The objective, or components approach, whilst having proved reliable for assessing objective ecological and conservation values, is less suitable in evaluating a more subjective or preference based subject such as aesthetic quality.

The Fines Method.

The study of landscape quality in East Sussex by Fines (1968) was the prototype for most of the holistic methods. Whilst the descriptive scale devised by Fines ("unsightly, undistinguished, pleasant, distinguished, superb and spectacular") continues to this day to provide a useful framework, questions must be asked about the calibration of Fines' numerical scale which he based on "landscape value units". At the lower end of Fines' scale the four lower quality descriptive groups from "unsightly" to "distinguished" are all accounted for by a mere 8 landscape value units. However, the subsequent 24 landscape value units apply to only two of the descriptive units classed as being either "superb" or "spectacular". Fines also concluded that Britain's highest quality landscape might only command a score of 18 under normal circumstances, whilst the highest "normal" value for East Sussex and the rest of lowland Britain could score no higher than 12.

Fig. 5.4. Fines' Evaluation Scale.

Fines' Descriptive Scale	Fines' Numerical Scale
Unsightly	0 -› 1
Undistinguished	1 -› 2
Pleasant	2 -› 4
Distinguished / Attractive	4 -› 8
Superb / Excellent	8 -› 16
Spectacular / Exceptional	16 -› 32

Other Studies.

Penning-Rowsell and Hardy's (1973) study of the Wye Valley Area of Outstanding Natural Beauty was a comparative study of the merits of three methods of aesthetic landscape evaluation. The first technique was the Subjective Evaluation Model where each evaluated unit of landscape was assigned a grade based on a descriptive value (Grade 1, extremely attractive; Grade 2, attractive; Grade 3, average; Grade 4, poor). The second technique utilised was the holistic model created by Fines (1968). The last method used was Hampshire County Council's model of 1968. The main thrust of this latter technique is the weighing of attractive or positive factors against detractors or negative factors to give an overall landscape value. As Penning-Rowsell and Hardy suggest, "The difference between this technique and others here is that the operators identify landscape components that contribute to high landscape value, map these components (with associated detractors if present) and arrive at a balanced assessment of the total landscape quality from this averaging procedure". However, they discovered that this method was in fact the most difficult technique to implement of the three, mainly due to the problems in balancing the attractive elements against the detractors. The surveyors concluded that techniques 1 and 3, these being the Subjective Evaluation Model and the Hampshire County Council Model respectively, produced similar results.

The study highlighted the unsatisfactory element of Fines' model, notably that high relief and lack of urban development equated to a landscape of higher quality whilst low relief and urban development was viewed as being of lower visual quality. The model tends to disregard the possibility of attractive residential areas as well as the argument that certain landscapes of higher relief may not necessarily be aesthetically attractive. According to the authors the reason for this was that the method was based on a "collective rather than an individual opinion. It is based on a premise, for instance, that most people will prefer hilly, woodland scenery to semi-urbanized flat land". Consequently, the landscape values will mirror this.

Penning-Rowsell and Hardy found that all three survey methods had certain positive attributes though none was infallible. It was noted that whilst Fines' approach tended to concentrate overtly on "characteristics of the landscape itself" the other methods, particularly the Subjective Evaluation Model which is very similar though more subjective than Fines' own method, were thought to be too dependent on the degree of overall attractiveness as perceived by the surveyor. This does seem strange, however, to criticise a subjective method for being subjective. If objectivity was the aim, then perhaps Linton's method would have been a more appropriate selection.

Penning-Rowsell and Hardy concluded that the modification of these methodologies should produce a technique of assessing the attractiveness of landscape which could then be used, for instance, as an aid in the designation of Areas of Outstanding Natural Beauty and also for improvement schemes within such designated areas, though they recognised the lack of objectivity present in such methods.

Refinements to Fines' Scale.

Refinements to Fines' scale have created a more equal division within the numerical scale. This has certainly improved on the original scale which lacked sensitivity at the lower end whilst being excessively sensitive at the upper echelons. Some adaptations (with Fines' descriptive scale included) are given below.

Fig 5.5. Fines' scale and revisions.

Fines Descriptive	Fines Numerical	Harding & Thomas	Price	Price (Proposal)
Unsightly	0 -› 1	0 -› 5	-II -› 0	-V -› 0
Undistinguished	1 -› 2	5 -› 10	0 -› II	0 -› V
Pleasant	2 -› 4	10 -› 15	II -› V	V -› X
Distinguished / Attractive	4 -› 8	15 -› 20	V -› VII	X -› XV
Superb / Excellent	8 -› 16	20 -› 25	VII -› IX	XV -› XX
Spectacular / Exceptional	16 -› 32	20 -› 25	IX -› X	XX -› XXV

Despite these changes, Fines must be applauded for his vision in devising such a system of valuation, not least for recognising the influence that external factors may have on landscape values. He noted their ability to change the "normal value" for a particular landscape and once again noting an element which is not accommodated within objective evaluation methods.

The Harding & Thomas method (Harding, pers. comm.) takes into account the insensitivity and lack of balance in Fines' method, remedying this by offering a scale of 1-30 divided equally into six groups which can be used in conjunction with the descriptive scale. This provides sufficient sensitivity at both ends of the scale. Price has taken the scale a step further by introducing negative valuation at the lower end of the scale for those landscapes of such low quality that one might prefer not to view them. Whilst Fines provided for negative factors to be considered in the overall valuation his final values were zero or positive. This later method recognises that truly unsightly landscapes have a negative effect on the viewer and should be valued accordingly. The proposed method by Price gives a scale akin to that of Harding & Thomas, but with the lowest five points being valued negatively.

It might be said that the lack of objectivity in such methods is a weakness, particularly for new users. After all, a components approach merely requires the surveyor to note the features present in a landscape. A subjective evaluation, however, requires the individual to give an overall value for how he or she perceives the aesthetic quality of the site. Scores here are likely to be more varied as a result of personal preference etcetera, though variation between the scores of different individuals does not in itself mean that some are correct and others are not. The main problem is probably that prospective evaluators may take time to align the numerical scale with their own perception of landscape quality. However, there may be two ways by which to aid this process. Firstly, previously evaluated sites can be illustrated by means of photographs, which may help them to calibrate how different landscapes might be scored. Similarly, whilst Fines' descriptive scale should by no means be accepted as suitable for all evaluations it does provide a very useful guide to the novice who finds it difficult to think of landscape aesthetic quality in numerical terms. Certainly, in time the need to use the descriptive scale becomes obsolete as the surveyor feels proficient enough to use the numerical scale unaided.

The Objective Approach - Quantifying the Unquantifiable?

There are those who dismiss holistic evaluation techniques on account of their lack of objectivity. Those who hanker for a less subjective means of measuring a landscape's aesthetic value are largely constrained to the use of a components approach for evaluation.

In the same year that Fines (1968) published his holistic approach, another pioneering work was produced by the school of objectivity. Linton (1968) designed a method for evaluation based on the measurement of "externally measurable components" (Price, 1991). This approach involves the quantification of landscape components both in land form and land use. Water, in particular, is noted as being an important factor, even worthy of "bonus points" (Gilg, 1975), of varying value depending on quality. This refinement by Gilg regarding water suggests the allocation of different values for various water features ranging from 15 points for the sea down to 3 points for reservoirs. This raises a degree of subjectivity which might not be acceptable to some among the purists of the objective cause. Allocating different values for lakes and reservoirs is to make a value judgement which is rooted in subjectivity. After all, if a lake scores 9 points and a reservoir a mere 3 there is a bias here, the only difference from the more subjective approaches being that the bias was placed into the equation / scale before the valuation rather than during the exercise.

Further refinements to the Linton method have been produced to include the contribution of negative factors to the overall aesthetic value. Studies by Penning-Rowsell and Hardy (1973) recognised the need to integrate visual detractors into the landscape value by deducting their negative effect from the score.

Additionally, as we are primarily interested here in the effect of trees on aesthetic landscape values, it might be worth noting that trees and woodlands may be allocated positive or negative values both in rural (Linton, 1968) and urban areas (Talbot and Kaplan, 1984; Price, 1991). For example, a geometric shaped conifer plantation might be deemed to be of negative value, whilst a broadleaf avenue in the urban landscape might benefit an area, visually.

The Aesthetic Landscape - More Than the Sum of its Parts?

Whilst there may be something to be said for the use of objective methods of landscape evaluation there are obvious flaws in the methods currently available. The main problem with such approaches is the inability to take into consideration the effect of some influences in the valuation process. The landscape is, aesthetically, more than a sum of its parts. This conflicts with a components approach for the measurement of its quality.

This is also allied to what Dunn (1975) describes as the "interaction between elements". An attractive landscape is not necessarily the product of a collection of the elements within but, more importantly, the result of their location and the interaction between them. Indeed, two landscapes might contain the same features, but one may be more attractive than the other because its layout creates a better balanced composition. Further influences such as the interplay between colours and the interaction of landforms as well as the external influences such as climatic, diurnal and seasonal influences are all ignored in components based techniques. These subtleties, which are omitted from such evaluations, contribute to regional character and spirit of place. They are, by their very nature, unquantifiable by a purely objective methodology.

Evaluation from Photographs and Public Participation.

Choosing the scale of evaluation is one step, but there are other considerations, such as how the evaluation is to be undertaken and who will be chosen to evaluate.

Evaluation from Photographs.

On the subject of using photographs as surrogates for site visits Dearden (1986) cites the importance of providing sufficient diversity of landscape types to allow a less restrictive valuation. Using Wales as an example, by showing a photograph of Snowdon and another of a South Wales coal mine consensus can almost be guaranteed. But this is not to say that it will always be the case. The important consideration is to ensure that the photographs are not taken in such a way as to ensure an increase in valuation by seeking to omit negative features, for example.

Where an initial site survey has taken place in the field, if photographs had been taken it would then be possible, if necessary, to reassess the results from the photographic evidence produced. The subjective evaluation from photographs or slides also means that much wider participation is possible than might be the case from a site visit. Dunn (1975) discovered that evaluations conducted under such conditions did indeed give a representative value for aesthetic quality. This does, of course, open up new opportunities, for instance in the field of public decision making. Its use for public enquiries into planning decisions could mean a much wider input by the public where communities concerned could provide their own valuation for the planning process.

Who evaluates?

Dearden (1981) noted the possibilities of public participation in the evaluation field. However, those presently responsible for the task of implementing planning legislation would probably shudder at the idea of such a proposal, a view echoed by Turner (1976) who lamented that he was "appalled at the prospect of planning landscape on the basis of public preference".

It seems extremely patronising, however, to proclaim that the public are somehow incapable of evaluating aesthetic landscape value. We are all consumers of the visual landscape and as it is a public good we should all have a voice when it comes to valuing it. Price (1991) notes that "aesthetic matters have traditionally been resolved by particular experts - landscape designers and planners - who are prone to seeing the public as ill-informed, unimaginative and inarticulate." The simple way to resolve this would be to allow evaluation to be undertaken by the individual expert. It would be less time consuming and less costly but an expert view will not necessarily provide a value judgement which represents the opinions of the public at large. It might be that experts are partly dissuaded from the merits of public participation due to fears concerning a lack of consensus between respondents. Novell (1993) argues the importance of the landscape architect's role in the world of environmental assessment, particularly when the impact of future development is to be gauged. He seems to suggest that they are the profession who are best qualified to undertake such assessments. Their input in such work may well be valuable but viewing such assessments in too elitist a way must be avoided and it must be recognised that the public as a whole have a right to give their opinions on the effect of development on our landscapes.

Consensus in Evaluation.

Another aspect concerning subjective evaluations is the importance of consensus. As personal preference is bound to play a large role in such evaluation work it is important that the measure given for landscape quality is representative of the view of the larger community, particularly in planning decisions. Obviously, the greater number of respondents, the more accurate and representative the results will be (Hull and Buyhoff, 1984). Additionally, it was cited that selecting a panel of observers / evaluators, including members of the public, might prove to be satisfactory. Certainly, different individuals' perceptions of an area will affect the values they place on particular views. Don Idhe's illustration of differing perceptions discussed by Evernden (1978) graphically communicates the effect of internal influences on people's perception of aesthetics and the possible effect of differing perceptions on the allocation of aesthetic values. Idhe (in Evernden, 1978) describes how two observers (a druid and a Cartesian) give two totally different accounts on viewing the same tree. It is a simple description but it underlines the problems in achieving consensus.

The next two chapters present the results of two landscape evaluation surveys. One was conducted by the author, in the field, the other was the result of a photographic slide presentation of the same views evaluated by a group of university students. The reason for the second evaluation was to gauge the correlation between its results and those of the field survey. The outcome should show if there was consensus between the two surveys, and whether or not the initial survey was representative of the results as a whole. If this was found to be the case it might support the case for single-expert evaluations.

Conclusions.

The main drawback with the subjective approach results from the number of different evaluation scales currently in circulation. This results in limitations when there is a need to compare results from different areas or from different eras. One technique may be in vogue one year and another the next. Consequently, until one scale is widely accepted and adopted universally, results of different evaluations must be converted though there are obvious limitations with such an exercise. Similarly, problems may arise if one wishes to make comparisons of landscape quality for different areas if the surveys have been undertaken by different individuals, as some may assign higher scores than others. This could, perhaps, be remedied if all evaluators were to initially place values for an approved set of "control" landscapes by which each individual's level of scoring might then be compared.

There is something to be said for both approaches to the evaluation of landscape as a visual resource. The objective approach will be the choice of those who regard subjective evaluation methods as being unscientific. As a means of recording that which exists within a landscape such an objective method may well be superior to the qualitative method. Objective evaluation techniques meticulously note the factors and features within a particular landscape to, supposedly, provide an account of landscape quality. However, there is a danger that such methods merely classify the landscape rather than evaluate it. Qualitative methods of evaluating the aesthetic quality of landscape, though lacking in objectivity, do nonetheless give a measure of the overall visual quality of that which is viewed in a way which is not possible from measuring the sum of the parts within a view. The basic question is whether a resource such as the aesthetic beauty of a landscape, which is fundamentally judgement based, can in reality be evaluated in an objective manner.

Evaluating the Aesthetics of Forests.

We have previously discussed a selection of landscape evaluation methods, both subjective and objective, within which the aesthetic evaluation of trees and forests is an integral part (if they are present in the landscape being evaluated). However, there are a number of other studies which are concerned solely with the evaluation of the forest / woodland constituent of landscape. What follows is an introduction to some of these methods of evaluating not only the aesthetic value of woodlands but also of other non-timber benefits of the forest enterprise such as wildlife and recreation.

Evaluating Non-timber Values in Forests.

Many studies, including that by Willis and Benson in 1989, underline the importance of the non-timber benefits of our forests and the realisation that they are more than simply crops on hillsides, that they are an environment within and around which a number of activities may be sustained. As a consequence, it is important that these benefits can be measured and compared with one another in order that we may be able to calculate a forest's wider value than simply its worth as standing timber. Allocating monetary values for aspects of forest and woodland amenity, for instance, can aid in furthering the cause for more sympathetic planting in the future.

The recognition that commercial forests offer more than opportunities to produce wood is not a recent phenomenon. Neither is the use of techniques aimed as classifying the potential of a forest as a scenic and recreational resource. Hamill (1971) was concerned, a quarter of a century ago with the task of the "Classification of forest land for recreational potential and scenery" in the forests of Canada. He was aware then of the importance in analysing how various forest regions differentiated in their amenity values by their "recreational potential, scenic quality, tourist potential, recreational demand" etcetera. Only by the identification and classification of these different "amenity subregions" would it be possible to decide the potential of each area in satisfying the demand for recreation. This paper also recognised that the analysis of a forest's aesthetic quality merited discussion, and accepted that negative as well as positive elements contribute to landscape quality. This, offered Hamill, might also be undertaken on the basis of subregions by grouping areas of similar aesthetic value.

The importance of evaluating "The View From the Road" (Appleyard et al, 1963) or from other prominent viewpoints also added further to the sense that forestry was somehow becoming more of a public utility and that its non-timber benefits were becoming increasingly relevant. Perhaps this was even more so during this period with the spread in automobile ownership as more and more individuals could now travel independently to remote, rural, afforested areas. On the aesthetic side Hamill cited the work of Harrison (1962) and that of Burke et al (1968) as a possible means of forest aesthetic evaluation. The former recommended that larger views be broken down to aid evaluation into foreground and background and that the landscape could then be categorised as either, "ordinary-quality, locally common and undramatic", "medium-quality, pleasing to most viewers" or "high-quality, tends to produce a strong feeling of appreciation by most viewers." The latter technique (Burke et al, 1968) was also based on zonal evaluation which they called the "roadside zone", "outer zone" and "far zone". The method here would be to compare the scenery with what Hamill described as the "characteristic landscape: the landscape that occurs most of the time - the average condition."

Predicting Scenic Values.

Schroeder & Daniel (1981) draw attention to their belief that "it has not usually been possible to predict aesthetic effects of management actions with the precision or reliability of physical / biological effects." However, they cite the Scenic Beauty Estimation method (Daniel & Boster, 1976) as being one of the better techniques available for predicting a forest's scenic value. The method is aimed at predicting scenic beauty before the plan is implemented by means of a statistical model which takes into account the physical characteristics of the site and gives a statistical prediction for each developed landscape based on the effect of the physical changes which would result from the management actions.

The technique appears to be a useful means by which to predict scenic value before planting takes place but there are a myriad of landscape elements / features which are not considered in the equation. As the authors themselves admit, "The scenic beauty prediction models....are, of course, subject to a number of limitations. First, they are intended to apply to forest conditions typical of the western ponderosa pine zone. Secondly, special or unusual features, such as waterfalls, lakes, or dramatic geological formations, have not been considered in the models presented here. Roads, buildings, and other human developments were also excluded from the samples and the models at this stage of development." The models, therefore, are extremely restricted in that they were specifically designed for use in a particular forest / landscape type and also in that they fail to consider the effect of a number of possible landscape elements. This is certainly a major weakness in this method as an attractive lake or waterfall might make a significant positive contribution to an otherwise unattractive landscape or an eyesore of a building might have a devastating effect on an otherwise attractive scene.

It is difficult, therefore, to envisage that an evaluation method which fails to consider these elements will give an accurate and full measure of predicted aesthetic landscape quality.

Computer Design as a Predictive Tool.

This topic of predicting the amenity of tree stands is also discussed by Pukkala, Kellomaki & Mustonen (1988). Computer graphics are offered as one means by which to predict the scenic beauty of forests. The authors stress the importance of "predict(ing) the amenity of a stand in its future states rather than evaluat(ing) the present status" due to the long term nature of timber production and forest management. Slides of forest stands were evaluated using the parameters of scenic beauty and suitability for recreation: a scale of 1 - 10 (very poor to very good) was used. On the use of computer graphics the study revealed that "The correlation between slide and drawing assessments of a person varied from 0 to 0.8, which means that there are great differences in individuals' ability to interpret computer drawings." However, it seems that a high correlation existed between university students and foresters and that it was the younger, secondary school pupils which had difficulty in interpreting the computer graphics. Whilst this is a plus factor in that those working in the field gave results of high correlation, the fact all groups were not adept at analysing the graphical data might restrict public use of the technique.

The technique of simulating amenity by means of computer predictions is discussed again by Kellomaki & Pukkala (1989). The probable aesthetic effect of tree felling is also discussed here, along with the importance of the ability to predict its effect before clearing commences. Again, however, though the computer representation of forest stands might be of sufficiently high quality for use by those expert in the field of forestry it is questionable whether the graphics are of a standard high enough (at this stage) for public participation in their aesthetic evaluation. Consequently, if computer graphic simulations of higher quality could be used, then much wider use could probably be made of such a method.

The technique is further discussed by Pukkala (1988). Here, he suggests that a "Lack of models for predicting and evaluating amenity values has led to management planning systems designed for wood production only. Consequently, the management of forest resources is based exclusively on wood production, although the importance of other outputs is widely acknowledged." Again, computer simulation is offered as a means of predicting visual changes in the forest (over a 20 year period in this instance). It is also argued, and quite rightly, that cutting will not necessarily decrease amenity value and occasionally may increase aesthetic quality "For example, the removal of small trees from a dense stand and a shelter tree thinning may increase amenity."

Empirical Tests.

Arthur (1977) cites some empirical tests for predicting the scenic beauty of forests. Again, the importance of pre-planting evaluation is stressed as is the need for forest managers to be knowledgeable in the components which contribute to scenic beauty. It is noted that "Unless components of scenic beauty can be specified, managers cannot accurately predict which management procedures will enhance or degrade the beauty of a forest or to what degree." The test found to be the "most efficient and effective tool for predicting public preferences and managing forests for increased aesthetic benefits" was the "timber cruise model". This was one of three methods tested to discover those components of landscape identified in the evaluations of the respondents. The landscape features used differed between the three techniques tested (the other two being the physical feature technique and the design technique). The timber cruise model was probably the most scientific method being based on actual measurement of trees as opposed to the more descriptive nature of the other techniques. This was the main reason why this method was preferred as it was based on the criterion which would be most useful and informative to forest managers. This obviously increases the desirability for the use of the technique where the task of amenity prediction is to be carried out by this particular group of foresters.

Allocating In-forest Values.

Brown and Daniel's psychophysical approach (1986) attempted to predict timber stand scenic beauty from a slightly different perspective by concerning themselves with what they termed "near view forest scenic beauty" as opposed to the evaluation of the wider landscape which they described as "vistas". This "near view" is described as the view a viewer might see when in the forest itself, usually at a distance of 100 yards or less rather than the view of the forest from outside, which one might usually expect to be evaluated. When the amenity value of a forest is to be assessed this is an important aspect of forest aesthetic evaluation. After all, when the recreational, wildlife and other amenities are being enjoyed it will usually be within the forest landscape. Though the aesthetic evaluation of the vista view from outside the forest is extremely important, such individuals may often only encounter such views on arriving at and leaving the site, whereas their day within the forest is otherwise dominated by the near view landscape.

The study involved evaluation from slide presentations, the results of which were used to calculate Scenic Beauty Estimates (SBE's) for each site. One of the findings was that "The models in this paper suggest, for areas of relatively dense ponderosa pine exhibiting few signs of previous harvest, that less horizontally complex stands with more herbage and mature pine and less small downed wood have higher scenic beauty. These preferred conditions occur in less dense (more open) stands." However, it was also noted that it could not be stated categorically that extensive areas of such low density forests would be preferred to areas of varying density which would allow for more diversity.

This study by Brown and Daniel is certainly a useful contribution to the prediction of forest scenic beauty. It is a means by which forest users can make judgements on the aesthetic quality of existing stands which might then be utilised by forest managers when designing the in-forest landscape in the future. Much of the data produced here is relevant only to those interested in the ponderosa pine forest. However, such techniques may have an increasing role to play as the potential of the forest environment as a recreational facility is realised.

Forest Structure and Attractiveness.

Brush (1979) was concerned with the effect of forest density and structure on the attractiveness of forests. He stated that "The aspect of forest aesthetics that forest managers can most easily control is the structure of forest stands." Through the use of photographs for 20 woodland sites in Massachusetts the study aimed to discover the forest landscape preferences of private landowners of commercial forests within the state. They were evaluated also by a group of non-forestry students. Brush noted that "Very few of these owners use the services of professional foresters. Among the reasons frequently given by landowners for not seeking professional help in managing their woodlands are that scenery would be destroyed or that loggers cannot be trusted." This suggests that these landowners who derived the non-timber benefits of recreation and aesthetic amenity from their woodlands would prefer to leave the woods unmanaged than to leave them in the hands of the foresters, from an aesthetic viewpoint. The results of the study, however, suggested that their actual preference from the photographic evaluation was for more spacious stands, indeed one of the sites ranked highest was not woodland but, rather, a clearing bounded by tall trees. The lowest ranked sites were of a closed character with smaller trees, densely packed with little penetration into the stand, one example of which was now unmanaged and abandoned.

The survey results suggest, therefore, that some forest management might prove beneficial to these landowners provided their aesthetic preferences were catered for by the foresters. The study seemed also to be in agreement with that of Brown and Daniel (1986) in that whatever type of woodland was favoured (the low density stands here) an overall sense of diversity within the forest is essential. Brush suggested that "A diversity of stand structures can result from dividing a forest tract into compartments to receive particular treatments, and this diversity alone can generate aesthetic benefits that would not develop in a large homogeneous tract". He went on to suggest that some tracts might also be left unmanaged to contribute additional diversity and that other compartments within the forest be simply left unplanted. The author concluded that "To the owners of private commercial forest land and to others passing through, the end result of such a plan could yield more aesthetic benefits than might have occurred without forest management".

Lee (1990) explored "people's preferences for landscapes presented visually". The study was based on respondents at a Forestry Commission Visitor Centre. These members of the public were invited to take part in a "rating board" preference study where they were given photographs of different landscapes so that they might arrange them according to their preference for each view. Features which were noted as being of importance were, diversity of species and colour, water, proportion of open space, tracks and access (Lee, 1990).

Conclusion.

Adding trees or woodlands to a landscape or modifying existing woodlands either by thinning, clearfelling or additional planting can all have a major effect on the landscape as a whole. The above studies, surveys and methodologies exemplify the amount of work which has and is being done in this field. The growth in the popularity of forests and woodlands as recreational sites has made it imperative that such aspects of forestry as aesthetics, access, wildlife, recreation, information and amenity are responded to in the design process.

Studies such as Benson & Willis (1990) and Benson (1994) are the first step in that those preparing and maintaining the forest environment must be aware of the demands and preferences of their consumers, the forest visitors. It is clear from such texts that recreation and landscape quality (among other considerations such as access and wildlife) are an essential ingredient in their enjoyment of the forest.

Whilst all the techniques reviewed above offer useful data to the forest designer, many of the methodologies have been designed for the evaluation and prediction of scenic quality for particular forest types, the ponderosa pine forest for example. Consequently, their wider application in the prediction of aesthetic beauty for other woodland or forest types is limited. However, the fact that the views of forest managers, forest landowners and visitors are considered is an important step as they are all consumers of forest amenity to some degree.

Despite the unquestionable contribution which all these studies have made to the evaluation of forest scenic beauty, there is not one single technique which provides guidelines as to which landscape types might be able to visually support different types of planting. It seems that there may be a case for restricting different types of forests to those landscapes which are deemed most appropriate to accommodate such developments. If high quality landscapes are to be safeguarded then the evaluation of the landscapes themselves should provide us with an insight into the types of planting which might:

(i). Damage them aesthetically or

(ii). Make a positive aesthetic contribution.

By conducting a pre-planting evaluation and an evaluation of the possible forest designs and their effect on the landscape (by means of drawn or computer designs), it will be possible to predict the effect of such development. Adding a willingness to pay angle, by means of public participation, would then enable the planner to gain a prediction by means of a monetary value for planned woods.

CHAPTER 6

THE EVALUATION OF WELSH LANDSCAPES.

The purpose of this evaluation of Welsh landscapes is to give an account of the values which they receive in their present form. Once this has been achieved, it will be possible to design woodlands for the landscapes concerned and to estimate how such planting might affect the scores given originally. The final aim would be to transform these evaluation scores into monetary values, which would then give an idea of the value which might be added by any additional planting.

Evaluation should provide an aid in predicting a landscape's aesthetic ability to accommodate proposed developments such as additional woodland. A subjective value judgement of different landscapes should also pinpoint those of particularly low and high scenic quality. From such data it should then be possible to identify those areas where it might be less desirable to locate the often aesthetically negative conifer forest, and those where such plantations may not only be quite acceptable but may actually make a positive contribution to the scene.

The following provides a summary of a sample survey of Welsh landscape types in order to illustrate their varying capability in absorbing different woodland and forest types.

The Survey.

Sample Selection.

The aim of the survey was to evaluate the visual quality of a sample of the landscapes of Wales as classified by the Institute of Terrestrial Ecology. In all 57 points were selected for valuation. They were chosen from a digitised map of Wales to provide five examples each of the following land classes, 1, 5, 6, 7, 8, 9, 13, 15, 17, 18, and 23 (as classified by the Institute of Terrestrial Ecology) in order that the most prevalent Welsh landscape types, as far as possible in a sample of this size, were represented. The reason for the inclusion of the two additional sites was to ensure that examples of areas designated as Sites of Special Scientific Interest (SSSI), Environmentally Sensitive

Areas (ESA), Areas of Outstanding Natural Beauty (AONB) and National Parks were all evaluated (both additional sites were of land class 17). Whilst 21 land classes exist in Wales, the 10 most prevalent were chosen as it was thought that this would give a sufficient selection of different landscape types, as well as ensuring 5 different sites from each land class. In addition, examples of land class 23 were also included. Although it is not the eleventh most prevalent land class in Wales, it is included as it represents the most elevated landscapes of Snowdonia which many might associate with Wales, and are often important as sites of tourist attraction. The sites themselves were randomly selected within the land classes from a digitised land class map of Wales to provide a stratified random sample.

Table 6.1. Frequency of ITE Land Classes in Wales.

Land Class	Area of Wales (%)
1	4.8
2	0.02
3	0.42
4	0.27
5	6.39
6	12.53
7	3.82
8	3.87
9	3.4
10	0.7
13	3.25
14	0.13
15	11.35
16	1.49
17	41.58
18	4.35
19	0.2
20	1.14
22	0.01
23	0.19
26	0.01

(Radford, G.L., Norris, D.A., & Reynolds, B, 1994),

Method.

The evaluation method used was that of Harding / Thomas which is, in fact, an adaptation of Fines' technique. The following table illustrates the relationship between the descriptive and numerical scale. This particular method was selected in preference to Fines' numerical model as it provides a much more balanced scale of evaluation at both the lower and upper echelons.

Table 6.2. The Evaluation Scale Used.

Fines (descriptive)	Harding & Thomas (numerical)
Unsightly	0 -> 5
Undistinguished	5 -> 10
Pleasant	10 -> 15
Distinguished / Attractive	15 -> 20
Superb / Excellent	20 -> 25
Spectacular / Exceptional	25 -> 30

The survey itself was conducted during July and August of 1992. There are differences between the evaluation of the 57 randomly selected points and the remainder which were chosen as high quality sites. The former involved the evaluation of the point itself from the most prominent nearby viewpoint, for instance roadside views or views from footpaths. The latter were also utilised as interview sites for a survey on "recreation and the value of landscape" (Bergin, 1993) and therefore it was the surrounding landscapes as seen from these points which were evaluated as opposed to the points themselves. Consequently, two types of score are included for the latter, the first being the score for each of the scenes visible from the viewpoint (scores for each view) and secondly the mean score for the site as a whole calculated from the views to all directions from the point.

Whilst photographic slides were taken of all the points evaluated, as well as the surrounding area in most cases, all evaluation was performed in the field rather than post-survey from photographs. It was important, therefore, that the whole survey was conducted under similar weather and seasonal conditions to achieve measurement with as little effect by outside variable factors as possible. This is the reason for the completion of the survey in as short a time period as possible. It was the comparative quality of the landscapes which was being evaluated, and seasonal and diurnal changes would definitely create an unacceptable bias which could prejudice the results.

Survey Results.

As the landscapes evaluated were selected on the basis of their ITE land classes it would probably be wise to consider the results in the same way. It should then be possible to discover whether or not there is a relationship between land class and landscape values. The land class descriptions utilised below and in quotations are taken from Benefield and Bunce's "Preliminary Visual Presentation of Land Classes in Britain" published by the ITE in 1982 wherein the full classifications may be found.

The following key relates to the abbreviations provided for designated areas in the tables below:

Key.

SSSI - Sites of Special Scientific Interest.
ESA - Environmentally Sensitive Areas.
AONB - Areas of Outstanding Natural Beauty.
Sn - Snowdonia National Park.
BB - Brecon Beacons National Park.

Land Class 1.

"Undulating country; varied agriculture; mainly grassland."

Point No.	Easting	Northing	Designation	Score
1	352593	206681	AONB	13
2	328804	184174	-	6
3	327683	185082	-	5
4	234771	214462	-	14
5	303823	177051	-	12

Mean of Scores: 10

Whilst the mean value for this land class sample is 10 the value for the purely agricultural examples 1, 4 and 5 would command a mean of 13. These three points illustrate pleasant landscape types with Pen-Y-Coed (4) attaining the slightly higher score due to the prevalence of broadleaves in contrast to the conifer constituent in the other two points. Point 2 was, until recently, agricultural land which would probably have been guaranteed a medium score. However, the site has now been developed as an industrial estate with its buildings of garish white facade and all the other paraphernalia associated with such units. The remaining point (3) should warrant a value of around 14 due to its gently undulating landform and well balanced broadleaf to open land ratio. The detracting factor here is the not insignificant backdrop of industrial Newport which provides a far from attractive background to the view.

In conclusion, whilst textbook land class 1 landscapes would probably qualify for medium scores the reality in South Wales is that many will not. Much of the region's land betrays signs of previous or present day industrial activity which will invariably result in a negative effect on the aesthetic values for adjacent views. From a tree-planting perspective additional planting could be fitted quite successfully into the existing woodland pattern in most examples. With the less undulating landforms lending themselves to the planting of more geometrical forest forms if necessary a simple counterfoil of local species will often integrate such plantations quite effectively.

Land Class 5.

"Lowland somewhat enclosed land; varied agriculture and vegetation."

Point No.	Easting	Northing	Designation	Score
6	341019	224042	-	15
7	307580	169377	-	15
8	232955	226623	-	13
9	215594	220836	-	12
10	307348	170766	-	9

Mean of Scores: 12.8

These are all agricultural landscapes with pure broadleaf woodland in all cases except point 9. Scoring varies with the abundance of woodland and undulating land. Point 10, for example, is rather a flat, uninspiring tract of land which lacks any focal point of interest and is traversed by hedge rather than hedgerow as trees are few in number.

Overall, such landscapes should be classed as pleasant, though in many cases the extraction of the broadleaf woodland would certainly negatively affect the landscape score. Excluding point 10 it is difficult to envisage how any of these sites could benefit visually from introducing any conifer woods as their character is so dependent on the present vegetation pattern which is predominantly broadleaf. However, an extension of the present woods with similar species might be desirable.

Land class 6.

"Gently rolling enclosed country; mainly fertile pasture."

Point No.	Easting	Northing	Designation	Score
11	237460	386147	-	15
12	249034	190602	AONB	14
13	222663	213109	-	13
14	246469	188679	AONB	15
15	297929	173241	-	13

Mean of Scores: 14

Compared with points from land class 5 these landscapes possess slightly more undulating landforms which contributed positively to their overall valuation. Neither are there any signs of the industrial squalor which blighted some of the land class 1 samples. Apart from the agricultural enclosure pattern the only other evidence of human activity is either in the form of farm buildings as in Llyn Alaw (11) or small scale settlements such as Knelston (14). Another aspect that should be noted is the location of power and telephone lines and pylons. Point 12 near Reynoldston in the Gower Peninsula shows a telegraph pole to the left of the view. This has not been allowed to dramatically affect the landscape score as its overall effect on the landscape would be minimal if viewed from further afield. However, at Cil Dywyll (15) an otherwise distinguished landscape must have its value lowered somewhat due to the significant visual intrusion caused by the five electricity pylons which traverse the horizon.

These are, therefore, landscapes of medium quality, examples of which abound on the southern and western coasts of Wales. Whilst those highlighted here could not be regarded as superb quality they do illustrate the type of landscape which could accommodate well designed woodlands, though they would be affected aesthetically by inappropriate plantations.

Land Class 7.

"Coastal, with varied morphology and vegetation."

Point No.	Easting	Northing	Designation	Score
16	234237	343039	SSSI, ESA	14
17	318637	169502	-	7
18	233774	256644	-	16
19	281636	381981	-	9
20	257563	331447	Sn.	14

Mean Score: 11.6

As the ITE description suggests, this is a land class of varied landform and vegetation pattern. Additionally, as a large proportion of Welsh settlements are located towards these coastal areas human activity has led to further regional variation. It would be unwise to generalise in the way that is possible with some of the more "uniform" land classes. Even this small sample of sites illustrates this point. The points evaluated at Llithfaen (16) on the Llyn Peninsula and Llangrannog (18) to the south of Cardigan Bay are examples of undulating coastal agricultural land, exposed clifftop landscapes given to sheep grazing which score quite respectably due to their perceived naturalness. The three other points show signs of extensive human impact. With points 17 and 19 this effect has been negative, the first being in the form of a dual carriageway near Llandudno, the other post-industrial land despoiling the view of the coast at Penarth.

The last of these points (20), however, is an example of architecture adding to an area's amenity value. The high incidence of thirteenth century castles on the north Wales coast is a phenomenon which cannot be ignored in the amenity valuation of these areas. Furthermore, whilst opinions and allegiances differ widely as to the historical contribution of these constructions it is difficult to envisage how they may be opposed from a purely aesthetic perspective. It is inescapable that many of these buildings provide a focal point to many landscapes which they would otherwise be lacking, especially those of an urban nature.

Whilst the siting of woodlands is largely irrelevant for the urban examples, some amenity planting would certainly prove beneficial on visually degraded land: indeed any kind of planting would improve some such areas. Agricultural sites such as those surrounding points 16 and 18 would need to be appraised individually to assess their suitability for planting. Local landform and the existing vegetation pattern will obviously play a part in the decision process. The naturalness of woodland form should be paramount as it is the perceived unspoilt and natural appearance of such sites which contributes to their character.

Land Class 8.

"Coastal, often estuarine; mainly pasture, otherwise built-up."

Point No.	Easting	Northing	Designation	Score
21	240683	367487	SSSI	12
22	227809	377138	AONB	18
23	329446	370710	-	3
24	279268	375856	-	17
25	319136	172778	-	4

<u>Mean of Scores: 10.8</u>

As the data above illustrates, there is a significant variation in the values for this particular land class. This is explained by the agricultural / built-up divide mentioned in the ITE landscape description. The less developed landscapes such as Malltraeth on Anglesey (21) and the attractive broadleaf backed shoreline at Cymryd near Conwy (24) score well due to the apparent lack of human activity as well as the quality of the landscape. The estuarine scene at Malltraeth (21) scores moderately in comparison due to the relatively flat landform which lacks a point of interest. The two remaining points at Connah's Quay (23) and Penarth (25) attain a lowly 3 and 4 respectively due to their obvious industrial character. These are not merely undistinguished views which fail to make any impact on the observer. They are rather unsightly sites which one might actually choose not to observe from an aesthetic standpoint. Consequently, the mean value is somewhat misleading as there are two distinct landscape types under discussion here. The first (Points 21, 22 and 24) were natural or pastural with a mean value of 14.7 and the other being industrial with a mean of 3.5. As with the low scoring points of land class 7 any planting would certainly improve the appearance of the sites at Connah's Quay (23) and Penarth (25). Even planting an "idiot strip" to screen such areas from some viewpoints could improve the landscape value. The other three points might also benefit from some planting though it is difficult to envisage how it would be possible to accommodate further woodland at Cymryd (24). Some additional broadleaves could be located on the hills to the background which are already well wooded. Small scale planting might also be suitable at Treaddur Bay: even a well designed mix of conifers and broadleaves should prove visually acceptable on such lowland. Although not visible from this particular view, this area is already very well wooded being in close proximity to Newborough Forest. However, the plantation is predominantly conifer and a counterfoil of mixed species at the forest edge would create a more natural appearance than that which now exists.

Land Class 9.

"Fairly flat; open intensive agriculture, often built-up."

Point No.	Easting	Northing	Designation	Score
26	323659	362982	-	5
27	343601	343680	-	14
28	322359	299949	-	15
29	310144	357836	-	15
30	311426	306337	-	18

<u>Mean of Scores: 13.4</u>

The landscape description above might give the impression that the landscapes of this land class would be rather undistinguished, bland areas showing obvious signs of urbanisation. However, in reality the samples evaluated here, with the exception of point 26 near Mold which is rather unattractive, are of good quality particularly that of

Llanfair Caereinion which earned the highest value of the thirty points visited thus far. Such landscapes predominate in the Welsh Marches in the counties of Clwyd and Powys. Whilst they could not challenge the dramatic grandeur of Snowdonia or the Brecon Beacons they are pleasant and attractive landscapes which still bear testimony to the enclosure pattern which divides them.

Additional planting may certainly be a possibility for many such landscapes. Firstly point 26 on the outskirts of Mold. This is a flat tract of wasteland which could greatly benefit from amenity planting and would doubtfully be visually impaired if the whole lot was simply planted with a block of Sitka spruce. It is the type of derelict wasteland which developers might argue would not only benefit the local economy but also the area aesthetically from the building of retail parks. Points 27, 28 and 29 are all agricultural in character with the hedgerow pattern being dominated by broadleaves though the farming regimes vary from arable to grazing land. The higher scoring point (30) at Llanfair Caereinion does so by virtue of the more undulating nature of the landform as well as the various woods in the foreground, middle and background which add a heightened sense of perspective to the scene.

The latter point whilst already showing a well proportioned open ground to woodland ratio would certainly gain from further planting. The aesthetic benefit achieved would come as a result of the increased visual interlock which would be achievable from integrating the smaller spinneys and hedgerows into the overall woodland pattern. Small scale conifer woods could be accommodated if suitably designed. These would be better located on the lower slopes and towards the valley bottoms as opposed to the upper slopes and certainly clear of any skylines.

The remaining three agricultural points are on less undulating land which could visually adopt further woodland, coniferous or broadleaved, without being negatively affected. Some might deplore the thought of planting trees on such land due to its agricultural potential but it is becoming increasingly clear that such land may be set aside or put under trees in the move to combat agricultural over-production.

Land Class 13.

"Somewhat variable landforms; heterogeneous land including urban."

Point No.	Easting	Northing	Designation	Score
31	261266	281228	-	10
32	338455	355272	-	9
33	308221	383566	-	7
34	302434	371992	-	13
35	298285	377512	-	10

Mean of Scores: 9.8

Though the landscape description for this class suggests variable morphology this is not the case for the sample evaluated here. These are all examples of plain landforms which should, consequently, result in land use, particularly vegetation pattern, becoming the dominant landscape feature. Although point 34 is blessed by the location of mature broadleaves which benefits the landscape value the scrubby nature of the growth at Llanbadarn Fawr (31) fails to do the same for that site.

The other three sites are flat tracts of land almost bereft of any trees whatsoever. These latter points could not be classed as unsightly but rather undistinguished, an aesthetic vacuum which rather fails to make any impression on the viewer, positive or negative. They may epitomise the future face of British farming. They are featureless plains where vernacular boundaries are replaced by fencing, cereals replace the local vegetation pattern and woodlands are conspicuous only by their absence.

From a forest design perspective points 32, 33 and 35 could visually accommodate most plantation types with ease. Conifers should not appear inappropriate, whilst careful species mix, for example with larch, and the ultimate goal of an uneven aged woodland would probably increase the landscape value. Such an increase would certainly result from the introduction of a well designed broadleaf wood where clumps and single trees can add a sense of perspective to such areas, in a way which commercial conifer forests do not.

Land Class 15.

"Valley bottoms with mixed agriculture, predominantly pastoral."

Point No.	Easting	Northing	Designation	Score
36	307580	380343	AONB	14
37	241965	240120	-	15
38	324200	312804	-	13
39	242606	242061	-	14
40	333309	347544	-	14

Mean of Scores: 14

The points within this group scored quite consistently giving, a more representative mean than some of the other land classes where one particularly high or low landscape value can have a substantial effect on the mean value for the land class sample.

These are rural points in nature (except Llandysul (37) which still secures a respectable value) where abundance of woodland and undulating landforms also have some bearing on aesthetic quality. Points 36 and 38 scored for the inclusion of broadleaf woodland as well as the more undulating landforms to the background. However, a small improvement in visual unity could be achieved at both sites simply by additional planting to strengthen the hedgerow / woodland pattern which currently appears somewhat disjointed. In-planting between the existing trees would give an increased sense of visual cohesion which is lacking when they are viewed singularly as they are now. Trees standing alone will appear acceptable when well related to adjacent clumps and small woods though regrettably this is not the case here.

Point 40 near Erddig on the outskirts of Wrexham illustrates a type of landscape created at the vanguard of landscape design when the estate owners of the eighteenth and nineteenth centuries employed individuals for the work of amenity planting and garden design. This site is adjacent to Erddig Park and is more agricultural in nature than the park itself. The conditions on the day of evaluation obviously play a part in the evaluation itself and the contrast of the darkly green broadleaves and the brash yellow of the barley stubble add to the site's appeal. There is also a harmonious relationship between open land and woodland. Even trees located singly do not create disunity as their overall mass as mature specimens and proximity to tree clumps and wider woodland ensure they are integrated to the larger woodland framework. Any additional planting should certainly be done bearing the existing pattern in mind, though it is arguable whether any further cover would actually increase visual quality.

The last two points in this class, 37 and 39 at Llandysul and Faerdre Fawr respectively, illustrate a similar characteristic, that is the division of land between wooded and open land. From the slides illustrated the split appears to be a 50/50 ratio between the two types of vegetation cover, trees and grassland, and far from the desirable 1:2 ratio seen in forest design texts. The relationship here is a successful one due to the divide between open and wooded land being strongly related to landform. The woodland at Faerdre Fawr (39) is located on the background slope whilst the foreground slope is left open for grazing. Any clearance would disrupt the equilibrium which currently exists. The woodland at Llandysul is also a significant factor. Here, it terminates at the boundary between flat and rising ground, which provides a more natural dividing line than would be the case if it were located further up the slope. From an aesthetic standpoint additional planting should prove to be superfluous whilst any woodland clearance might well be damaging.

Land Class 17.

"Rounded intermediate slopes, mainly improvable permanent pasture."

Point No.	Easting	Northing	Designation	Score
41	274763	324396	Sn	14
42	281209	220195	BB	23
43	290842	215690	BB	17
44	261266	287075	SSSI, ESA	14
45	306280	330824	SSSI	14
46	281850	296726	ESA	15
47	283773	238197	-	13

Mean of Scores: 15.7

The points highlighted above show a movement to the uplands in comparison with those land classes discussed previously. Seven points were sampled here in order to include examples of various types of designated areas within Wales. However, it is worth noting that six of the seven points evaluated above were protected in some way. This is also the case with most of the following points, which may also be classed as upland in nature.

It can be seen from the values above that these landscapes and others of similar quality do indeed merit safeguards to ensure their quality for the future, though the SSSI's are not protected for their aesthetic quality.

Point 41 at Coed Y Brenin is pleasant enough without being particularly distinguished or attractive. It is an area of open land backed by forest which can be found where the Ganllwyd forest road exits the canopied area near Friog farm. It is a pleasant enough counterbalance to the extensive afforested area which surrounds it and the conifers located in the middle ground add some sense of perspective whilst fortunately having been planted at an elevation which ensures they do not serrate the skyline. However, they seem divorced from the open foreground as well as the sliver of conifers in the background. Planting lower down the background slope might create increased unity with these middle ground trees.

The almost treeless landscapes of Cwm Rhiwiau (45) and Borth (66) should accommodate woodland with careful design. Cwm Rhiwiau currently has a distinctive vegetation pattern which is partly as a result of the drainage pattern. Consequently, anyone aspiring to afforest the area could do much worse than to loosely adhere to these patterns when faced with the task of forest design. Planting conifers down the spurs and upwards to the gullies either side of the main river, Afon Disgynfa, whilst positioning some broadleaves closer to the watercourse should prove visually satisfying. However, there are obvious conservation implications from such a scheme which is often the case when such "wilderness" is earmarked for "development". Whilst it might be that visual integration is feasible it may be that such a project is not necessarily desirable for conservation reasons particularly due to the risk of ecological degradation.

Points 44 and 47 at Borth and Cynghordy are of moderately scoring landscapes which could both, probably, support additional woods. The view at Borth illustrates the already geometric nature of the existing landscape pattern, and strengthening the existing hedgerows as well as some field corner planting may be desirable. It is tempting to suggest that such a field pattern, particularly due to the variable coloration present, would be ideal for small block planting of trees. In reality this would be wholly inappropriate particularly in winter months when all other fields would be clothed in similar vegetation and the planted area would stand like a tombstone on the hillside, especially when viewed from a less elevated location.

As for the point near Cynghordy there is quite a useful balance between open and wooded land, the only negative factor being the straight conifer edge at the opening in the centre of the composition. Extending the conifer plantation to the broadleaved hedgerow would erase this obtrusion. Additionally, further broadleaf planting to the foreground and middle ground would ensure a more gradual development of tree density from foreground to background whilst retaining those areas of open land.

The agricultural landscape at Aberhosan (46) pleases as the flatter land gradually draws the eye towards the hillsides at the horizon. The broadleaves in the left foreground also add interest seemingly mirroring the forms of the far hills though on a smaller scale. Further planting would probably impair the existing view of the hills and should therefore be avoided.

The two remaining points are both of the Brecon Beacons National Park one being of the arete at Bannau Sir Gaer in the Black Mountain, the other being near Ystradfellte. The former, point 42, is an excellent view of this very attractive mountainous area. The view extends from a foreground crop field to a middle ground dominated by green fields and broadleaved hedgerows backed up by hills rising to the peaks of the Beacons. It is arguable whether any amenity planting would benefit the area further as it is of such high quality.

The framed view near Ystradfellte is also of the Brecon Beacons and the viewer's attention is drawn to the elevated area by the location of the broadleaves which abound in the area. There are both positive and negative attributes to the woodlands. On the positive side they act as a screen which conceals the (rather small) caravan park in the foreground as well as drawing the eye towards the focal point of the hills to the background. On the negative side they create something of a barrier between foreground and background. Felling a few of the trees to the left of the clearing would create a much improved sense of visual unity as the open ground would curve sinuously through the composition attracting the viewer's attention to the far hills as well as creating a more harmonious ratio between open and wooded land.

Land Class 18.

"Rounded hills, some steeper slopes; varied moorlands."

Point No.	Easting	Northing	Designation	Score
48	320436	361700	AONB	3
49	286996	313463	Sn.	14
50	270917	283870	ESA	14
51	301134	357195	-	9
52	313616	227763	BB	17

Mean of Scores: 11.4

One might have expected the values for this land class to mirror those of the previous one (17) as they are of similar elevation and character. Indeed, due to the slightly steeper topography and more rugged landform, this land class should probably attain higher landscape values than its predecessor. Despite what the above scores suggest this may well be the case if the overall class was evaluated. However, this was merely a random sample of land class 18 landscapes which raises some worrying points concerning the human contribution to landscape quality.

The hedgerow at Mallwyd (49) and the small, traditional architecture at Llangors (52) are obviously man made, but their effect on the landscape as a whole is minimal in these circumstances. The other three examples in this class, unfortunately, have not been dealt with so benignly by humans. Land use in these areas has undoubtedly contributed to the degradation of these landscapes. Indeed, at Coed Y Fedw Quarry to the east of Ruthin it has led to an extensive modification in land form to the detriment of the area's scenic quality.

The areas evaluated at the forests of Rheidiol (50) and Clocaenog (51) testify to the inadequacy of forest design in the past. At Clocaenog, for example, we view a straight edge of Sitka spruce surrounding a small reservoir patronised by local fishermen. Such areas within forests should be viewed as opportunities to create attractive, intimate landscapes. They should provide points of interest on forest walks and drives within what is often bland and repetitive scenery. It is obvious to any visitor that Clocaenog is an almost purely conifer forest and as a result it would be foolhardy to attempt to plant broadleaved "idiot strips" to create a more natural atmosphere at such clearings. Improving this particular site could be accomplished quite simply by felling selected trees and planting a broadleaf counterfoil. This would create a more uneven forest edge compared to the monotonous straight edge which currently exists. An additional shrub or even herb layer might also prove visually satisfying by adding to the sense of gradation from grass to conifer layers.

The Rheidiol Forest view works rather better in the foreground where a shrub layer and a less even aged edge, adds some much needed variation. Some counterfoil planting might create further improvement. The negative point here concerns the plantations in the background. Firstly the planted hill at the centre shows a felling coupe where a rather intrusive sliver of trees has been retained at the horizon as well as a rather geometrical form to the coupe itself. Further felling may be necessary in order to create a more organic form. The other detraction is the design of the plantation of the far right forest. The straight forest edge straddles the hill almost at its apex creating a far too symmetrical form. A more pleasing design would be achieved by planting the whole of the hill at the next rotation or part clearance of the existing plantation in order to introduce more irregular, organic (Bell, 1993) forms between the new and existing trees.

The third of these landscapes where land use has had a dramatic effect is at Coed Y Fedw Quarry near Ruthin (48). The natural landform is now unrecognisable following the modification caused by extraction from the site. Such by-products of mining are prevalent throughout Wales be they relics of the copper, slate or coal mining industries or present day sites where opencast coal extraction occurs. Whilst this particular example does indeed degrade the site itself, the location as well as the abundance of local woodland act as quite a successful screen to conceal this view from adjacent viewpoints.

The remaining points are pleasant, pastoral landscapes of the kind which normally score in the low to mid teens. That at Llangors (52) is complemented by the Brecon

Beacons to the background which add to the overall landscape value. The attractive cluster of buildings in the left foreground also creates a point of interest by breaking the uniformity of the hedgerow. Mallwyd (49) is slightly affected by the uneasy proximity of the single conifers to the skyline. Their dark, skeletal forms, particularly against the backdrop of a light sky, are uncomplementary to the rounded forms of the local topography. The less severe shapes of the broadleaves such as beech should create more unity as well as providing seasonal variation and a blaze of autumn colour.

Land Class 23.

"High mountain summits with well drained moorlands."

Point No.	Easting	Northing	Designation	Score
53	268976	364905	SSSI, Sn.	21
54	306013	331732	SSSI	12
55	269154	366525	SSSI	20
56	261124	355824	SSSI, Sn.	23
57	283417	337679	Sn.	20

<u>Mean Of Scores: 19.2</u>

It is obvious from the data above that as a land class this is the most impressive of those to be surveyed in Wales. This is not surprising: the ITE's landscape description quoted above notes the occurrence of mountain summits which most would probably regard as being the most attractive of the Welsh landscape types. These are the last of the randomly selected sites and on the strength of the evidence here it seems that they are among the highest quality landscapes in the principality. Point 54, despite being in this land class, scores quite moderately in comparison with the others. This underlines the fact that caution needs to be exercised when comparing land classes and landscape values.

Point 54 is an elevated landscape and is as unspoilt by man as any of the five evaluated here. Indeed, it certainly shows fewer signs of human impact than any of the other four points, without even the stone walls which normally dissect such areas of the Welsh uplands. It may be surprising, therefore, that this view fails to command a higher score. The problem here is that whilst it is a landscape free from human interference it is also lacking in any points of interest. It is a treeless moorland displaying more rounded morphology than one might associate with the usual "high mountain summits" such as those rugged landforms of Snowdonia and, to a lesser extent, the Brecon Beacons. In fact, the adjacent though less elevated point (45) of Cwm Rhiwiau actually achieves a higher score due to the location of a river, albeit small, which creates some point of focus. Added interest may be achievable by planting a scatter of hardy trees such as birch both to create an additional layer to the existing vegetation and to create seasonal variation.

The four remaining landscapes are all located within the boundary of the Snowdonia National Park. They vary in quality though none could be described as being less than attractive, gaining values ranging from 18 to 23. The lower scoring view of Arenig (57) is still a most attractive landscape. The landform obviously dominates here creating an opportunity for some small scale planting. It is an area which has seen widespread afforestation which is still on the increase. Planting a sweep of woodland (conifer if need be) at the depression to the centre of the view as well as additional planting of local broadleaves should prove visually acceptable without being detrimental to the landscape value. A swathe of broadleaves, similarly located though at slightly lower density, might actually increase the score, especially when in autumnal leaf.

Point 53 at Carnedd Llewelyn is an example of a treeless landscape which does actually appear attractive due to the very strong landforms present. The bare rock faces to the background add a rugged quality to the landscape an element omitted from the landscape of Moel Sych (54) for example. Even the slate wall in the foreground is a positive element which contributes a further sense of perspective to the composition.

Craig y Dulyn (55) is another attractive landscape evocative of the forms present in the Brecon Beacons. It is less rugged than the summits of Glyder and Snowdon for example though it has much stronger forms than the upland moorlands. There would certainly be opportunities for planting in the middle ground, though it should be kept well clear of the middle ground horizon lest it disrupted the view of the far mountains.

The last point is a view which shares the accolade of equal highest value with Bannau Sir Gaer (42) in the Brecon Beacons. It is a landscape at the heart of Nant Peris in Snowdonia which illustrates the rugged grandeur of this area. The landform obviously dominates as rock outcrops and serrated summits pierce the skyline. Perhaps unusually, human contribution here is actually a positive one as the walls and traditional buildings, of local material, accentuate the sheer scale of the landform. A further sense of perspective and scale is achieved by the scatter of rocks in the fore and middle ground as well as the stream to the foreground.

The Bergin Interview Points.

Further to these 57 points an additional eight points representing five sites were chosen specifically due to their higher landscape quality and their value in attracting tourism. Some of these, such as Snowdon's Miners Track and Nant Gwynant in particular, could be regarded as being the principality's most prestigious landscapes. These points must be studied separately due to the obvious bias in their selection. They are included here as they exemplify the kind of high quality landscapes which merit special consideration when development is being planned.

These sites were at Nant Gwynant and the Miners Track, both in Snowdonia; Clywedog Reservoir in Dyfed; The Storey Arms in the Brecon Beacons; and Llyn Alaw on Anglesey.

These views have been allocated numbers from 58 onwards and are grouped by site, for instance 58 - 62 are all views of Nant Gwynant though two viewpoints were used (thus A and B) and the six figure co-ordinates here refer to the viewpoints not the points viewed.

Nant Gwynant.

Site	Co-ordinates	Point No.	Score
Nant Gwynant B	645516	58	22
Nant Gwynant B	645516	59	21
Nant Gwynant B	645516	60	21
Nant Gwynant A	628506	61	21
Nant Gwynant A	628506	62	19

Mean of Scores: 20.8

This is obviously an area of high landscape quality on the A498 road frequented by tourists travelling between such centres as Betws-Y-Coed, Beddgelert and Llanberis. Point B at the lakeside scored marginally higher than the other precisely due to "the water factor". However, the views from both points were of high quality displaying dominant landforms and extensive mature woodland following patterns in the morphology. At point B the lake, Llyn Gwynant, not only contributes an additional feature of interest but also, due to the plane quality of the water's surface, it provides contrast with the landforms which surround it.

Llyn Alaw.

Site	Co-ordinates	Point No.	Score
Llyn Alaw	375855	63	5
Llyn Alaw	375855	64	13
Llyn Alaw	375855	65	14

Mean of Scores: 10.7

This area was evaluated from points on and near the reservoir dam. It is a moderately scoring landscape overall although there is a substantial variability between the views in different directions. This is mainly due to the low scoring of point 63, a pumping station adjacent to the dam at the south west side of the reservoir, where no apparent effort has been made to blend the buildings into their surroundings by means of tree-planting or ground-shaping, for instance.

The surrounding landforms could, as a whole, be regarded as rather flat and undistinguished. The only redeeming factor for point 64 is the location of a small broadleaved woodland which adds some elevation to what would otherwise have been an even less significant sliver of land. Water, as was noted at the Nant Gwynant site, is often beneficial aesthetically as is the case here to some degree, but the sheer aesthetic dominance of the water area creates imbalance due to the landforms being of insufficient scale to provide a counterbalance.

Point 64 is a view from a nearby picnic site as opposed to the view from the dam itself. The proximity of the tree to the left of the picture and the vegetation to the foreground add something of a frame to the view whilst apparently decreasing the contribution of the water area to the scene to create a much better balanced composition.

Llyn Clywedog.

Site	Co-ordinates	Point No.	Score
Llyn Clywedog A	910870	65	17
Llyn Clywedog A	910870	66	6
Llyn Clywedog A	910870	67	18
Llyn Clywedog B	885893	68	13
Llyn Clywedog B	885893	69	14
Llyn Clywedog B	885893	70	14

Mean of Scores: 13.7

Most of the values here are at the middle of the scale, a pattern mirrored in the mean by the two higher scoring points 65 and 67 being counterbalanced by the low valued point 66.

The reason why the allotted values are somewhat moderate is the apparently artificial nature of the landscape, bar point 67. At first glance the most apparent sign of human impact is the dam at the south eastern side of the reservoir. It is architecture of such inappropriate design for its surroundings that only the most ardent espousers of functionalism would dare attempt to argue in favour of such a design. That is not to say that dam designs are always this inappropriate. There are many reservoirs where a well designed wall proves perfectly suitable for its landscape.

A deeper look at this landscape divulges more to the viewer of the extent of human influence in shaping this area. The dam itself obviously betrays the fact that this is a reservoir as opposed to a natural lake, as does the regularity of the shoreline. The conifer forest is obviously introduced whilst the apparent even age of the plantation and the harsh single storey conifer edge, for instance at point 68, also negatively affect the overall quality of these views. Some modification could increase the sense of naturalness, which the area currently lacks. Receding the forest edge at the aforementioned point 68 whilst replanting with a mixture of broadleaves and conifers at less intense density whilst aiming for a more irregular boundary would appear less severe than the current edge. Planting a shrub and even a herb layer would create an even more gradual elevation to the forest canopy and might be worth considering here. In the longer term selective felling and replanting with an additional species such as larch would add some variation, especially during the autumn, by breaking the monotony of the present plantation colour. The conifers sited at the opposite end of the dam from viewpoint A should be extended further down the slope as they appear to balance uneasily across the spur in their present form. Additional planting of single trees at the upper planting line and at a wider spacing would relate the woodland more effectively to the landform than a sharp boundary of dense forest with open land. The highest scoring view here is that of 67 from Clywedog dam to the east and the valley of Afon Clywedog. It is a landscape of hedged fields and mixed woodlands which relate well to their surrounding landforms where forests abound on the upper slopes and agriculture dominates the valley bottoms. It appears to be a far less "contrived" landscape than that at Clywedog itself and consequently it scores significantly better.

Storey Arms, Brecon Beacons.

Site	Co-ordinates	Point No.	Score
Storey Arms	298220	72	16
Storey Arms	298220	73	17
Storey Arms	298220	74	16
Storey Arms	298220	75	13
Storey Arms	298220	76	17
Storey Arms car.pk.	298219	77	12
Storey Arms car.pk.	298219	78	15
Storey Arms car.pk.	298219	79	16
Storey Arms car.pk.	298219	80	11
Storey Arms car.pk.	298219	81	19
Storey Arms car.pk.	298219	82	19

<u>Mean of Scores: 15.6</u>

Despite the variation in the range of values the overall mean value for this area of the Brecon Beacons was a respectable 15.6. This is a lower value than many other sections of the Park might command, as the close proximity of the busy A470 road does nothing to increase any of the values and is a negative factor in more than one of these views, especially points 77 and 80.

Woodlands could contribute positively to such an area. Excluding views 81 and 82, the only tree cover is in the form of closely spaced conifer plantations. The landscape is a combination of open space and dense forest. There are no broadleaf spinneys or even single trees scattered on the hillsides which might aid in integrating the plantations to the surrounding open land. The outcome is far too severe a relationship between field and forest, though it could easily be remedied by further mixed planting creating an irregular and, more importantly, a less dense forest edge. Planting groups and individual trees further up-slope would provide increased unity between afforested land and the surrounding hills.

The two higher scoring views of 81 and 82 are both of the dramatic Glyn Tarell valley. Afon Tarell meanders down the centre of the composition drawing the eye down towards the plantation known as Coed-Ty-Mawr located to the western side of the valley. Whilst it is a conifer forest similar to those near the Storey Arms itself there are sufficient broadleaf trees here to integrate the plantation into the surrounding landscape quite harmoniously. Were the mid-valley broadleaves taken from the view the harshness of the boundary between open land and forest would prove visually disruptive as their inclusion allows a more natural gradation from field to forest.

Miners Track / Llyn Llydaw.

Site	Co-ordinates	Point No.	Score
Llyn Llydaw	634545	83	24
Llyn Llydaw	634545	84	23
Llyn Llydaw	634545	85	24
Llyn Llydaw	634545	86	22
(evening / dusk)	634545	87	25
(evening / dusk)	634545	88	23
(evening / dusk)	634545	89	23
(during snowfall)	634545	83b	22
(during snowfall)	634545	86b	23
(after snowfall)	634545	83c	25
(after snowfall)	634545	84c	24
(after snowfall)	634545	86c	23

Mean of Scores (83-86 only): 23.3

Of all the points evaluated this site earned the highest landscape value for a single view (24 for point 83) as well as the highest mean value of the interview sites evaluated with a score of 23.3. The initial evaluation was conducted under similar conditions to all the previous sites, those being daytime visits during the summer months of 1992. Comparisons with the other points can be made with views numbered 83-86.

Following the initial evaluation it was decided that the views from Llyn Llydaw would be re-evaluated, particularly picture number 83 of Snowdon summit, in an attempt to gauge the effect that diurnal and seasonal variation may have on our perception of landscape quality. Though these additional views can not be fairly compared with the other sites evaluated, as the influence of the variable external influences would prove prejudicial to such an exercise, it is useful to contrast them with the initial evaluation of these Llyn Llydaw/Miners Track landscapes.

The landscape surrounding Llyn Llydaw is of superb quality. The landforms are rugged and dramatic, dominating this treeless landscape. There is a strong sense of genius loci here, largely due to the sheer scale of the morphology, the sense of enclosure afforded by the surrounding aretes and the unmistakable form of the summit rising impressively above the lake. The area was not evaluated during the months of autumn, the lack of woodland limiting seasonal variation, though it raises the question of tree-planting in such an area. Possibly the only additional tree planting which might actually increase the aesthetic value of such an area would be to plant a swathe of broadleaves down the valley side. It might not affect the view significantly during most of the calendar, whilst adding to the landscape quality during the Fall.

Two evaluations were conducted during the winter months, one during snowfall in February, the other following a lighter fall in November. The first evaluation concluded that the genius loci was strengthened by the snow factor in both views, increasing the value for picture 86b by one point. However, the snowfall impaired the view of the previously highest scoring point 83 proving a negative effect in its value as 87 (the same view with snow falling). The second evaluation scored rather higher, adding a point to all the initial values. All skyline features were visible and the sense of place also benefited.

Probably the most dramatic images are those captured at dusk during late summer. Whilst points 88 and 89 score equally to their previous evaluation, due to sunlight percolating along indentations in the skyline to allow relatively normal viewing, the view of Snowdon itself (87) is quite outstanding. All that is visible is the silhouetted skyline and a fleeting reflection of sunlight on the lake itself. The success of the view is in its simplicity. It is a landscape stripped down to its most basic element, a backlit landform. Ironically, of all the points viewed it is the one picture which reveals the least about the landscape itself, yielding nothing of land use or vegetation patterns though, significantly, it is the omission of these diversions which allow us to view the point without distraction.

Land Class as a Predictor of Landscape Quality.

It was thought, before the survey was conducted, that land class might be used as a means of predicting the aesthetic value of landscape. The lower numbered land classes tend to be of flatter, less undulating landforms of the kind that might be described as "undistinguished" in Fines' scale. The highest numbered land classes, 20 and 23 in particular, are used to classify mountainous areas and might be expected to score higher values.

An analysis of variance was conducted between the landscape values for each land class and the land class itself. The results were an F value = 6.13 and P = 0.000. This suggests that there was some significance in the relationship between land class and landscape values. However, it appears that this is mainly due to those higher numbered land classes 20 and 23 scoring higher values. As this seems mainly due to landform relief, the evidence does not suggest that land class numbers are an accurate predictor of landscape quality. After all, if development was to take place in a landscape such as that of land class 23 at Llyn Llydaw, the aesthetic value might be lowered dramatically, but the land class would remain the same.

Fig. 6.3. A one way analysis of variance of the original survey results against land class.

One-Way Analysis of Variance

```
Analysis of Variance on Own
Source       DF        SS          MS          F        p
L.class      11    1061.4        96.5       6.13    0.000
Error        77    1211.9        15.7
Total        88    2273.2
                                       Individual 95% CIs For Mean
                                       Based on Pooled StDev
 Level       N      Mean       StDev   ---------+---------+---------+------
     1       5    10.000       4.183    (-----*-----)
     5       8    12.000       3.423        (----*----)
     6       5    14.000       1.000          (-----*-----)
     7       5    12.000       3.808       (-----*-----)
     8       5    10.800       7.050     (-----*-----)
     9       5    13.400       4.930         (-----*-----)
    13       5     9.800       2.168   (-----*-----)
    15       5    14.000       0.707          (-----*-----)
    17       7    15.714       3.450              (----*----)
    18      25    14.960       4.467               (--*--)
    20       2    20.000       1.414                 (---------*---------)
    23      12    21.667       3.420                         (---*---)
                                       ---------+---------+---------+------
Pooled StDev =    3.967                       12.0      18.0      24.0
```

The table above gives the analysis of variance calculations for the original survey results against land class. There is no evidence of a clear positive relationship between a rise in land class corresponding with a rise in landscape values. However, it appears that (with a 95% confidence interval) the higher numbered land classes 20 and 23 did score consistently higher than the other land classes. Whilst the results support the view that the higher land class views are of higher aesthetic quality, and the lowest land class numbers 1 and 5 are among the lowest scorers, there is no pattern where the other eight land classes are concerned. These results tend to suggest that land class is not an useful predictor of landscape aesthetic quality. Further statistical analysis on this subject, as well as a more in depth discussion are provided later in the text in chapter 10.

CHAPTER 7

GROUP LANDSCAPE EVALUATION FROM PHOTOGRAPHS.

Following my own landscape evaluation survey of Welsh landscape types it was decided that re-evaluation of these landscapes by other individuals might be useful both as a means of comparison with my own initial values and to attempt to gauge the correlation between values allotted to different landscape types. Another aim of this exercise was to discover where there was greatest agreement regarding the aesthetic values for these scenes. It should also prove useful in adding to the debate concerning who should be invited to contribute to landscape evaluation generally, for instance when public enquiries are held. Dearden (1981) welcomed the possibility of greater public participation in such forums (see chapter 5). If the results of the initial survey and those of different individuals in the slide survey were found to be similar, this might strengthen the case for a single expert survey. Consensus would prove that the initial survey was representative of the group as a whole.

The group chosen for this evaluation exercise were ten students at the University of Wales, Bangor, studying for the degree of Rural Resource Management. All had some prior knowledge of the subjects of forest landscape design and landscape evaluation work.

Some Pre-survey Thoughts.

Before embarking on this study it was thought probable that landscapes of extremely low aesthetic quality or those of particularly high value would be recognised as such by the evaluators. Conversely, it might be predicted that landscapes of more moderate quality; ranging between "undistinguished", "pleasant" and "distinguished / attractive" on the descriptive scale, would be those most affected by personal preference and, consequently, there might be a greater discrepancy between the values allocated for such views.

A possible answer might be to widen this "pleasant" scoring band though this has its drawbacks. The problem with allowing for greater scope within this "pleasant" band is the possibility that even greater differentials between individual scores might occur. For example, if the category "pleasant" was allotted 10 points on the scale, say from 8 to 17 inclusive, the danger is that two individuals which both score the view "pleasant" on the descriptive scale may still give a numerical value which differs considerably depending on where they locate the view within this scoring band. Dividing this band might be one answer. It might be that even a numerical only scale would be preferred to such an adjustment which would mean using the present scale without the descriptive titles. These descriptions are only meant as a guide but any first time user of the technique would undoubtedly vouch for the usefulness of these titles, when becoming acquainted with this method.

Method

The evaluation exercise was conducted through the use of a slide presentation. 89 slides were evaluated in all, these being one view each of the 57 initial points and a further 32 views from the sites at Llyn Llydaw, Nant Gwynant, Llyn Clywedog, Llyn Alaw and Storey Arms. The aim with these latter sites was to calculate an overall mean value for the individual sites. It should then be possible to compare scores between the initial evaluation and the group means for each site.

The evaluating group were familiar with the Harding & Thomas technique.

When the slides were shown the location of the sites was not revealed. The main reason for this was to avoid any bias which might result from naming the locations of these landscapes. For instance, if a view was named as being in a National Park or an Area of Outstanding Natural Beauty the temptation might be to allocate a higher score for the landscape's aesthetic quality simply by virtue of its designation as one of the above. Similarly, the reverse might be true for landscapes located in the more industrial parts of South Wales where views might be scored down because the area is not known for its aesthetic attractiveness. Hopefully, the views will then be evaluated on their visual quality alone. A gap of approximately 30 seconds was allowed between the slides for the evaluation of each individual picture. The scores were written down silently and were not shared, in order to lessen the chance of bias if individuals were aware of values allocated by others within the group.

Additionally, as the sites are grouped in land class order for the purpose of the thesis itself it was decided to show these slides in a random order in an attempt to avoid showing groups of similar landscape types. Certainly, were landscapes shown in land class order there might be an assumption that the higher relief land classes which would be evaluated last would merit the higher scores. Though the higher numbered land classes do tend to score higher than the lower numbered ones, there is nothing to prevent some landscapes of land class 23, for example, being unattractive. Similarly, if an individual prefers to view less undulating terrain then he or she should be allowed to score the views accordingly. However, the point numbers given here are the same as those used throughout this study rather than the questionnaire numbers themselves.

Results.

Of the 89 points evaluated there were only 6 where the group mean differed from my own initial values by 4 points or more on the Harding & Thomas scale. These are noted below:

(The "difference" is calculated using my own initial survey as the base number).

Fig. 7.1. Points Where Group Mean Scores Differed With the Original Survey By 4 Points or More.

Point No.	Site	Initial Score	Group Mean	Difference
20	Harlech	14	18	+4.0
42	Brecon Beacons	23	18.6	-4.4
3	Pen-Sidan	5	11	+6.0
17	Penarth	7	13.3	+6.3
63	Llyn Alaw	5	14.2	+9.2
67	Clywedog	6	14.9	+8.9

It might be tempting to simply assume that personal preference is responsible for the discrepancy between these two sets of values. However, on closer inspection there is a common link between five of these six sites in that each shows a significant element of the human, built environment within the view. If we were to omit those smaller features of the built environment such as single cottages or distant powerlines and pylons, for example, and to include only those scenes where roads, buildings, settlements and other man-made structures make an obvious contribution to the view only 11 of these 89 landscapes would meet this criterion. However, when looking at the views above which differ by 4 or more points on the evaluation scale it is clear that all five where the difference is positive, fall into this group.

The most obvious example is that of Harlech Castle in the Snowdonia National Park. Although the castle itself is an attractive structure there is quite a significant amount of modern, urban development to be seen in this particular view, for instance the tarmac covered road, modern streetlighting and buildings which although by no means unsightly could not be classed as attractive either.

Point 67 is a view of the concrete dam at Clywedog Reservoir in Dyfed. Interestingly this point showed the second greatest differential between the survey score and the group mean of +8.9 where the survey value was 6 and the group scores varied between 12 and 18. This view and the scores allocated for it were largely responsible for the overall differences in the values given for the site as a whole. It seems that personal preference may play a greater role in the aesthetic valuation of such man made features than might be the case for more "natural" landscapes. Personally, I regarded the view of the dam itself as being rather unattractive though without quite being worthy of the "unsightly" tag. However, from the results of this evaluation survey others did not share my view and, after all, someone must have actually designed it in the first place though whether aesthetics played a major part in the process must be highly debatable. One factor that might have influenced the scoring could be other elements in the view. Other respondents may have focused on these rather than the dam.

A similar difference occurs between the group mean and the original value for view 63, which is a scene at Llyn Alaw on Anglesey where the differential is +9.2. The reason here again is largely due to the presence of a built feature: the reservoir's pumping station to the right of the picture.

Points 3 and 17 at Pen Sidan and Penarth respectively show how the background to a view can affect our perception and our enjoyment of the landscape as a whole. They illustrate the industrial backdrops of Newport and Penarth which is the reason why my own values for these landscapes were lower than the group means for both these points. However, half the group did actually score the former point (3) at 10 or under as indeed they did point 17, though two other respondents actually scored this latter point at 22 and 25 which largely explains the higher group mean for this view. The differences between the values allocated here may be explained by different individuals placing greater or lesser importance on the effect of the background on the overall quality of the view. In my own evaluation I believed that these industrial backdrops detracted significantly from my enjoyment of these landscapes and it seems that some of the respondents were of the same view. The landscape of Penarth (17) would probably have merited a value of around 13 were it not for the effect of the backdrop as it would otherwise have been a rather pleasant coastal scene. The other view of Pen Sidan (3) would have earned a score in the region of 15 or 16 were it not for the view of industrial Newport in the distance and would, without doubt, have been the highest value for any of the Land Class 1 landscapes evaluated. However, aesthetic detractors are as important a part of evaluation as are those elements which we perceive as making a positive contribution to our aesthetic enjoyment of a scene. Only by comparing how scenic quality values differ between landscapes with and without such developments can we ultimately decide whether such visual degradation is a necessary by-product of progress which we must accept. Similarly, we may also be able, via such methods, to gauge how much aesthetic degradation the public are actually willing to accept in the case of certain planning issues.

The final landscape noted in the table above is that of point 42 which is, in fact, a view of Bannau Sir Gaer in the Brecon Beacons National Park. This point differs from the other four points highlighted here in that it is the only one where the differential between my own initial evaluation score and the group mean is a negative one this being a difference of -4.4. Of the 57 "land class" points as opposed to the later "prestige" interview points (numbered 57 ->) this scored equal highest in the initial survey along with point 56 which is a view of Nant Peris in the Snowdonia National Park. Personally, I thought that this point (42) in the Brecon Beacons was one which merited a value of around 23 being worthy of inclusion in the category "superb /

excellent" in Fines' descriptive scale. It is difficult to explain the discrepancy between the two scores for this particular point. It is an elevated landscape of high relief of a height of about 650 metres. Neither are there any elements which could be described as obvious aesthetic detractors to be seen. Comparing this score of 18.6 with that of 21.5 for the Nant Peris view (56) however does offer some insight into the reason for such a difference. The elevation within the views (from the viewpoints to the highest point of elevation visible in the views) would both be within the range 650 - 750 metres. However, the view at Nant Peris (56) appears more dramatic, the landform rising steeply from the streamside to the glacially carved Cwm Glas and towards the summit of Garnedd Ugain. This elevation from viewpoint to summit is much more gradual in the case of point 42 in the Brecon Beacons. Here there is a possibly less dramatic development from the foreground of arable fields, through the greener, broadleaf wooded middle ground which rises to foothills which climax in the summit of Bannau Sir Gaer. It is a highly attractive landscape resulting from a satisfying aesthetic relationship between its component parts though it might not appear as breathtakingly dramatic and awe inspiring as the Nant Peris landscape. However, personal preference will obviously have a role to play in the work of evaluation and this is probably the case here. This may lend weight to the argument that "landscape professionals probably give more weight to subtleties than would members of the public" (Price, 1978).

As was mentioned earlier, the expectation might be that landscapes of particularly high or of particularly low aesthetic quality would be recognised as such by most evaluators. Looking at the values allocated here for each individual's lowest (or equal lowest) and highest (or equal highest) scoring view this certainly seems to be the case.

Fig. 7.2. Lowest Value Points

Respondent	Point No's	Score
I	25	3
II	41	1
III	2, 23, 25, 48	0
IV	2, 25	1
V	2, 48	4
VI	2, 48	1
VII	23	5
VIII	2, 77, 80	0
IX	26	1
X	48	3

Starting with each individual's lowest valued view it is interesting that of the 89 points evaluated there were 7 landscapes which earned this dubious accolade. Three of these were only scored lowest by one respondent, these being points 26 (Mold, Clwyd) and 77 (Storey Arms, Brecon Beacons) 80 (Storey Arms, Brecon Beacons) scored equal lowest by each respondent with values of 1, 0 and 0 respectively. Of the other four landscapes two respondents scored landscape 23 (Connah's Quay) lowest or equal lowest whilst three individuals did likewise for point 25 (Penarth). These are both similar types of derelict, industrial landscape. Half of the ten respondents questioned scored point 48 (Pen-Y-Fedw Quarry) lowest or equal lowest and five of the ten were also in agreement that point 2 (Duffryn, near Newport) merited the lowest value. Whilst the other landscapes discussed here are either rather featureless rural views or obvious urban and industrial scenes these two landscapes (2 and 48) are peculiar in that they contain a strong sense of human activity / man-made features in what would otherwise be rural landscapes. At Coed Y Fedw Quarry we see an extractive industry at work in the heart of the countryside whilst at Duffryn near Newport we are confronted with a view of a rather garish, modern design building on an industrial park located on what was, until recently, agricultural land.

This suggests that unsightly features located within otherwise pleasant or attractive rural scenes are disliked aesthetically more than they might be in landscapes of lower aesthetic value. This is also relevant for forest design as it suggests that badly designed woodlands may be more visually damaging in higher quality views where they are capable of diminishing the aesthetic value by a greater margin than in the case of more moderate quality views. This is, perhaps, partly explained by the more evident geometry of such plantations in a high-relief landscape than might be the case in the lowlands.

It is also worth noting from the scores allocated for these landscapes how there is a difference between the lowest scores given by different respondents. Respondents number III and VIII scored their lowest quality landscapes at 0 whilst respondent VII chose to even allow her lowest valued view a score of 5. This may be a result of individuals' different perceptions of landscape quality. There may also be an unwillingness by some to allocate particularly low (or especially high) scores for a view in case an even worse (or even better) scene was shown which could not then be accommodated within the scoring scale if the lowest (or highest) values had previously been utilised for what may ultimately prove to be less deserving views. There might be a case for bounding the scale by showing examples of 0 and 25 point views. However, there is a real possibility that this might influence the individual's own perception of what constitutes landscape quality

Fig. 7.3. Highest Value Points.

Respondent	Point No's	Score
I	58	27
II	86, 88	27
III	83, 84, 85	28
IV	83, 84, 85, 86	28
V	56, 58	25
VI	58, 60	28
VII	83	23
VIII	22, 89	27
IX	68	27
X	83	28

All the respondents bar one allocated a highest or equal highest value to at least one site within the Nant Gwynant / Llyn Llydaw areas of the Snowdonia National Park and even that individual allocated a score of 26 for the first view shown of Nant Gwynant (58) which was a mere one point below his highest score for point 68 at Clywedog Reservoir. Three of the ten respondents scored this view (58) of Nant Gwynant either highest or equal highest whilst two scored likewise for point 86 of Llyn Llydaw. However, the greatest consensus was with regard to point 83, also of Llyn Llydaw, with two respondents scoring this scene equal highest and another two allocating it the highest value of all the views shown. This was also my own highest scoring view under normal, daytime conditions with a value of 24 (this particular view taken at dusk was the highest valued overall at 25). It is interesting, however, that none of the respondents allocated a higher value for this point in the view than they did for the daylight picture. Three individuals scored the two pictures equally whilst all the others scored the daytime picture higher than the view at dusk, the most marked difference being in the results of respondent (ix) who scored them at 22 and 9 respectively. It is further proof of the not insignificant effect which external factors (the diurnal change here) can have on our perception of landscape quality. It also suggests that external factors affect individuals differently. Some people may respond to "atmosphere" whilst others respond to "visibility".

Comparisons With the Original Survey.

We have previously discussed the differences between some of the landscape values, and some of the reasons for them. What follows is an analysis of the results for the survey as a whole (89 sites) and a comparison between the initial survey and the group scores. This will give us an idea of the representativeness of the initial site survey.

Fig 7.4 gives the correlation between the individual respondents to the photographic slide evaluation and the initial site survey.

Fig. 7.4. Correlation between individual scores and the initial survey.

Respondent	Correlation coefficients
I	0.642
II	0.829
III	0.776
IV	0.753
V	0.825
VI	0.666
VII	0.713
VIII	0.668
IX	0.620
X	0.790

It is clear that some respondents' scores correlated more strongly with those of the initial survey than others, and from this data the evidence as to whether or not the initial survey represented the group results is inconclusive. However, when the correlation between the initial survey and the group mean of the values was calculated the coefficient was 0.868. This suggests that the single expert survey, in this case, gave a fairly representative account of the scores given by the group.

The full table of Pearson correlations is given in Fig. 7.5. These results show that all r-values are positive and there is only one which is less than 0.5. This shows a positive relationship between the values of all respondents, including the original survey.

Fig. 7.5. Correlations (Pearson) Between All Respondents (including the original survey).

	Own	r1	r2	r3	r4	r5	r6	r7	r8	r9	r10
r1	0.642										
r2	0.829	0.664									
r3	0.776	0.604	0.735								
r4	0.753	0.572	0.746	0.664							
r5	0.825	0.654	0.769	0.722	0.795						
r6	0.666	0.708	0.650	0.608	0.804	0.744					
r7	0.713	0.575	0.717	0.744	0.765	0.714	0.729				
r8	0.668	0.450	0.633	0.536	0.732	0.706	0.671	0.685			
r9	0.620	0.538	0.577	0.578	0.632	0.542	0.591	0.615	0.453		
r10	0.790	0.657	0.795	0.713	0.765	0.784	0.680	0.763	0.700	0.657	
Mean	0.868	0.754	0.868	0.818	0.901	0.885	0.863	0.863	0.794	0.737	0.895

A regression analysis was conducted between each individual's values and the group mean. The regression equations for each respondent are given in Fig. 7.6. It is worth noting that only one respondent's slope coefficient was higher than 1 against the group mean. All the other results, including the original survey (own) were less than 1. The initial survey came closest to the group mean at 0.916, which is again evidence that the initial survey was representative of the results of the group as a whole.

Fig. 7.6. Regression Analysis For Each Respondent Against the Group Mean.

Respondent Regression Equation

Own mean = 0.82 + 0.916 own

r1 mean = 1.50 + 0.816 r1

r2 mean = 4.45 + 0.697 r2

r3 mean = 4.23 + 0.655 r3

r4 mean = 5.74 + 0.625 r4

r5 mean = 2.06 + 0.877 r5

r6 mean = 5.79 + 0.594 r6

r7 mean = -1.35 + 1.16 r7

r8 mean = 7.62 + 0.568 r8

r9 mean = 5.83 + 0.607 r9

r10 mean = 4.61 + 0.720 r10

The results tend to support the argument for a subjective landscape evaluation by a single expert. This argument is strengthened by the results of an analysis of variance between respondents. Whilst the analysis (Fig 7.7) shows that there were significant differences among the respondents, the initial survey falls right at the centre ("own" in Fig 7.7). As the method of evaluation and the subject being evaluated were innately subjective, it cannot be said that the values of any respondent were correct or incorrect. However, this analysis of variance suggests that the values allocated in the original survey were representative of those given by the group overall.

This might also suggest that the photographic slide method of evaluation was a workable technique, as it appears that there was consensus between the original survey conducted in the field, and the mean values for the scores from the photographic slide survey.

One-Way Analysis of Variance

```
Analysis of Variance
Source      DF        SS        MS        F        p
Factor      10     912.5      91.3     2.74    0.002
Error      968   32249.1      33.3
Total      978   33161.7
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
 Level       N      Mean     StDev  ------+---------+---------+---------+
own         89    14.607     5.083            (------*-------)
r1          89    16.607     4.451                        (-------*------)
r2          89    15.225     5.996                (------*-------)
r3          89    16..528    6.012                        (------*-------)
r4          89    14.921     6.943              (------*-------)
r5          89    14.820     4.856             (-------*------)
r6          89    15.596     6.991                  (------*-------)
r7          89    14.101     3.571         (------*-------)
r8          89    13.090     6.730  (-------*------)
r9          89    15.202     5.847                (------*-------)
r10         89    14.506     5.987           (-------*------)
                                    ------+---------+---------+---------+
Pooled StDev =    5.772                 12.8      14.4      16.0      17.6
MTB >
```

Fig 7.7. One-Way Analysis of Variance Between Respondents.

Fig. 7.8 and 7.9 illustrate the relationship between landscape scores and their variability. The results show a concentration of mean scores in the range 10-15. These were the landscapes of medium quality which account for almost two-thirds of the sample.

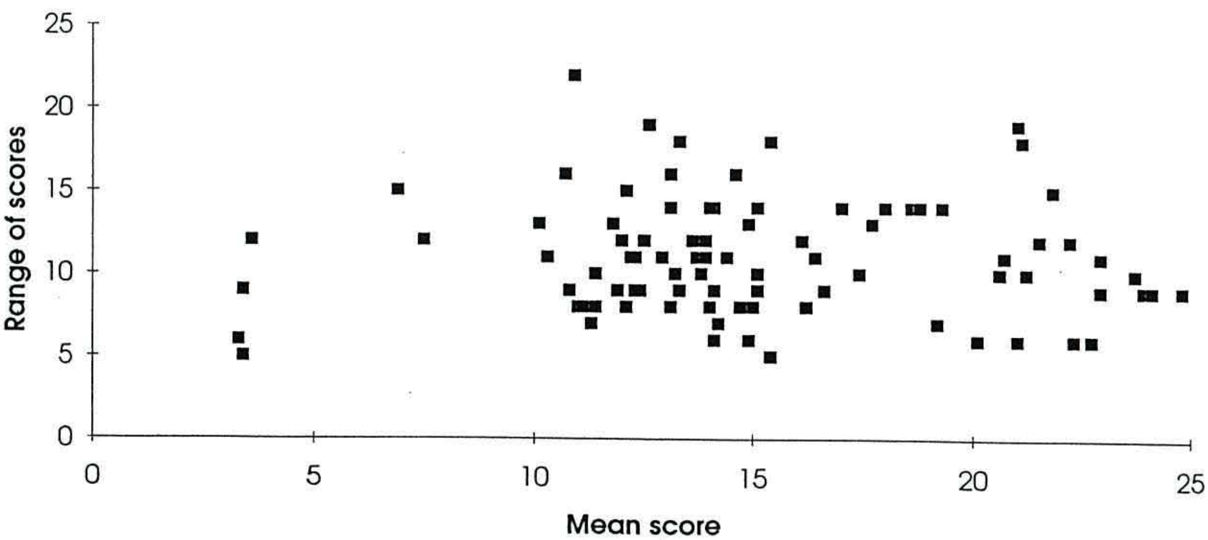


Fig. 7.8. Relationship of landscape scores and their variability.

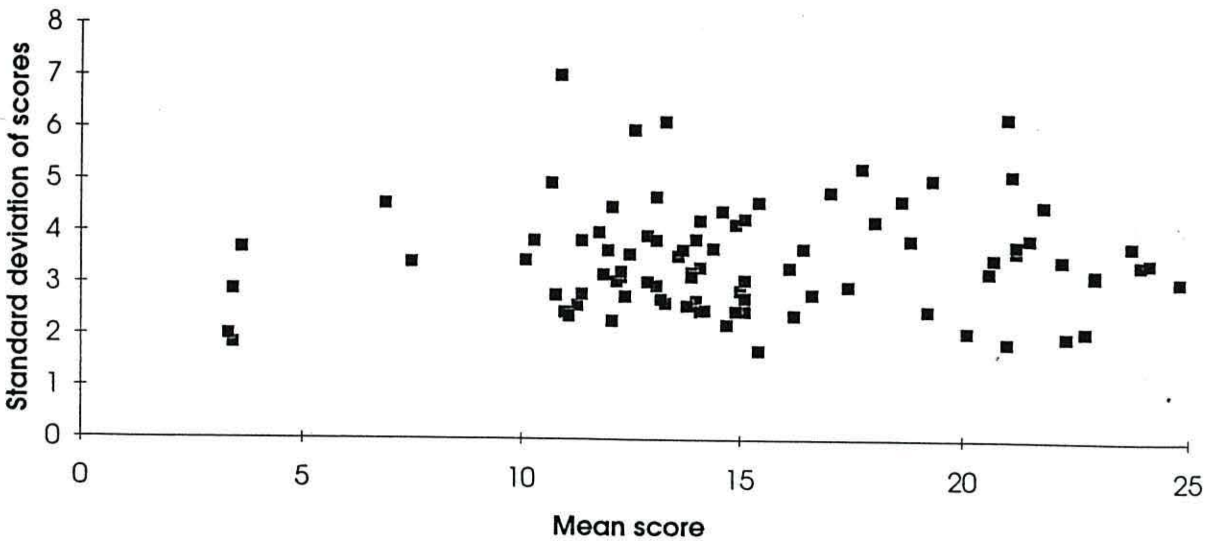


Fig. 7.9. Relationship of landscape scores and their variability

Results and Land Class.

A one-way analysis of variance was conducted to discover whether or not there was a relationship between the mean value of the group results for each land class and the land class number. A positive relationship (where the landscape value rose with an increase in the land class number) would suggest that the land class was, in some way, a predictor of landscape aesthetic quality. The results are given in Fig. 7.10.

One-Way Analysis of Variance

```
Analysis of Variance on mean
Source      DF        SS          MS          F        p
class       11     941.0        85.5       5.99    0.000
Error       77    1099.7        14.3
Total       88    2040.7
                                       Individual 95% CIs For Mean
                                       Based on Pooled StDev
 Level       N      Mean       StDev  --------+---------+---------+--------
     1       5    11.620       4.905    (----*-----)
     5       8    12.238       2.126      (---*----)
     6       5    12.740       1.476      (----*-----)
     7       5    13.700       2.871       (-----*----)
     8       5    10.860       7.700  (-----*-----)
     9       5    13.320       3.985       (----*-----)
    13       5    11.920       1.712    (-----*----)
    15       5    13.560       1.516       (-----*----)
    17       7    16.900       2.276             (----*----)
    18      25    15.344       4.447             (--*-)
    20       2    21.700       1.414                 (---------*--------)
    23      12    21.542       3.027                      (---*---)
                                      --------+---------+---------+--------
Pooled StDev =     3.779                  12.0      18.0      24.0
```

Fig. 7.10. One-way Analysis of Variance of Group Mean Values for Land Class Against Land Class Number.

The results above show a similar trend to that in the analysis of variance between the initial evaluation and the land classes. Land classes 20 and 23 gained higher values than any of the other land classes. This again suggests that these two land classes include landscapes of higher quality, and they are likely to be recognised as such by evaluators of the landscape. Apart from these two land classes, there does not appear to be any clear relationship between land class and landscape quality.

Survey Questionnaire.

Following the evaluation of the 89 landscapes by means of a slide presentation the respondents were invited to reply to questions concerning both their landscape preferences and their views on the method of evaluation used.

Questions Asked.

Question 1.

Respondents were first asked to list those features or elements of landscape which they believed to:

(a) make a positive contribution to landscape quality and
(b) have a negative effect on landscape quality.

The respondents recognised the importance of variety and diversity in the landscape particularly with regard to the landform itself. Changes in landform height were noted as a contributory factor to aesthetic quality which mirrors Fines' (1968) view that higher relief is often a positive contributor in aesthetic landscape scoring. Other elements noted as having a positive effect were those landforms of undulating and mountainous or hilly areas. There seems also to be a preference for a sense of "ruggedness", "jagged" landforms and rocks and for a degree of "wildness". This view was replicated in the numerical evaluation where the more elevated, mountainous landscapes scored rather higher than those in the lowlands. One female respondent noted her own liking for marshland and another for "wide open spaces" though none of the males questioned made this point, which is perhaps surprising considering Appleton's theory on Prospect and Refuge.

On the subject of "features" which made a positive contribution, the factor most consistently noted (by all nine individuals which replied to this question) was water, be that in the form of the coast, lakes or rivers. Trees were also cited by the majority of respondents as having a positive aesthetic effect. Most supported the use of broadleaves but conifers were also deemed appropriate when planted sympathetically. The above features were noted for their positive effect but those rural landscapes which showed little sign of human activity were also favoured by some.

Although the question was concerned with elements in the landscape itself one respondent did actually highlight the importance of external influences on her perception of landscape. Clouds were noted as a positive contributor but the effect of reminiscences was also seen as being influential, with familiar landscape types which remind one of other landscapes from one's own experience being deemed more attractive.

On the negative side, a variety of landform and land use elements were thought to have a detrimental effect on landscape values. Lack of variation and plainness was noted as a negative influence, examples of which were large flat fields, moorland, grassland or areas of flat land in general. Trees were noted as a factor which could create some diversity and a lack of tree cover was seen as an influence here. Other natural features such as heather moorland and scrub were also noted as possible detractors.

Whilst man made features were conspicuous by their absence in the "positive" category they are in abundance in the "negative" influences. Man made objects in general were highlighted by one respondent whilst others singled out unsightly or inappropriately placed and prominent buildings as having a negative aesthetic effect. Modern buildings in rural landscapes were abhorred as were other features such as roads, tracks, pylons or wires. Present day quarries were included here as were areas of derelict or neglected land. There was also a dislike for block or harshly outlined conifer plantations and "fussiness" in planting was also noted for its negative effect. Continuing on the subject of tree-planting, one respondent highlighted the effect of "conifer clumps in nice ragged fields" suggesting the unsuitability of small geometric block planting in the wider landscape dominated by "organic" (Bell, 1993) forms.

Finally, the internal influence of the viewer's "mood" was also noted here.

Question 2.

The second set of questions was concerned with the effects of woodland and forestry on the landscape and how they might:

(a) diminish landscape quality and
(b) contribute to landscape quality

There was a mixed response to the first category here. One respondent argued that any treeless landscape would benefit from tree-planting adding that "even conifers (are) better than nothing".

On the other end of the scale another individual said that block conifer planting "anywhere" would seem to diminish landscape quality. Others placed conditions on the planting of conifers which related both to design and location. There seemed to be a consensus that block planting was not attractive and particularly so when located in areas where they appeared alien such as on heather moorland, near coastlines or (interestingly, considering the title of this study) in areas of lowland arable farming. There seemed also to be a dislike for conifer blocks in mountainous areas, the straight edge boundaries of which were often noted as a factor which diminished aesthetic quality.

Moving away from exclusively conifer plantations the location of woodlands and forests in general was also discussed at this juncture. Plantations, according to one respondent, should not be planted where they might be "unexpected" in the view. Planting on mountaintops was highlighted as an example of this latter point though this would probably be inappropriate on economic grounds as well as aesthetics. Another point was that excessive planting which covered rocky areas was also undesirable, probably due to its effect in decreasing visual diversity. Also relating to this point of over-planting, some respondents were against excessive woodlands in small scale, enclosed landscapes, the result of which can be detrimental to the visual interlock of the woodland and hedgerow pattern.

Another view expressed concerned the effect of trees in blocking one's view of some landscapes. Similarly "landscapes where you feel free because you can see for miles would be wrecked". This, again, was a view expressed by a female respondent and is once more at odds with Appleton's Prospect-Refuge Theory.

On the second point concerning the positive aesthetic attributes of forests and woods, the main response was the ability to use trees to screen certain landscape features. Their use was noted for breaking up or hiding features of the built environment, for obscuring "carbuncles", to hide buildings or for the screening of roads. Another reply was that blanket afforestation can be beneficial in over-fussy landscapes.

Other examples were noted of using trees as objects of beauty in themselves as opposed to being a means of screening or hiding less attractive landscape elements, as was the use of trees to add diversity, especially when planted in smaller plots. Planting in otherwise barren landscapes (except heather moorland) was also mentioned, and planting in what were termed "boring fields" or treeless valleys. Woodlands planted at riversides as well as wooded valleys were highlighted as positive contributors to aesthetic landscape quality. Trees were noted as a means of creating a feature in otherwise featureless views, particularly by the use of broadleaved species.

Trees were likewise viewed as a means of creating diversity by means of height variation which would be particularly relevant in the context of lowland planting.

The main aesthetic consideration concerning species selection seemed to be that plant forms should repeat forms seen elsewhere in the landscape. More than one respondent noted that "pointy trees" were more acceptable in "pointy landforms" whilst offering that where the landforms were not of such "spiky" nature broadleaves may be better suited visually.

It is clear that these responses are very much in agreement with the principles of forest and woodland design outlined in chapter 2. The replies given confirm the principles of contrast and variety, harmony, unity, pleasantness and naturalness.

Question 3.

The final point to be discussed concerned the method used for the evaluation exercise and questioned the need for the refinement of the scale or any change in the technique in general. The question was asked whether there was a need for a negative score at the lower end of the scale, though there seemed to be no support for such a refinement.

On the subject of the scale itself there seemed to be some interest in the relationship between the numerical and descriptive scales (even though it had been stated at the beginning of the exercise that the latter was only meant as an initial guide to the numerical scale if it was needed). One respondent argued that the descriptive labels did not fit with the descriptive scale, noting that he preferred some "undistinguished" landscapes to others which might be classed "pleasant". Another answered that there was there was some overlap with some of the word descriptions whilst it was also suggested that the band titled "pleasant" could be widened somewhat.

On the whole, however, the scale used seemed to be satisfactory for most of those questioned, and to be, in one respondent's own words "a pretty sound if subjective method".

There was some support for a "test run" prior to such an evaluation so that those evaluating had some idea of scoring different landscapes prior to the exercise itself. This might avoid the need for adjusting one's scores during the evaluation on finding that one had allocated excessively high or low scores for initial views, which might only become apparent from viewing further landscapes. However, it must be stated here that such a "test run" should only consist of a set of photographs which the respondents themselves should evaluate. Were the questioner to show a set of landscape photographs or slides and allocate his or her own values for the views, then this would invariably prejudice the experiment. For instance, if I had shown a set of slides previous to the evaluation and shared my own values with the respondents then they might be tempted to score similar landscapes with similar values. Consequently, although I might score landscapes with undulating landforms, for example, relatively higher than those tracts of flatter land (as indeed did the respondents themselves incidentally) that is not to say that every individual will agree with such a view.

Conclusions.

The responses to this questionnaire provided an insight into why the respondents allocated landscape values in the way in which they did, by highlighting those factors and constituents of landscape which affected their perception of aesthetic quality both negatively and positively.

The replies to the questions concerning the aesthetic contributions of woodlands and forestry illustrated an awareness of the visual considerations based on reasoning rather than a simple implication that "all conifer forests are unsightly" for instance. Whilst some respondents did state the belief that conifer plantations were often responsible for a negative aesthetic effect there seemed also to be a willingness to allow such plantations, providing they were suitably designed, to be located in landscapes deemed capable of supporting them visually. The main consideration was undoubtedly that of aesthetic appropriateness. Only one respondent replied that any trees would be preferred to no planting in any landscape. Conversely, no one answered by saying that all trees would have a negative aesthetic effect although many raised the point concerning the inappropriateness of straight edged block planting in the countryside. The general consensus seemed to be that the location of woodlands and forests should be dependent on aesthetic as well as practical site conditions and that a well designed plantation related to surrounding forms in the landscape should normally prove acceptable.

The results of this questionnaire seemed to underline the accepted design principles outlined in an earlier chapter. As a consequence, these comments as well as the principles themselves, were all considered when designing woodlands for the sample sites.

It is important to note here the biased nature of the respondent sample used in this survey. The respondents were students of an environmental / landscape based subject and were consequently familiar with such evaluation exercises, which would not be the case with the majority of the general public. Perhaps, ideally, one would need a sample of visitors to the landscapes to respond to such a survey. One means by which to gather data might be to get addresses from relevent "B&B's", for instance, though this could prove time-consuming and might involve a "break of trust". Another method might be to pull out respondents to some of the general countryside surveys who met the criteria. However, neither sample could be said to be totally without bias as they would not account for those individuals who do not visit the countryside or take an interest in such matters generally.

CHAPTER 8

WOODLAND DESIGNS FOR EVALUATED LANDSCAPES

The evaluation of this sample of Welsh landscapes was the first step. The second would be to use these landscapes as a means of discovering how areas of differing aesthetic quality might be able, visually, to accommodate additional tree-planting. This would be both in the form of sympathetically designed woodlands and ill-designed plantations and would offer us the opportunity of deciding which landscape types would be most appropriate for planting in the future. There may also be examples of existing woodlands or forests which might be removed for the aesthetic benefit of the wider landscape.

The objectives of these designs is to utilise the design guidelines outlined in chapter 4. The designs concentrate on small plantations of the type that might be applicable to farm woodland enterprises.

This chapter utilises woodland designs to illustrate how different landscape types may or may not be able to support them visually. There are landscapes which will benefit from planting whilst others may be degraded visually, depending on the type of design proposed. Through this we should be able to highlight those landscape types which should be utilised for planting and, perhaps, those which should not be used.

It should be noted that beneath each example a score is given for each design. Each landscape is given with its original evaluation score and a score for the design itself. This "design score" should be added to the "original score" to calculate the new landscape value. For "before design" photographs of these landscapes, please refer to appendix 3.

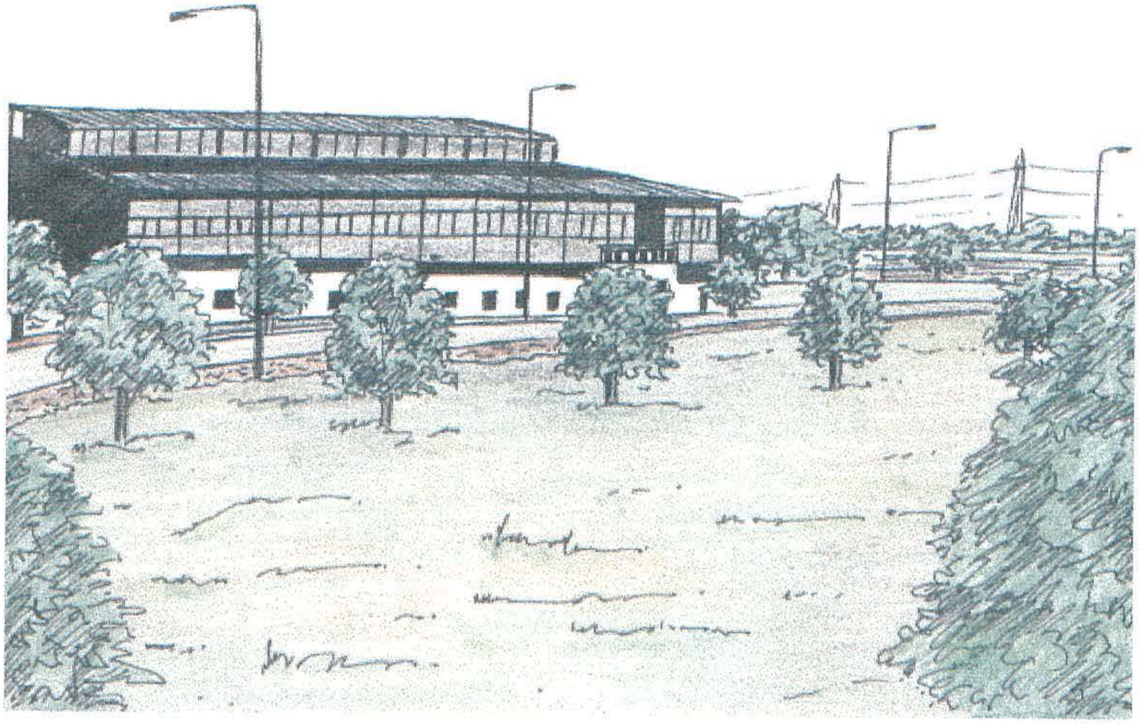


Fig. 8.1. Point 2. Duffryn, near Newport. It is unlikely that any planting design would transform this scene into an attractive landscape (that is assuming that demolition is not a viable proposition). However, by planting some broadleaves, though not in the form of a screen, it should be possible to soften the impact of the building by breaking up the facade. This introduces a slight element of nature into what is presently a man-made dominated scene.

Original Score: 6. Design Score: +2

Fig. 8.2. Point 3. Pen-Sidan, near Newport. The question that must be addressed here is whether the background view of industrial Newport is of sufficiently low aesthetic quality to merit its total screening by means of a line of fast growing conifers in the foreground. This leaves the designer facing an aesthetic dilemma. Is the negativity of the background sufficiently bad to sacrifice the more attractive middle ground in order to screen it? A line of conifers would achieve such screening but, as this design suggests, the outcome would be of lower aesthetic quality than that which currently exists.

Original Score: 5. Design Score -3

Fig 8.3. Point 3. Pen-Sidan, near Newport. At present, although the foreground and middle ground are of medium / pleasant landscape quality the eye is drawn down the middle of the composition as if funnelled by the broadleaves at each side to the view of Newport in the background. The view is not sufficiently bad to plant a conifer screen but some broadleaf planting might be beneficial. Additional planting in the middle ground can help in separating it from the less attractive background though it is important that some open ground is retained in the middle ground area. This is the opposite of planting to draw the eye towards attractive features. Groups of trees planted towards the foreground would also be beneficial as might some groundshaping to elevate the landform, though this would be likely to be impractical due to the costs involved.

Original Score: 5. Design Score: +3

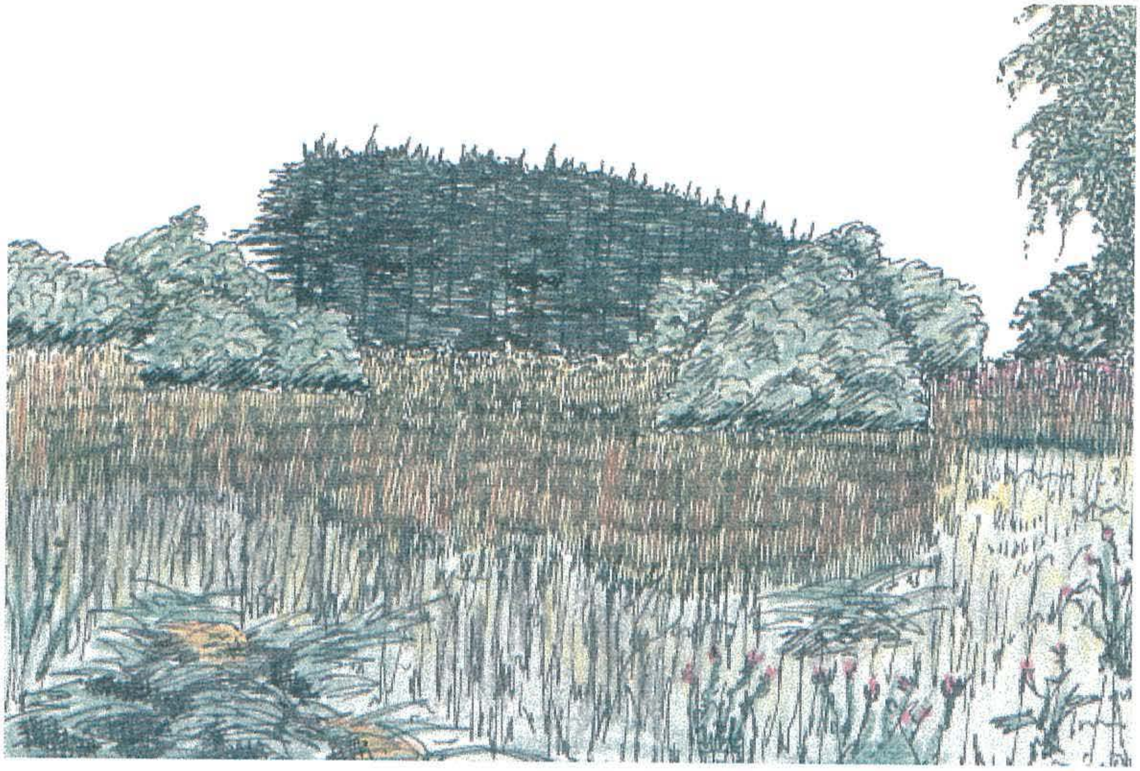


Fig. 8.4. Point 5. Pendoylan. Presently, the conifer stand at this site has become rather wispy and thin below, especially at the sides of the plantation, which are even more pronounced when viewed against the sky. If the conifers are to be retained then a simple solution might be to plant additional shade tolerant broadleaves at each side of the woodland. If the purpose of the stand is to provide shelter then it is not accomplishing this task at present due to this thinning of the understorey. This is often the case with such conifer plantations and those farmers planting shelter woods should bear in mind the importance of a broadleaf and shrub layer to compensate for the loss of shelter caused by maturing conifers.

Original Score: 12. Design Score +2

Fig. 8.5. Point 6. Grosmont. This design illustrates the difference in aesthetic quality between a conifer edge and a broadleaf one such as that which exists there today. The most significant difference is the lack of visual diversity produced by such a conifer edge. Also, the texture of the branches can seem harsh especially in single aged, single species plantations such as this. The lack of gradual development from field to forest canopy is another negative factor as is the lack of undergrowth which again contributes to the sense of detachment between open land and forest. Such a design would certainly be scored lower than the broadleaf edge which exists at the site.

Original Score: 15. Design Score -10

Fig 8.6. Point 11. Llyn Alaw, Anglesey. The nature of this landscape provides an opportunity for conifer planting though it would be likely to mean a small decrease in aesthetic value. One problem with the plantation illustrated below is that the upper right edge screens more of the reservoir than is currently in view. The plantation may also appear rather monotonous due to the lack of species variation. However, there are very few trees currently in the landscape which makes aesthetic integration a problem, though adding some broadleaves within the plantation and as a counterfoil at the edge might go some way towards remedying this.

Original Score: 15 Design Score -2

Fig 8.7. Point 11. Llyn Alaw, Anglesey. Much of Anglesey is very sparsely wooded and this area above Llyn Alaw is no exception. As the landform is relatively flat there is little visual diversity to the scene. Additional broadleaf planting could certainly be aesthetically beneficial to this view as it would contribute to the horizontal variation. When animals are left in such an open landscape as this then the shelter benefits of tree-planting are also worth noting. From an aesthetic standpoint note that the woodland at the right of the picture is kept back somewhat in order that the view of the reservoir is retained as it contributes some diversity to the scene.

Original Score: 15. Design Score: +3

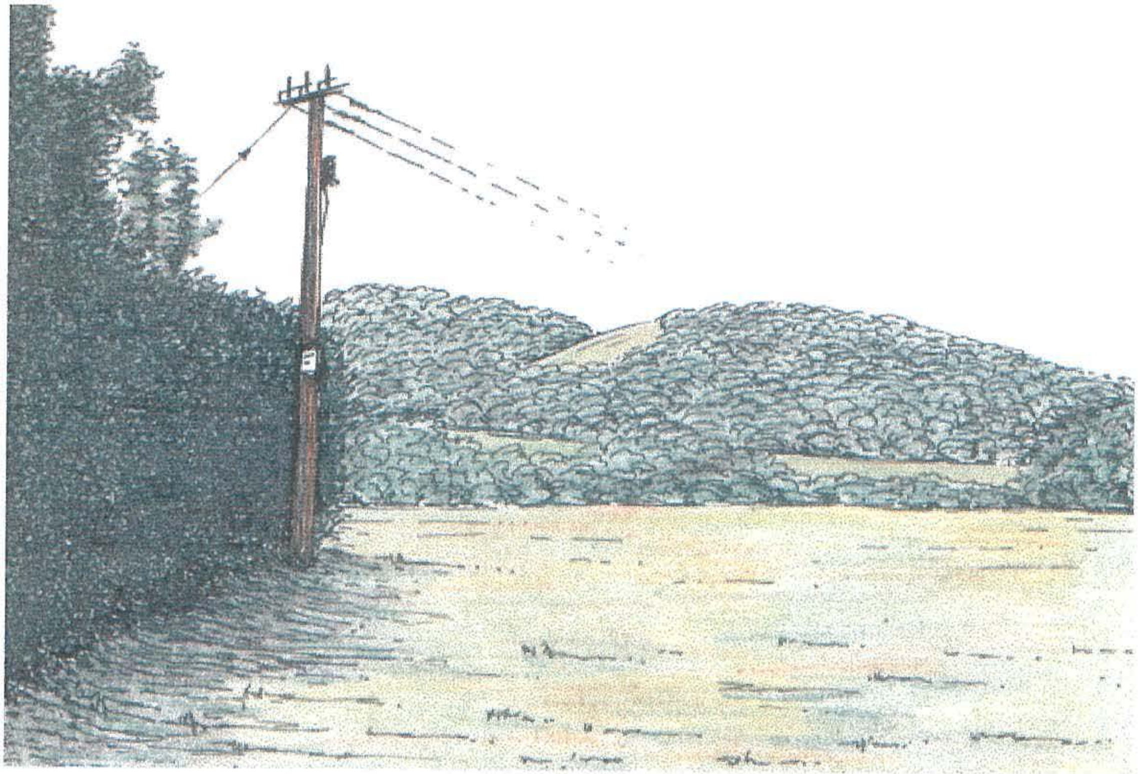


Fig. 8.8. Point 12. Old Walls, Gower. This medium quality landscape is pleasant enough without being outstandingly attractive. There are some broadleaved hedgerow trees in the middle ground of the composition but the higher ground is treeless. Extending the broadleaf woods onto this elevated background would undoubtedly add to this landscape's aesthetic value. From a design point of view the most desirable effect would probably be achieved by planting almost the entire background (leaving some open land for visual diversity). The unplanted area of the middle ground should be left as such as it allows for a well balanced development from the unplanted foreground to the densely wooded background hills.

Original Score: 14. Design Score: +3

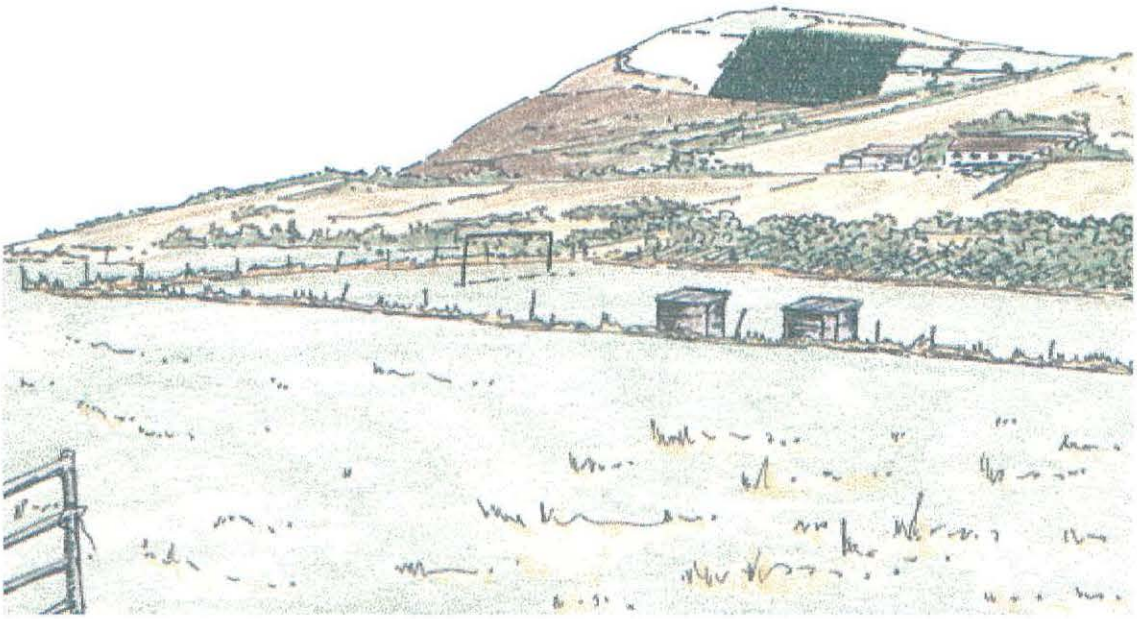


Fig. 8.9. Point 18: Llangrannog, Dyfed. Here is an example of how an ill-designed plantation can have a major effect on the aesthetic landscape. The woodland is relatively small compared with the landscape as a whole but its elevated position, geometric form and the lack of aesthetic unity in species selection all contribute to accentuate its visual impact. The geometric form of the field boundaries goes some way towards visual integration but the effect in winter following snowfall would be even more pronounced. Whilst planting the whole of the background hill would improve the element of form the plantation would still not appear well unified with the surrounding vegetation pattern.

Original Score: 16. Design Score: -4

Fig. 8.10. Point 23. Connah's Quay. At first sight this landscape may appear beyond redemption but, in fact, it is the type of landscape which could certainly benefit from tree-planting schemes. The problem here is that the industrial towers dominate the view, the flatness of the landform being a contributory factor. By planting faster growing conifers near the site itself and adding broadleaves and shrubs towards the middle ground and foreground the visual impact of these buildings can be decreased. No trees could completely screen the whole bulk of these structures but as with many such areas of post-industrial land if money was available then groundshaping would certainly be worth considering. One important practical consideration, however, would be the suitability of the land for planting due to soil degradation.

Original Score: 3. Design Score: +3

Fig. 8.11. Point 30. Llanfair Caereinion. Whilst this is already quite an attractive landscape there is certainly an opportunity for additional planting here. A pleasing relationship exists between woodlands and open ground, resulting from the strong hedgerow pattern. However, this is not to say that further broadleaf planting could not make a positive aesthetic contribution if grafted sympathetically into the existing woodland framework. The design here concentrates on planting in the indentations, leaving the upper landform unplanted. The result is to accentuate the landform due to the lighter colour of the open land.

Original Score: 18. Design Score: +2

Fig. 8.12. Point 31. Llanbadarn Fawr, Aberystwyth. At present this landscape appears rather scrubby and although there are some broadleaves here (mainly oak) their aesthetic contribution could be enhanced. The first step should be to remove the tree in the left middle ground and also the one to the right. This opens up the view and would itself increase the aesthetic value from this viewpoint. A further improvement would be to plant additional oaks onto the rising ground to the right side of the composition which would hopefully give the scene more of a woodland feel than the scrubby hedgerow appearance it currently has. Also, by opening the view to the middle ground there would be far greater balance between planted and open land and much less fussiness.

Original Score: 10. Design Score: +3

Fig. 8.13. Point 33. Near Gronant, Clwyd. This landscape is presently an undistinguished, largely treeless tract of coastal land. Whilst the flatness of the land offers little in visual diversity it does, nevertheless, offer an excellent opportunity for tree-planting. As can be seen above plantation form is of far less importance in such landscapes than might be the case in upland areas. Planting broadleaves in the foreground and middle ground and as a counterfoil to the conifer plantation will also increase the sense of depth perspective to the view. This area exemplifies not only the type of land which can easily accommodate conifer planting but also the type of area which, perhaps, we should be utilising if we are to safeguard areas of higher scenic value.

Original Score: 7. Design Score: +3

Fig. 8.14. Point 42. Bannau Sir Gaer, Brecon Beacons. This scenario illustrates the considerable negative effect that blanket afforestation can have on the aesthetic diversity of a landscape. Not only are the colour variations in the vegetation pattern lost but also the landscape features and undulations in the landform are disguised by the uniform texture and colour of the conifer plantation. The development from foreground to background appears far less gradual as the plantation seems to create a solid boundary in the centre of the composition. The only redeeming factor is that the background landform is still visible, though this is not sufficient to avoid a sizeable drop in the landscape's aesthetic value.

Original Score: 23. Design Score: -7

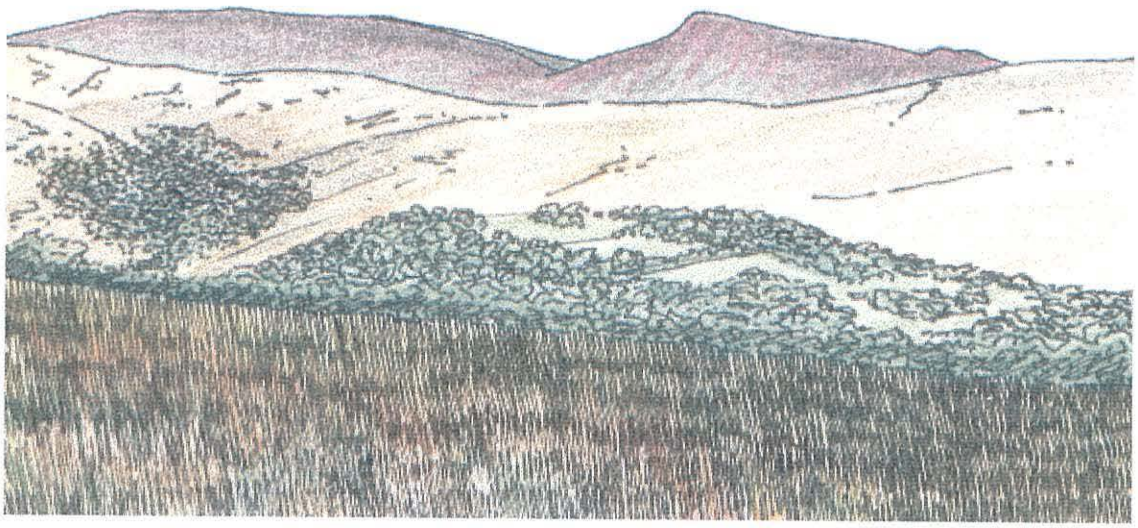


Fig. 8.15. Point 42. Bannau Sir Gaer, Brecon Beacons. One of the most striking features concerning this landscape is the colour variation in the existing vegetation pattern. It would be inadvisable, aesthetically, to plant a conifer plantation within such a landscape. Additional broadleaf planting could, probably, be accommodated in the middle ground without affecting the landscape quality either negatively or positively.

Original Score: 23. Design Score: no effect

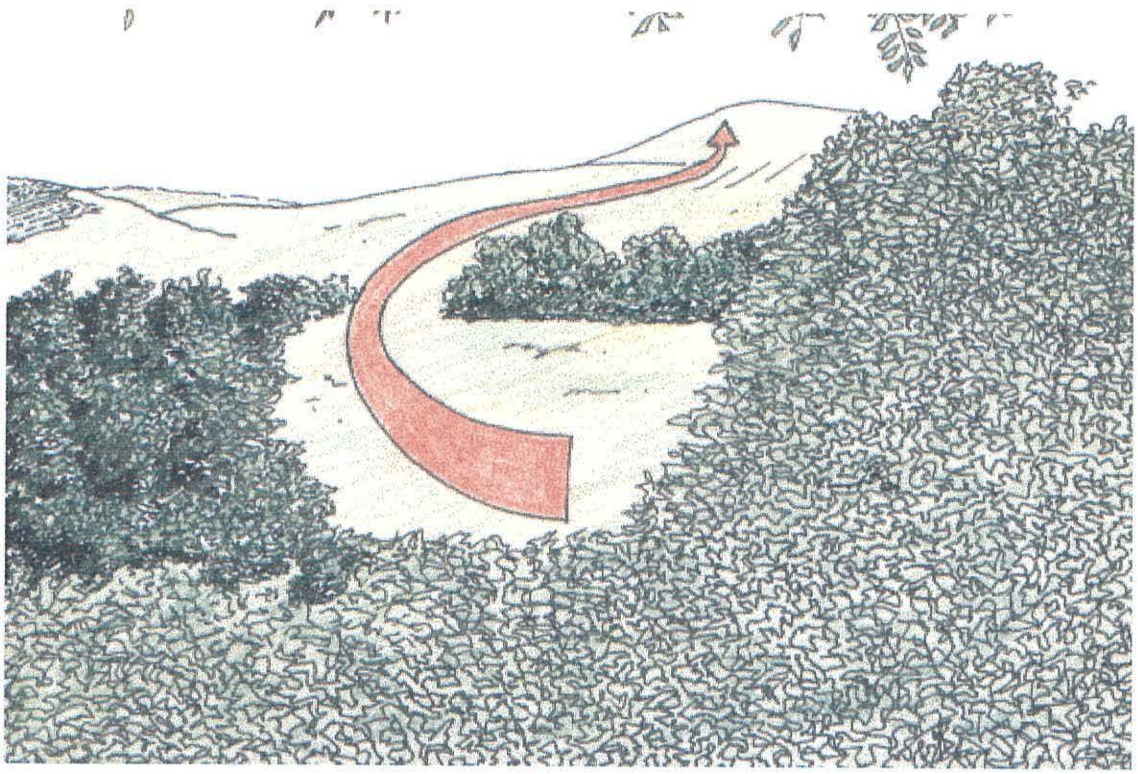


Fig. 8.16. Point 43. Ystradfellte, Brecon Beacons. At present the trees in the middle ground divide the open land into two sections, these being the field in the middle ground and the more extensive area of land which leads to the hill in the background. By felling relatively few of these middle ground broadleaves it would be possible to create greater unity within the scene. This is achieved by using the open ground as a means of drawing the viewer's eye through the composition to rest on the hill in the right background which is the focal point of this view.

Original Score: 17. Design Score: +2

Fig. 8.17. Adjacent to Point 44. Coed Llechweddmelyn, Borth. The conifer woods in the background appear to sit uneasily in such an open landscape as this. This may be remedied by extending the area under conifers to achieve a more satisfactory balance. The hedgerow trees to the right of the composition also appear to meet the skyline at an awkward angle. It might be beneficial either to clear this band of trees or to extend the broadleaves as illustrated. Alternatively, if such a belt was planted lower down the slope and designed to follow the curve of the hill it should appear less intrusive.

Design Score: +3

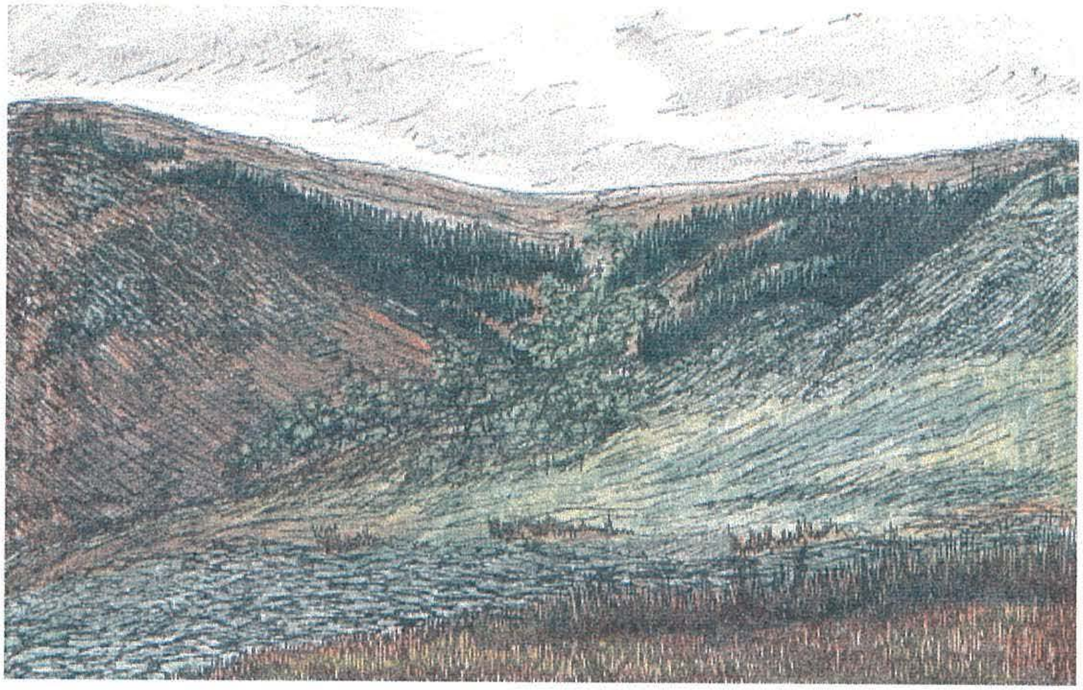
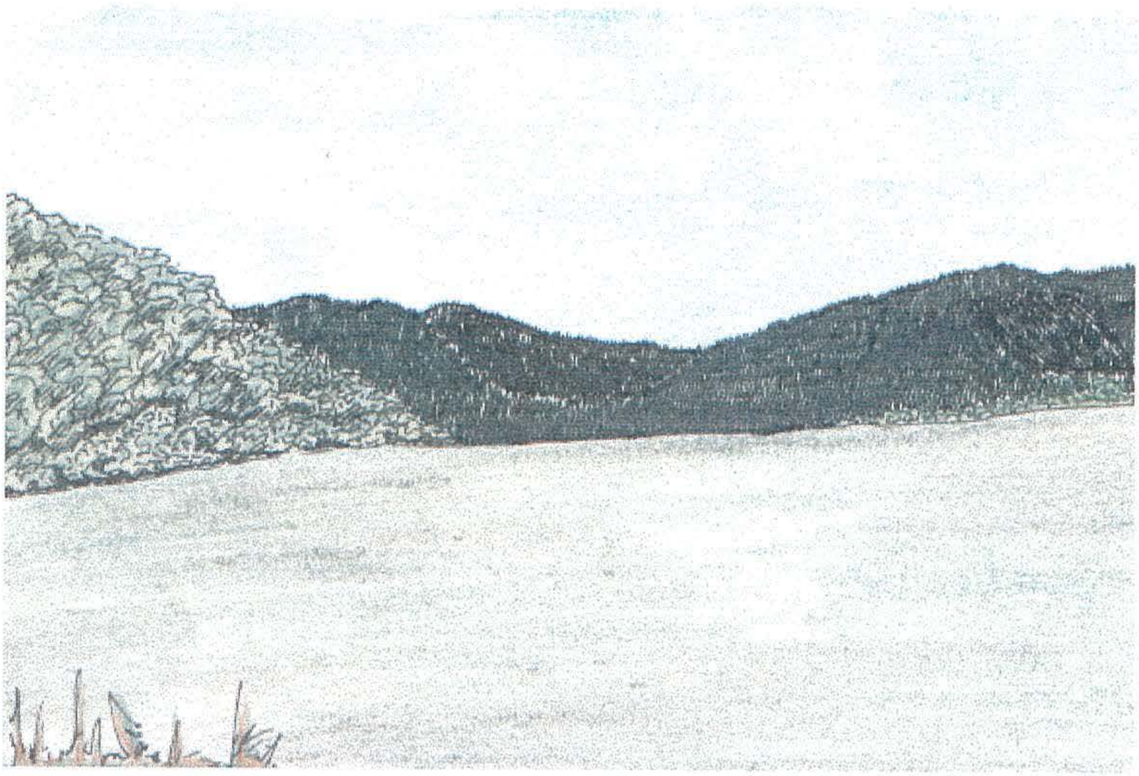


Fig. 8.18. Point 45. Cwm Rhiwiau. If any planting was to take place in such a totally treeless landscape it should be done in a positive manner. Scale is the main consideration and any small scale, half-hearted planting scheme would appear fussy within such a view. However, a large scale single species plantation could appear excessively dominant. The answer, therefore would be to allow the landform to dictate the woodland pattern. The planting of broadleaves at the streamside should also prove visually satisfying.

Original Score: 14. Design Score: +2



<u>Fig. 8.19. Point 46. Aberhosan, Dyfed.</u> Single aged, single species plantations almost invariably succeed in masking landscape features unless they are sympathetically designed. Here the effect is to hide the variation which exists in the vegetation pattern and also to mask the contours and undulations in the landform. The effect here is not particularly bad due to the open middle ground and the location of broadleaves adding at least some visual diversity. It would still have some negative effect on the aesthetic value however.

<u>Original Score: 15. Design Score: -3</u>

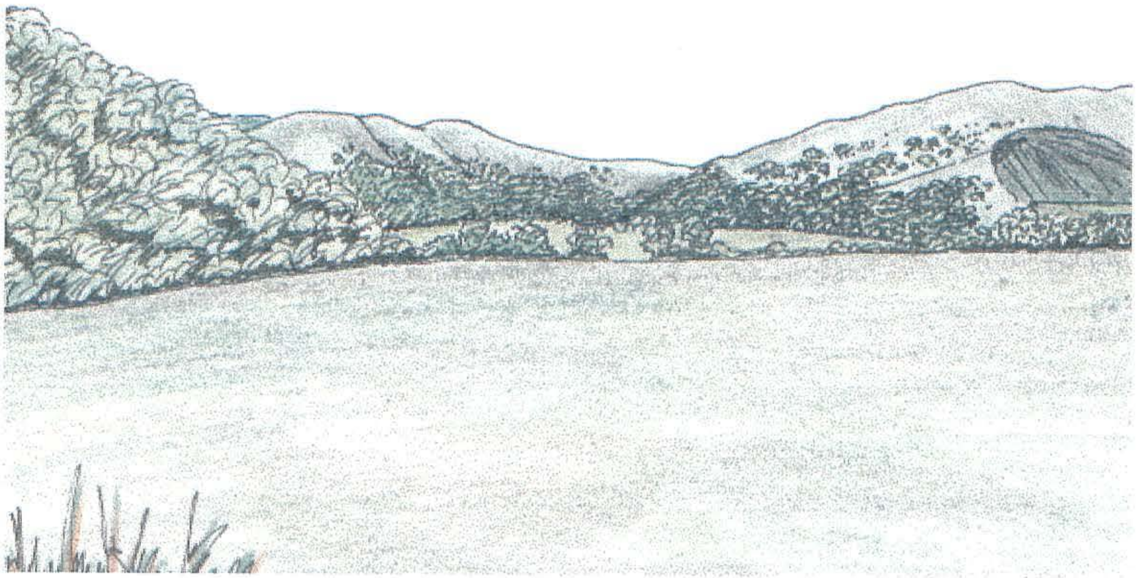


Fig. 8.20. Point 46. Aberhosan, Dyfed. Today, this is a sparsely wooded landscape. Those trees which presently grow here are broadleaves and the design above suggests that additional oak planting would further increase the site's aesthetic value. By leaving the fields in the foreground in their current unplanted state a sense of openness is retained. Some additional planting to the middle ground hedgerow would also create increased unity with the more densely planted background. Note also that the upper planting line is of irregular form with a scatter of trees at the upper margin to give a more feathered, natural effect.

Original Score: 15. Design Score: +3

Fig. 8.21. Point 47. Cynghordy. Whilst this is, generally, quite an attractive landscape the straight edge of the conifers at the centre of the composition appears rather intrusive. By planting this area with more trees and designing an irregular boundary with a broadleaf counterfoil the woodland would appear more natural. The planting of additional broadleaves towards the foreground and middle ground would also increase the overall visual unity of the scene by ensuring a more gradual development from open foreground to partly wooded middle ground to forest.

Original Score: 13. Design Score: +2

Fig. 8.22. Point 49. Mallwyd. At present this landscape is partly wooded by a mixture of broadleaves and shrubs whilst the skyline is largely dominated by a small number of wispy conifers which appear even worse against the backdrop of a light sky. The landform is not particularly strong and its form would be more suited to the rounded shapes of the broadleaves than to the more severe forms of most conifers. The aesthetic solution might be to plant broadleaves up to the skyline whilst the foreground clumps add some perspective.

Original Score: 14. Design Score: +2

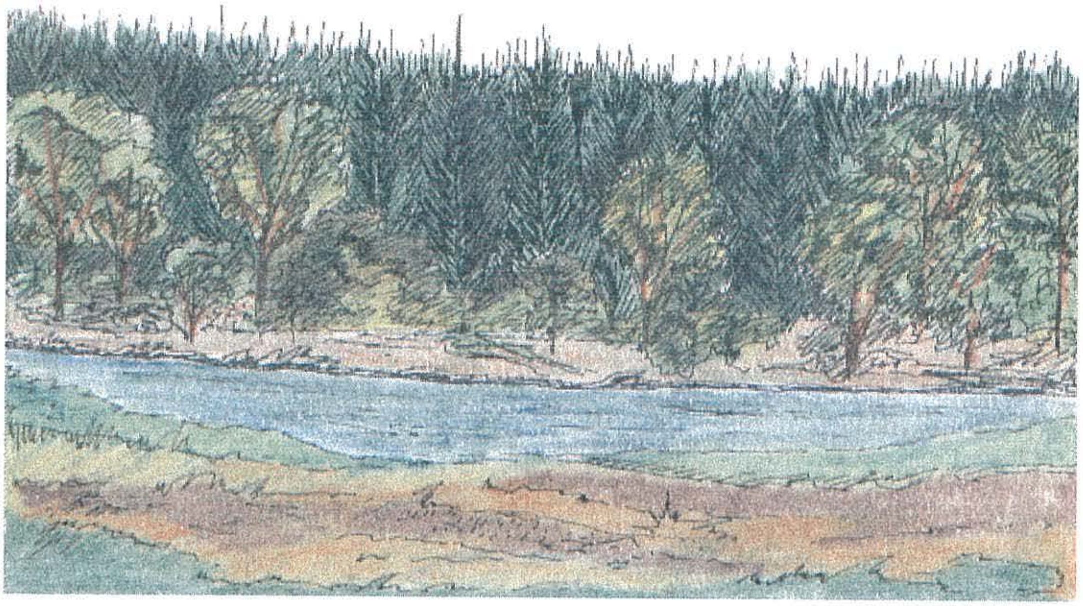


Fig. 8.23. Point 51. Clocaenog. The unnatural appearance of the conifer edge could be remedied with relative ease. The temptation in the past might have been to plant a single row of broadleaves to conceal this edge. The conifers would mature more rapidly thus continuing to be visible above the broadleaf idiot strip. It is far more effective in such circumstances to plant broadleaves as a counterfoil which partly screens to add diversity but is not a blatant attempt to hide the conifers completely. This has the effect of softening the edge and could be furthered by taking the conifers back in some areas. The planting of a shrub layer would also add to the sense of naturalness.

Original Score: 9. Design Score: +2

Fig. 8.24. Point 57. Arenig Fawr. Although it is not visible in this particular view, much forestry already exists in this area. This landscape was valued at 20 and whilst a poorly designed plantation would certainly downgrade this score a well designed woodland should be of little if no visual detriment. By relating the plantation to the topography the landform continues to appear to dominate rather than the forest. Additional planting of broadleaves towards the foreground and at the edge of the plantation should also assist in the visual integration of the forest.

Original Score: 20. Design Score: -1

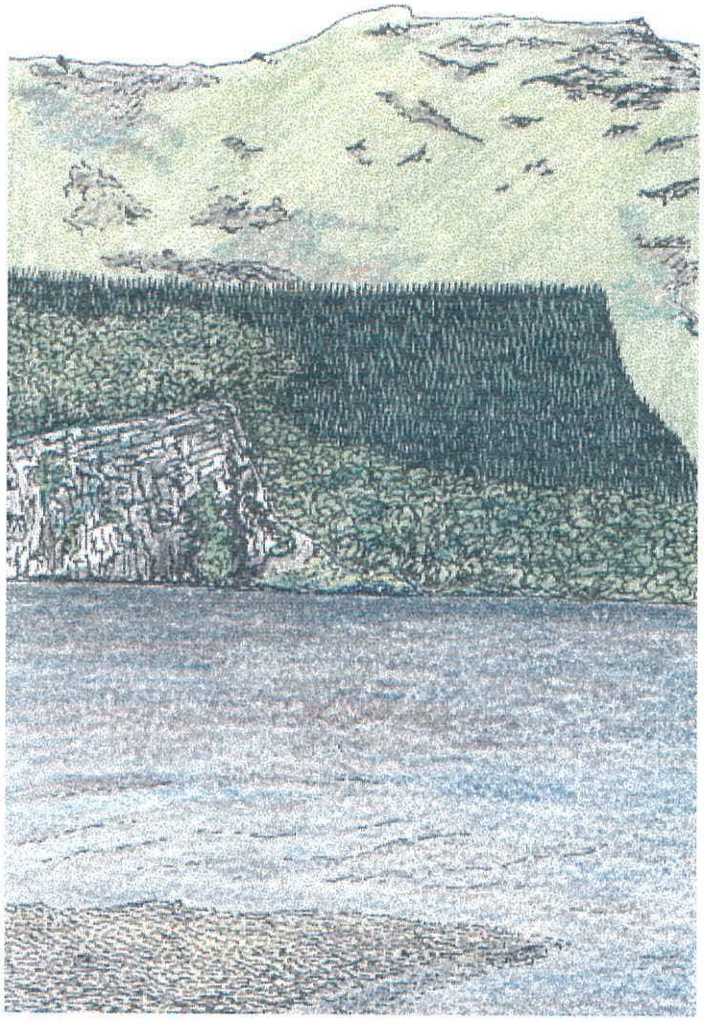


Fig. 8.25. Point 60. Nant Gwynant. The above picture exemplifies how planting without due consideration to the topography and visual forces can have a negative aesthetic effect. A forest designed in this manner would certainly diminish the landscape value for this view.

Original Score: 21. Design Score: -5

Fig. 8.26. Point 63. Llyn Alaw, Anglesey. The problem here currently is that the pumping station to the right of the composition is in full view. Rather than simply planting an idiot strip around these buildings, a more satisfactory effect would result from broadleaved planting to cover the entire landform on which the buildings stand. The aim of such a design would not be to attempt to hide the buildings in their entirety but, rather, to break-up their bulk and to soften their appearance.

Original Score: 5. Design Score: +4

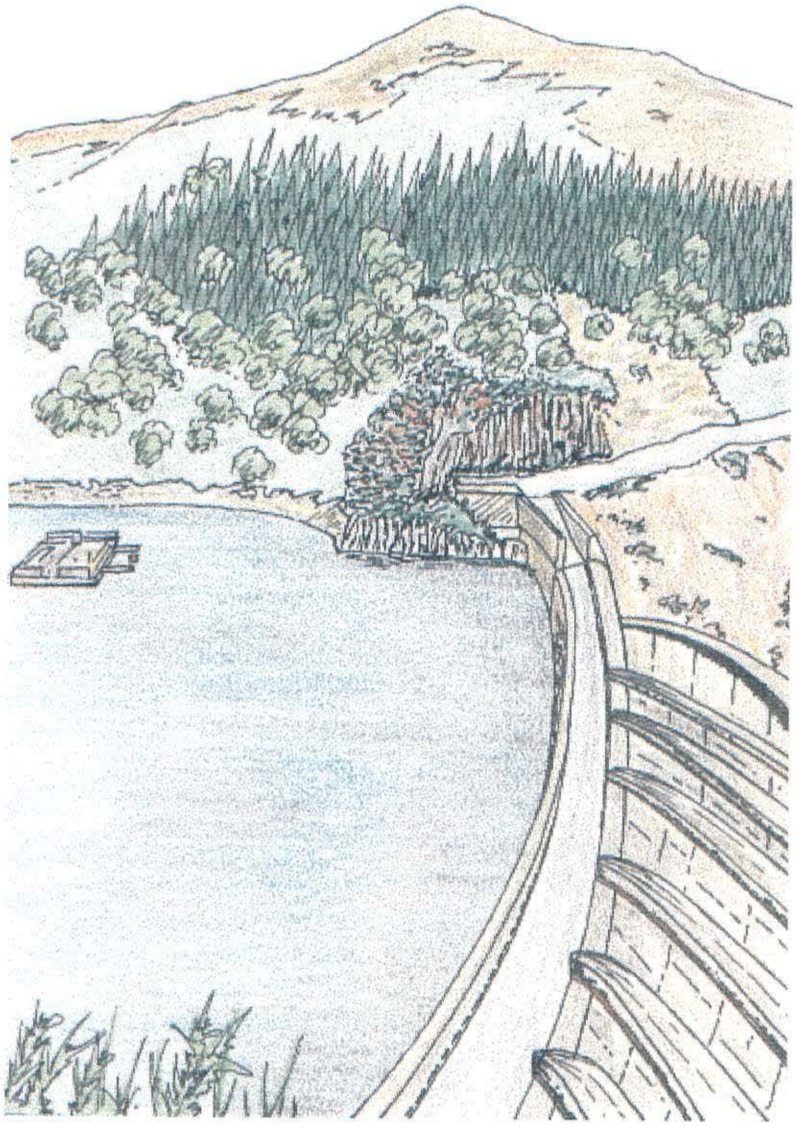


Fig. 8.27. Point 67. Llyn Clywedog. Apart from the dam itself, another aesthetic consideration concerns the form of the conifer woods on the opposite side of the water. It appears to sit rather uneasily, balancing on the spur at the end of the dam. This could be resolved by adding some broadleaves beneath the conifer plantation to support them, similar to the pillar solution. Although this would benefit the appearance of the woodland it would be unlikely to have much bearing on the aesthetic value as the negative aesthetic effect of the dam itself is so strong.

Original Score: 6. Design Score: +1

Fig. 8.28. Point 69. Llyn Clywedog. The problem with this landscape is the uniformity of age and species within the conifer plantation and the lack of visual diversity at the forest edge. The edge could be softened through the use of a broadleaf counterfoil. Diversity within the plantation could be achieved by adding some broadleaves within its boundaries. There is a slight undulation at the right hand side of the forest where this might be appropriate.

Original Score: 13. Design Score: +2

<u>Fig. 8.29. Point 76. Storey Arms, Brecon Beacons.</u> Such a plantation as this would certainly have a negative effect on this landscape's aesthetic value. There is no sense of naturalness to the design. The upper forest edge at the left hand side is at odds with the landform whilst planting to the skyline at the right has produced a serrated appearance against the sky. The lower forest boundary also appears to end abruptly without finding a level dictated by visual force. The final negative aspect is the total lack of foreground and middle ground trees which has the effect of further accentuating the plantation itself.

<u>Original Score: 16. Design Score: -6</u>

Fig. 8.30. Point 76. Storey Arms, Brecon Beacons. It should be possible to add conifers to this landscape with relatively little effect on the area's aesthetic value. The upper forest edge in this design is pegged into the dip in the landform at the skyline. The lower edge, though straight, has found its own level at an undulation in the landform in the middle ground. The straightness of this lower edge is partly offset by adding a scattering of conifers in the foreground whilst a smaller group of trees planted in the background also adds to the sense of irregularity and naturalness. Were there broadleaves present in the scene then additional ones might be worth planting to aid integration but as this is not the case it seems churlish to add them if the conifers are aesthetically acceptable without them.

Original Score: 17. Design Score: -1

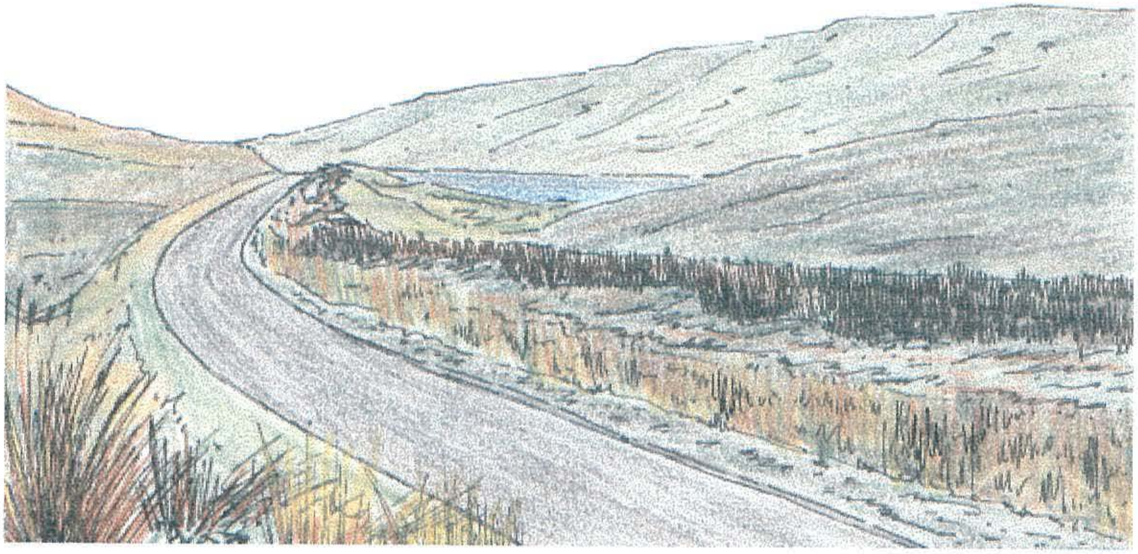


Fig. 8.31. Point 77. Storey Arms, Brecon Beacons. It seems in Wales that a reservoir is not complete without being bounded by an obligatory conifer plantation and this view of the Beacons Reservoir is no exception. Here is an example of how the removal of existing trees might improve a landscape's aesthetic value. By removing the conifers from this scene the water becomes more of a feature and the sense of naturalness and openness is increased.

Original Score: 12. Design Score: +3

Fig. 8.32. Point 86. Llyn Llydaw. Due to the altitude of this particular point it would be unlikely that planting here would be worthwhile. However, as it is in the highest quality site evaluated (Miner's Track) it might be worth discussing as an example of whether or not planting should be allowed in such views. The design above utilises larch and is shaped to conform with the landform. It would be unlikely to have a drastically negative effect on the view but it may be that any change of such a large scale should not be allowed in such landscapes. However, anyone who has actually visited this site and viewed the pipeline which runs from Llyn Llydaw to Nant Gwynant might argue that the relative effect of woodland planting would be minimal in comparison.

Original Score: 23. Design Score: no effect

The purpose of this design exercise was to illustrate the importance of the suitability of different planting and designs for different landscape types. This provides a basis for the type of indicative forestry strategy discussed in chapter 10, where design decisions are based on the evaluation of the pre-planted landscape and its aesthetic quality. What follows in chapter 9, however, is a method by which the increases in landscape values attributable to the types of proposed tree-planting schemes in this chapter might be allocated a monetary value.

CHAPTER 9

THE MONETARY VALUATION OF LANDSCAPE

The Case for Environmental Valuation

The previous chapters were concerned with the evaluation of a landscape's aesthetic quality and predicting the effect of landscape change. The subjective technique utilised provided a means by which to compare landscapes of differing aesthetic quality. However, it is impossible to compare the aesthetic value of these landscapes or woodlands directly with the values for other benefits such as recreation, wildlife or access. Neither can such values be compared with revenues from timber production, or with the cost of actually planting or growing the trees or of food production. In order to facilitate comparison it is necessary to transform the data into a scale of values which is used universally to allocate value or worth, and one which is understood by all. This is achieved by transformation to a monetary scale.

It is, perhaps, anathema to some to think that landscape quality could be quantified by means of a monetary scale. HRH the Duke of Edinburgh is one who appears to be of this view, stating that, "It seems, that economists have no way of putting a value on such things as natural beauty or amenity" (Price, 1994). Even for those working in the field of landscape evaluation, the task of going out to view a tract of high quality landscape for the sole purpose of assigning it a numerical score can sometimes seem disheartening. It might be fair to say that one never really views landscape in the same way again having started to evaluate it. Having participated in landscape evaluation surveys, the mind-set tends to guide the viewer always to calibrate landscape value rather than to simply enjoy the scenery for what it is. As Price (1995b) explains, "The world is a wonderful place as you experience it, it's only depressing when you start to evaluate it". But this does not detract from the need to evaluate and place values on landscape quality, be they monetary or otherwise. After all, if decisions are to be made regarding landscape quality and proposed change, then it is imperative that those expert in the field of landscape evaluation and valuation play a role in such discussions. The alternative would be to refuse to gauge such environmental goods as landscape quality in economic or monetary terms and to leave it to others, politicians perhaps, to quantify their work implicitly.

Environmental valuation can be utilised to assist in safeguarding present landscape standards (Bowers & Hopkinson, 1991) by using a sustainability approach where the aim would be to maintain existing landscape quality levels (Bowers & Hopkinson, 1994). It might provide a basis for management agreements, such as the Countryside Council for Wales' Tir Cymen scheme, to predict the cost of increased benefits (Bilsborough, 1994). Thirdly, it may be utilised to estimate the benefits to society accruing from environmental goods. Perhaps most importantly, the monetisation of environmental goods or benefits "assist(s) in giving landscapes 'due regard' in complex decisions" (Price, 1994). This enables us to compare, for instance, the timber value of a woodland with its aesthetic value to a landscape. It might sound somewhat philistine to some, to attempt to measure the quality of a view of a snow-capped Snowdon on the same scale which we use to calculate the cost of our week's groceries. The harsh truth is that there is no alternative, that only by comparing like with like, by valuing an attractive sunset as one would any other commodity can we ensure that its full worth is recognised. If landscape quality or benefit from public access, for instance, are not allocated a monetary value, the danger is that they are viewed as being without value and are treated as irrelevant side-issues when development is considered.

The main purpose of monetisation is to provide a monetary value for the benefit provided by environmental goods, in order that this can be compared with the costs incurred in providing or preserving them. This is part of "cost benefit analysis" (CBA). "CBA attributes a social value to everything affected by a project. Some things are negatively affected (costs) and others are positively affected (benefits). CBA adds up the costs, and the benefits. It gives a social decision rule: economics says a project whose benefits exceed its costs is worth considering, while one whose benefits are less than its costs is not," (Laslett, 1995). The costs of providing the benefits will usually be known, for instance the planting and management costs of a woodland. The methods of environmental valuation described in this chapter allow us to allocate a monetary value for the positive effect of these benefits to society. For example, a CBA for a forest involves so much more than comparing the cost of planting trees with the value of the standing timber: the public access, landscape and wildlife values can also be gauged and included as benefits.

In the field of environmental economics, there are a number of methods which may be used to calculate the value of an environmental good such as landscape quality. Most methods of monetary valuation of landscape quality are based on discovering the respondent's level of willingness to pay (WTP) for the good. What follows is an explanation of the methods by which environmental economics may be used to allocate monetary values for environmental goods. Most of the methods such as the contingent valuation (CVM), stated preference method (SP), the travel cost method (TCM) and the hedonic pricing method (HPM) are based either on questioning the public (CVM, SP) or on data based on purchases made by citizens (HPM) or both (TCM). Other methods, for example Helliwell (1967), could be termed expert valuation procedures.

Hedonic Pricing Method

The hedonic pricing method (HPM) is a means by which to calculate the monetary worth of an environmental good by separating it out of the overall value of another "commodity", such as the price of a house. For a rather simplistic example, if two identical houses were sited in landscapes, identical except that there was a broadleaf woodland in one of them, then the difference in house value might be attributed to the presence of the woodland.

In the real world, there is clearly greater variability and complexity than in the example given above, and there will normally be a number of attributes which contribute to house prices. As Garrod (1994) explains, "The hedonic pricing method (HPM) uses statistical analysis to estimate the part of price due to each of these attributes, and hence to predict what change in price would be associated with altered levels of attributes."

Garrod & Willis (1991) discovered that landscape elements did have an effect on house prices, in a study conducted throughout Britain. "Results suggested that the two most important positive landscape attributes are proximity to woodland and water, which raise prices on average by 7% and 5% respectively" (Garrod & Willis, 1991).

The technique clearly has its uses, but is not without its weaknesses. Both Price (1995b) and Bateman (1994) draw attention to the importance of correctly identifying and distinguishing the factors which are responsible for affecting the price of a house.

Price (1995b) cited a result within a study by Willis & Garrod (1992) as an example which illustrates a weakness in the HPM. The study "found, among other results, that lower house price was associated with the presence in the kilometre square grid of Sitka spruce plantations older than 50 years. On the other hand, presence of younger Sitka spruce had no adverse effect" (Price, 1995b). These results might lead one to believe that Sitka spruce becomes less aesthetically pleasing with age, though anyone who has seen examples of both young and mature Sitka spruce would know that the opposite is the case. One possible explanation given is that more recent, and therefore younger, plantations are better designed and might be more visually appealing than the older ones, but this has nothing to do with the trees themselves. Price (1995b) cites this as "a clear conflict of information and judgement" and notes that, "The important point is that the right explanation has to known, before the hedonic method can give guidance in decision making."

Another weakness in the HPM is the scarcity of data relating to house prices. Studies are dependent on the goodwill of institutions such as building societies, some of which "have realised that their records can easily be modified to facilitate valuable studies, while fully protecting their customers' privacy. Unfortunately such institutions are exceptional, and availability of price data in England and Wales will probably remain a major obstacle in the foreseeable future" (Bateman, 1994).

The HPM is a useful tool for calculating monetary values for different environmental attributes, as long as those evaluating can be sure that the differences in values can be correctly attributed to the environmental goods that they have identified. Not only is Bateman's (1994) point concerning the scarcity of data availability due to the need for secrecy valid, but there will also be a sparseness of data due to the lack of inhabitants and dwellings in more rural areas.

The Travel Cost Method

The travel cost method (TCM) (Clawson, 1959) is similar to the HPM in that it is based on discovering the payments which have already been made (in this case to visit an area). Landscape is not purchased as such (Price, 1994), but individuals will usually be required to make payments in order to arrive at any given site. Apart from those actually living in the vicinity of the landscape, those wishing to view it will need to pay travelling expenses, accommodation cost or, at the very least, forgo some other use of their time in order to do so. The TCM is based on measuring the actual payments and choices made to visit a site, and the value of the consumer surplus to each visitor (the consumer surplus can be described as the difference between an individual's willingness to pay for any good and his or her actual payment for it). These data can then be used to quantify the public's WTP for a particular environmental good such as landscape.

Bergin (1993) and Bergin and Price (1994) utilised this technique to evaluate five sites in Wales which are popular with visitors. The method used was described by the authors as "simple and elegant. A sample of visitors to some site which embodies desired environmental attributes is asked factual questions about the origins of their journey to the site, their mode of transport, and perhaps about other costs incurred and their own socio-economic characteristics".

The above study gathered respondents' replies to questions regarding travelling distance and the cost of their visit and utilised the data to estimate their WTP and consumer surplus for each of the five sites concerned. The visiting population was divided into 7 groups on the basis of the distance travelled to the site. These group zones varied from 0-50 miles (Group 1) to the world (Group 7). The mean distance travelled to each site was measured, with the figures ranging between 120 miles for Clywedog and 175 miles for the Miners Track (Llyn Llydaw). Data was also gathered for the duration of the visit as well as the mean total cost per visit to each site (total cost/number of days). The figures for the latter were as follows:

Llyn Alaw £53.65
Clywedog £53.73
Storey Arms £56.82
Nant Gwynant £58.33
Miners Track £71.56

The cost of the visit and visits per head of population were used to calculate each site's consumer surplus. This was achieved by multiplying the number of visitors from each catchment area by the average of the net value (consumers surplus) per visit (Bergin & Price, 1994). The consumers surplus per site visit for each landscape is given below:

Llyn Alaw £22.99

Clywedog £22.01

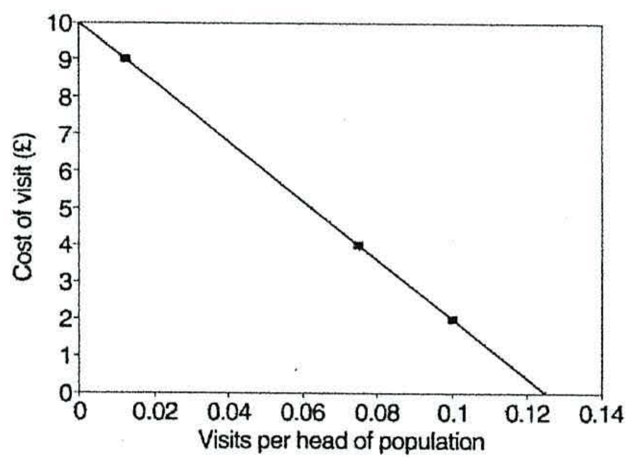
Storey Arms £24.46

Nant Gwynant £30.41

Miners Track £41.3

Fig 9.1 is an example of a demand curve for a landscape showing how the numbers of visits is influenced by the cost of travelling.

Fig. 9.1. Demand curve for a landscape (Bergin & Price, 1994).



The authors also suggested that "a small deterioration in the quality of landscape......reduces the gross value of the experience, without any compensating reduction in travel cost. For some purposes, then, the basis of calculations may be gross value including actual travel cost as well as the consumers' surplus already being calculated" (Bergin & Price, 1994).

Benson's (1994) study used the TCM to gauge how individuals valued forest landscapes compared with other attributes of the forest. By using a token allocation method for the purchase of forest amenities, Benson studied 14 forest districts in all (6 in 1987 and a further 8 in 1988) with the aim of measuring visitors' valuation of some of the non-timber benefits of Britain's forests. The first survey used four attributes (the all-site values for each attribute are bracketed following each one), these being wildlife (35.8%), landscape (34.3%), recreation (14.0%) and information (15.7%). The second survey, whilst retaining the categories of wildlife (29.0%) and landscape (20.0%), added a further attribute referred to as access (29.0%) and slightly altered the other categories to specialised recreation (10.4%) and visitor centres (11.5%) although this last attribute was only valued at three of the eight sites.

Benson revealed that "Non-specialist visitors to commercial forests place a high value on wildlife, landscape and access attributes of sites, relative to more specialist recreation and information facilities". However, it must be remembered that these attributes are by no means mutually exclusive. The environment in which wildlife and recreation may be viewed or participated in is often partly dependent on the landscape and its quality. Similarly, few of the other attributes could be enjoyed without an element of access. The study concluded by valuing the total unpriced recreation in the Forestry Commission's whole estate at £53 million at 1988 prices (Benson, 1991). If it is presumed that all the value was accounted for by the aforementioned attributes, the aggregate values for the whole of the estate would be as follows (based on the results of the 1988 eight district study):

Wildlife £15.4 million
Access £15.4 million
Landscape £10.6 million
Visitor Centres £6.1 million
Specialised Recreation £5.5 million
TOTAL £53.0 million

The results are even more surprising when one discovers that the cost to the Forestry Commission of providing these benefits during 1988 was only £8.5 million (Forestry Commission, 1988c). These results are important in that a monetary measure of recreational and amenity value for British forestry is essential for an industry which uses such non-timber benefits as one of the justifications for accepting the low rates of return that accrue from forestry (Benson & Willis, 1992). Benson & Willis add that "Forests provide a broad range of opportunities for such uses, particularly because of their ability to absorb large numbers of people and to screen activities both physically and perceptually" as well as generating personal, social, psychological and economic benefits to society.

Bergin (1993) and Bergin & Price (1994) utilised this token approach introduced by Willis & Benson (1989) in asking "respondents to disaggregate both the total holiday and the specific site visits into reasons for choosing that particular place for their holiday or visit" (Bergin, 1993). The method was based on the allocation of 20 tokens to each respondent, who would then divide them between any or all of the attributes of "recreation", "landscape", "solitude", "wildlife", "culture" or "other". Recreation scored highest overall, with landscape second. The percentage totals for each attribute were as follows:

Recreation 39.6%
Landscape 32.2%
Solitude 11.5%
Wildlife 10.7%
Culture 3.1%
Other 2.9%

By using the data for travelling and accommodation costs to each site, these data were then transformed into monetary values for each attribute on a site by site basis.

The strength of the token method is in its ability to gauge a respondent's monetary WTP for each attribute of a site/visit without requiring him or her to actually make a monetary bid for each benefit. Consequently, the technique avoids the myriad of problems associated with the contingent valuation method.

This method is probably the most accurate means of monetising the value of an environmental attribute. This is because the data are not based on prediction or hypothetical questioning, but on gauging the actual costs and payments which individuals have previously made to gain access to and spend their recreation time in a particular locale. As with the HPM, the weakness with such an approach concerns the gathering and availability of data.

Whilst the method is tailor-made for valuing the environmental benefits of visited landscapes, the lack of interviewees in less accessible landscapes means that such a method may not be useful in such circumstances. It might be fair to argue that such rarely-visited landscapes as those mentioned above have little economic value as visited landscape. However, the fact that they are not often visited today does not preclude them from future use. They may be utilised to a greater degree by future generations. Also, the mere fact that they are not often visited at present does not mean that they have no worth. Such influences are described as "non-use values" or "passive-use values" (Krutilla, 1967). The difficulty in measuring such passive-use values is in the fact that they are of value to individuals other than those at the sites themselves. These passive-use values cannot be "uncovered in (the) cost of visiting" (Price, 1976). A landscape may be valued by individuals who have never actually visited it. Price (1976) explains some of the different components which are collectively known as passive-use values:

1. Quasi-option value. "Certain courses of action (for example the extinction of species) foreclose the future options which may become desirable in unforeseen circumstances."

2. True option value. "Although people do not visit a landscape, they may value the continuing option to visit the place in an unspoilt state."

3. Vicarious value. "Even if people know they will never visit a landscape, the knowledge that others can enjoy it may please them. As long as this is not pure altruism the value can be added to the enjoyment others actually experience."

4. Existence value. "Even if no-one would see a landscape, satisfaction might stem from knowing the existence of an unspoiled place."

All the above are probably influences which should be considered in the valuation of landscape, but none can be quantified by the TCM. As Price (1976) states, "Clearly option-demand ought not to be ignored. But, equally clearly, information is not sufficient to indicate the proper extent of its influence."

The Contingent Valuation Method

The technique differs from the TCM in that it is based on hypothetical WTP, whereas the TCM depends on gauging the levels of real payments.

The contingent valuation method (CVM) is "a means of valuation based on statements made by consumers about their hypothetical willingness to purchase, or receive compensation for a change in circumstances" (Price, 1994), whereas the HPM and the TCM are based on the levels of payments which have actually been made.

The method cannot only be used to discover the citizen's level of WTP for access to sites of different quality or for an increase in welfare, it can also be utilised to discover the level of compensation that an individual would be willing to accept (WTA), for example for a degradation in landscape aesthetic quality. Bateman (1994) describes the method as a means by which, "valuations can also be elicited via willingness to accept compensation (WTA) for forgoing a welfare gain, or tolerating a loss. Invariably in field experiments, the WTA measure for loss of an environmental attribute (e.g. present landscape) is found many times greater than WTP for a gain (e.g. a new preferred landscape)". Such results might suggest an over-pricing of the existing landscape. An individual seeking compensation for the loss of an environmental attribute would probably allocate it a higher monetary value than he or she might if asked to pay for the same attribute. The most likely explanation for the discrepancy is the importance of the status quo (Kahneman & Tversky, 1979) to individuals' perception and their unwillingness to accept change to their surroundings.

Randall et al. (1974) and Randall et al. (1978) utilised the CVM to place values on abating power plant pollution and the reclamation of opencast mines. Such studies not only produce a value for the benefit accruing from such changes, they could also be interpreted as an indication of the disbenefit accruing from the present condition of the landscape.

Hanley and Ruffell's (1993) study was concerned with the evaluation of different forest characteristics, and found that there was an increased willingness to pay for access to those forests where there was greater diversity. This might be due to open areas or the height diversity of the trees themselves (Price, 1995a).

O'Riordan et al.'s (1992) study used this method to gauge public preference and perceptions of a range of hypothetical future landscapes located within the Yorkshire Dales National Park. The survey was conducted by inviting respondents from the general public to view an exhibition of alternative landscapes which were depicted in the form of artists' impressions. The study found that 47.2% of visitors and 50.2% of residents gave "today's" landscape as their first choice preference. The "conserved" landscape was the second most popular first choice landscape and was found to be the most preferred second choice. The least preferred landscape management was that which was labelled "intensive": not one respondent selected it as their preferred landscape and only 0.3% of respondents (residents or visitors) made it their second choice. It is understandable, due to the importance of the status quo to many, that the present landscape was the preferred first choice of landscape. It then follows that the conserved landscape would be the second choice, as much of that which is being conserved is that which already exists. What is, perhaps, most notable is the distinct lack of appeal for respondents in the intensively farmed landscape, as this is the landscape type which has been produced in many parts of Britain over the past 50 years as a consequence of modern farming methods.

Respondents were also questioned as to their willingness to pay for each landscape management regime via monetary bids for each of the alternative landscape depictions. "The Newcastle University contingent valuation study showed that most people valued the present landscape the highest, though with a great range of prices. Higher figures from visitors reflect a greater valuation amongst those who travel to see the park (see table below). The high values for the conserved, leisure and wild landscapes reflect a number of higher than average bids amongst a smaller group of respondents compared with a larger response rate for the present landscape" (O'Riordan et al. 1992).

Fig. 9.2. Willingness to pay to preserve landscapes most preferred by each respondent. (Newcastle University Study, from O'Riordan et al. 1992).

(£ per visit per day)

Landscape	Visitors	Residents
A. Abandoned	23.75 (17.68)	7.67 (13.33)
B. Semi-intensive	-	-
C. Intensive	-	-
D. Planned	18.18 (22.07)	13.38 (30.24
E. Conserved	34.96 (64.50)	27.44 (42.79)
F. Leisure	33.67 (57.45)	22.50 (32.29)
G. Wild	34.20 (35.50)	29.75 (28.88)
Q. Today's	22.12 (32.21)	26.03 (57.06)

(standard deviations in brackets)

Respondents were found to be concerned about the continuation of farming "to retain the characteristic landscape of the Dales", (O'Riordan et al, 1992). Farming was found to be regarded as the most important element of management in determining individuals' preferred landscapes. However, according to O'Riordan et al, "Woodland was considered to be a particularly important landscape feature". When questioned on the subject of increasing or reducing certain landscape features, 69% of respondents wanted more broadleaf woodlands (the largest vote for an increase in any of the features). Only 6.5% of those questioned wished for more conifer woodlands, whilst 54% wanted a reduction and 39.5% favoured no change.

This type of study could prove useful when setting the levels of grants or compensation payments, for instance to farmers, for developing or conserving a landscape in a particular way. If respondents to such studies provide an idea of their level of WTP for a landscape then it might be possible to base maximum conservation payment levels on such data.

The CVM is not without its weaknesses, however. The method is based on gauging the WTP of respondents who, probably, have never been requested to answer such questions previously. Consequently, "The method is in theory subject to several sources of bias and unreliability……… Hypothetical bias exists because the interviewee has no experience of paying directly for improved environmental quality, and may find it difficult to conceive what is being offered. Mitchell at al. (1988) consider that interviewees do not appreciate the full implications of environmental change" (Price, 1994). Bateman (1994) suggests that as the questions are only measures of hypothetical WTP, "respondents may ignore other demands on their income", spending more of their hypothetical money than they might have in reality, thus leading to a "tendency to overstate hypothetical WTP". A similar point is made by Bateman and Langford (1998) who suggest that income is often not as strong a factor in respondents' considerations as it should be. They argue that "Clearly, ability to pay should affect WTP", but that is not the case where individuals make valuations which are beyond their "personal circumstances and constraints". The CVM is also fraught with other biases which are capable of influencing the validity and accuracy of the survey results. These biases include the following:

Strategic bias is where respondents may be guilty of giving untruthful answers to CV questions in order to further their own ends (Price, 1994), for instance exaggerating their valuation of a good for which they might expect compensation. However, this may not be significant in the context of farm woodlands as respondents may not see how they might actually be charged for viewing landscape.

Question-order bias concerns how ordering of questions may be responsible for eliciting a particular response (Bateman & Langford, 1998). This may be accidental or on purpose.

Non-response bias is a particular problem with postal questionnaires, where individuals decide simply not to reply (Edwards & Anderson, 1987; Price, 1994). This can be a problem as those individuals who fail to respond are not typical of the population as a whole.

Filtering bias is where the interviewers decide to remove or disregard "protest answers" for what ever reasons (Edwards & Anderson, 1987; Price, 1994). The problem here is that researcher is capable of producing a questionnaire result which is closer to what he or she wants by virtue of disregarding replies they do not like.

Instrument bias is influenced by the hypothetical payment vehicle, in that respondents may have preferences for certain methods of payment which may affect their judgement of the valuation (Rowe & Chesnut, 1983). Brookshire & Coursey (1987) suggest that one means by which to alleviate this problem is by making the payment vehicle resemble the market vehicle as far as possible.

Start point bias is particularly relevant to the bidding game, in which the contingent price of a good is altered until the interviewee reveals his or her WTP for it (Rowe & Chesnut, 1983; Price, 1991). The problem here is similar to that of filtering bias in that the questioner can influence the result by starting the bidding high or low depending on the hypothesis which it is desired to prove.

Part-whole bias "(or embedding) entails a blurred distinction between a particular amenity, and amenities of that type" (Price, 1994). This concerns individuals giving, for instance, a valuation for general environmental conservation rather than valuing a particular aspect or area. In the case of valuing farm woodlands, this might be the difficulty in getting the respondent to value a single example of farm planting rather than farm woodlands or tree-planting as a whole.

Price (1991) highlights a problem in the CVM which can also affect the TCM namely "finding people to interview" as well as concerns about "sampling a representative set of conditions, through a completely daily, weekly and annual cycle of experience". However, as most of the biases above illustrate, the main weakness of the CVM is in the hypothetical nature of the questioning.

The Stated Preference Method

The stated preference method (SP) is a method of valuing environmental goods by means of the "experimental analysis of choice" (Adamowicz, 1995). Put simply, the respondent is given a choice of various packages of environmental attributes and is required to make tradeoffs between attributes in order to satisfy his or her demands, for example in the choice of recreation site.

By allowing the respondent to make choice decisions between a range of attributes or "a sample of events drawn from the universe of possible events of that type" (Adamowicz, 1995; Louviere, 1994), the individual is not required to answer "yes/no" or "how much?" questions, but simply to decide on the attribute package which best suits his or her own requirements. Below is an example of a stated preference question.

Fig. 9.3. An example of a stated preference question (Adamowicz, 1995).

	A. Standing water	**B. Running water**	**C. Non-water**
Water feature	Reservoir	River	
Terrain	Rolling prairie	Foothills	
Driving distance	25km	150km	
Fishing:			
Types of fish	Pike and perch	Mountain whitefish	Any other
Fish size	Small	Large	non-water
			related
Typical fishing			recreational
Success	1 fish every 35mins	1 fish every 35mins	activity or
Camping facilities	Day-use only	None	stay at home
Water quality	Good	Good	
Boating	No restrictions	None	
Swimming	Yes	No	
Beach	Yes	No	

Had the above opportunities been available last August, which one would you have most likely chosen? (Check one and only one box.)

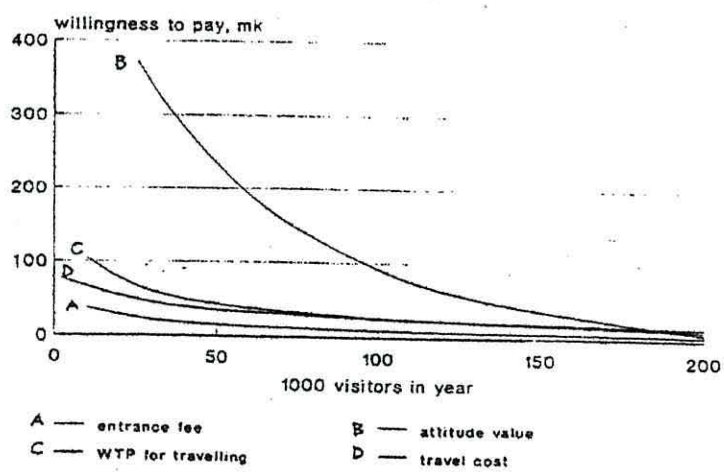
☐	☐	☐
A	B	C

The respondent is asked to select one of the given attribute packages and, consequently, may be required to make tradeoffs between attributes in deciding which package comes closest to fulfilling his or her recreational needs. It is also possible to include a monetary cost for different packages.

Sievänen et al. (1992) used the SP method to discover individuals' 'attitude value' for forest visits. The study was described as an "attempt to relate the value of one forest visit to market prices of some other leisure services or goods. The idea was to ask for the value of the opportunity of a recreation visit compared for example to the opportunity to play tennis or use an indoor swimming pool or listen to a concert or read a book."

An interesting result of the survey was that the bids gained from respondents were found to be much higher than either their WTP to travel or to enter the site (Sievänen et al. 1992). The authors suggested that, "It is quite obvious that whilst they (people) do subjectively appreciate forest recreation they are not willing to pay the sum of money equal to the value that they have expressed in the bids of 'attitude" value". Sievänen at al. identified the influence of strategic bias on the CVM, partly resulting from "the effort of respondents to free ride; that is to reduce their payments obligation (e.g. entrance fees) by stating low values". As the SP method does not require the respondent to make the kind of monetary bids which can cause strategic bias, not least in the form of protest bids, it is possible that it may provide more accurate results than might the CVM alone. However, Sievänen et al. concluded that "the 'attitude' value is likely to be an over-estimate of the monetary value of the recreation visit" and that "the 'real' value of a recreation visit is probably somewhere between the 'attitude' value and the WTP values", as illustrated in Fig 9.4.

Fig. 9.4. Demand curves of recreation visit processed by different measurements. (Sievänen et al. 1992).



Adamowicz (1995) highlights another strength of SP methods in that when "appropriately designed, (they) should alleviate the problem of 'yea saying' since there is no clear environmental good cause to support". As the questions are presented in the form of a choice of attribute packages, the respondent is not faced with trying to give what he or she might perceive to be the answer they 'should' give but, rather, to make the choice most appropriate to their own recreational needs. SP methods are also useful in alleviating the problem of part-whole bias associated with CV in that the choice situation in SP offers a straightforward set of attribute packages for selection.

SP methods of environmental valuation are relatively new compared with the TCM and CVM. However, there is a strong case for suggesting that "some of the problems associated with CV can be alleviated using SP" (Adamowicz, 1995) and that since it has been utilised successfully in marketing and transportation economics (Adamowicz, 1995), it is likely to prove to be increasingly useful for environmental economists also.

Helliwell and Willingness to Pay.

Possibly the most well known system for the valuation of the aesthetic contribution made to landscape by trees is that of Helliwell (1967) (Arboricultural Association, 1990). This method is used to allocate monetary values for trees and woodlands, even down to the value of a single tree to a landscape. Since the adoption of the method by the Tree Council in 1974, "the method for individual trees has been extensively used in court cases, insurance claims and public enquiries. The method for evaluating woodlands has also been applied in a number of instances" (Arboricultural Association, 1990).

The purpose of this technique is to assess the amenity value of trees and woodlands. This can then be used to assess alternative courses of action as well as the effects which different types of planting and species selection might have on the landscape. However, it must be noted that the values it produces are a monetary estimate purely of aesthetic and amenity value, and are most useful, for instance if development threatens a mature tree growing in a town centre. Such trees would never have been planted in such locations for the purpose of timber production and the value of the timber itself would be all but irrelevant in the discussion on removal / preservation. Such trees are valued and often cherished for their amenity value, for providing a small reminder of nature and the countryside in the built environment, or as a shady haven where one might sit whilst out shopping on hot summer days. This method of valuation provides the town planner with the measure of value that he or she can compare most easily with other development costs, a monetary scale. One important factor which is considered is that the existing landscape will affect the values allocated to different trees and woodland and that it is not only the tree itself which is valued but its overall contribution and suitability to the scene as a whole.

Trees are valued on a scale of 1-4 according to various factors, these being size, life expectancy, importance of position in the landscape, presence of other trees, relation to the setting, form, and other special factors where applicable. The scores for each of these factors are multiplied by each other and then multiplied by £10 to give a monetary value. Fig. 9.5 gives an example of a valuation assessment for a "horse chestnut tree in a meadow near (the) centre of a small town" (Arboricultural Association, 1990).

Fig. 9.5. An example of Helliwell's tree valuation method.

1. Size	large	Scores 3 points
2. Useful life expectancy	20-40yrs	Scores 2 points
3. Importance in landscape	some	Scores 2 points
4. Presence of other trees	none	Scores 4 points
5. Relation to setting	very suitable	Scores 3 points
6. Form	good	Scores 3 points
7. Special factors	none	Scores 1 point

Total score = $3\times2\times2\times4\times3\times3\times1 = 432$, or £4,320 (when multiplied by £10).

This method is a useful means by which to place values on existing trees. The Arboricultural Association booklet of 1990 provides an excellent introduction to the technique and gives examples, such as that above, of how the method might be applied to a variety of tree and woodland types. Mention is made not only of how changes in the woodlands themselves might change their value but also of how adaptation of other features in the surrounding landscape, such as the construction of houses, would be likely to change a tree or woodland's amenity value.

At first glance, the system appears to use a relatively scientific approach. The values for each variable are multiplied to give a monetary value for the trees concerned. The guidelines are clear to follow, and the effect of the subjective bias of the evaluator should be minimal.

The system is not without its faults, however. Price (1995a) notes that values depend on whether trees are seen individually or as part of a wood. There may be quite a discrepancy in the valuation depending on the criteria. Price also notes that, "There are also problems in interpreting the descriptive categories. Notably, 'appropriateness to setting' depends on cultural background".

The technique might also suffer from lack of objectivity, particular for those who yearn for a more scientific and less subjective means of evaluation. The technique itself is intrinsically a subjective one, as it is based on the subjective view of its creator and his willingness to accept compensation for the loss of particular types of trees and woodlands. In this respect, the system may be likened to the CVM. It is based on predicting a monetary value which might be paid to compensate for a loss in environmental goods, in this instance trees and woodlands. Where this method differs from a public respondent-based CVM is that the valuation of the environmental good has been made in advance by an expert who has based the system on his own (and the Arboricultural Association and the Tree Council's) level of WTP and WTA. This should not be perceived as a weakness if their level of WTP or WTA is correct, and there does appear to be consensus that the values are reasonable. But there is no escaping the fact that the technique is based on a subjective evaluation of the landscape features concerned. The method also differs from the CVM in that it is based on a components approach to evaluation (whereas the CVM is holistic in its approach) and as such it might also be likened to the components element of the HPM.

The last word on this subject should probably be left to Helliwell, who devised the method. He said of the technique that there is a "good case for trying to place a value on trees and woods, even if it is only used for comparing the value of one tree with another when it is necessary to remove one for some reason."

Conclusions on Monetary Valuation Techniques.

It is clear that the monetisation and cost-benefit analysis of environmental goods has come a long way since its inception and it becoming operational in the USA in the 1930's (Price, 1997). Such methods are not without their detractors (Duke of Edinburgh, 1994; Timber Growers Association, 1972), some of whom appear opposed to the mere idea of placing monetary values on such elements as landscape. However, as Price (1995b) suggests, though the idea of environmental evaluation is not a romantic one, it is one that is, perhaps regrettably, a necessity. Forestry and landscape evaluation are areas at the forefront of such environmental evaluation.

It is not possible to state that any one of the above techniques, when used individually, provides a satisfactory means by which to evaluate present and predict future values for proposed farm woodland planting. The HPM suffers from the isolated, rural nature of the subject to be evaluated. In my view, the CVM's limitations are firstly due to the availability of interviewees. The method has been utilised with some success in the forest landscape, where respondents are often plentiful, and whilst the method is much used today it suffers from the influence of a myriad of biases, the part-whole bias in particular. Helliwell's method, on the other hand, is not used as a predictive model but, rather, as a means of measuring WTA for losses in tree cover, though there is no apparent reason why it might not be useful for valuing proposed planting. Finally, the TCM's effectiveness for such work depends heavily on the availability of respondents to interview. However, in those areas, of rural Wales for example where visitors are prevalent the method could prove invaluable, not least as a component of predicting values for proposed tree-planting.

The voice of the environmental lobby is probably stronger today than it has ever been. Partly as a consequence of this, forestry design and development has become increasingly "landscape friendly", and methods of valuing the non-timber benefits of forests have assisted in proving their value beyond the monetary worth of the timber itself. Such techniques could have a major role to play in the future, both in valuing existing landscapes for their preservation and sustainable development, and in determining the probable effect of landscape change.

Comparison of the Landscape Evaluation Surveys with Bergin's (1993) Travel Cost Method Results.

The main purpose of the landscape evaluation survey was not only to compare the results of my own initial survey with those values allocated by the group from photographs, but also to compare the results with those produced by a different evaluation technique, that being the TCM as used by Bergin (1993) for the same sites. The travel cost estimations were calculated based on interviews at these five sites (Llyn Clywedog, Llyn Alaw, Nant Gwynant, Storey Arms and Llyn Llydaw). An outline of the study can be found in Bergin & Price (1994).

Bergin's scale (a) is for "consumers' surplus per visit (no accommodation cost", scale (b) for "consumers' surplus per visit (with accommodation cost)" and (c) "gross value per visit (with accommodation cost)". Obviously, there will be other considerations apart from landscape quality which will affect respondents' valuation of a site, not least the influence of wildlife and recreational opportunities. However, scales (a), (b) and (c) are based on the assumption that if "all sites offer similar recreational opportunities, landscape could be said to account for differences in WTP between sites" (Bergin, 1993). Consequently, a WTP measurement based solely on aesthetic landscape quality should give results resembling (in the ranking of landscapes) those of a purely subjective landscape evaluation such as that discussed previously. The results in column (d) used the token approach also highlighted in Benson (1994), to apportion value to landscape.

The following table shows the results of the survey which are given in four different monetary scales (a,b,c,d) based on the criteria shown beneath the table. I have also included my own mean values for these sites.

Fig. 9.6. Results of initial site evaluations and Bergin & Price (1994) TCM results.

SITE	LANDSCAPE VALUE	(a)	(b)	(c)	(d)
Llyn Llydaw	23.3	£28.43	£41.30	£112.86	£37.64
Nant Gwynant	20.8	£26.82	£30.41	£88.74	£31.90
Storey Arms	15.6	£19.84	£24.46	£81.28	£25.56
Clywedog	13.7	£16.80	£22.01	£75.74	£26.89
Llyn Alaw	10.7	£14.65	£22.99	£76.64	£19.05

("Landscape Values" measured on Harding & Thomas' 1-30 scale. (a), (b), (c) and (d) values in £'s per visit).

a. Consumers surplus per visit (no accommodation cost)
b. Consumers surplus per visit (with accommodation cost)
c. Gross value per visit (with accommodation cost)
d. Gross value per visit attributable to landscape (with accommodation cost)

If the sites were ranked by value then the Llyn Llydaw and Nant Gwynant landscapes are consistently placed first and second respectively, irrespective of which TCM criterion is used, and also in the same order as the initial subjective evaluation. Again, it indicates that high quality landscapes, as these two undoubtedly are, are likely to be recognised as such. Three of the TCM value scales (a,b,c) place the Storey Arms in third place in agreement with the subjective evaluation whilst monetary value scale (d) places it in fourth place, though only slightly behind the Clywedog landscape, which replicates the results of the group means (from the evaluation from photographs) for these two sites. In the other monetary value scales Clywedog is ranked fourth in one (a) and fifth and lowest behind Llyn Alaw in another two (b,c). Llyn Alaw is ranked fourth by the criteria of scales (b) and (c) and fifth and lowest by (a) and (d). This pattern is reminiscent of the results of the aforementioned subjective evaluations where the values allocated to the Llyn Llydaw and Nant Gwynant landscapes (both in the Snowdonia National Park) were consistently high, but there were greater discrepancies in the valuation of the other three sites suggesting that personal preference and perception often play a greater part in the subjective evaluation of more moderate quality landscapes.

For the purpose of this study, we shall concentrate on the gross value to landscape (GVTL) data in column (d) which includes accommodation costs. The reason for selecting this data set, rather than those of columns (a), (b) or (c) is that the valuations of those three "assume that all WTP for travel to and accommodation in an area is due to landscape" (Bergin, 1994). This is only an assumption and is dependent on levels of other attributes such as recreation being available in equal amounts and values at all the sites. Due to the differing recreational qualities of the sites the assumption is unlikely. The GVTL data, however, have been disaggregated from the total value, via token allocation, to calculate the proportion of the value which can be attributed to landscape so as to give a monetary value for this attribute.

Monetising the Subjective Evaluation Values.

As the landscapes studied in Bergin's (1993) TCM study were included in the surveys in chapters 6 and 7 it is possible to transform the subjective landscape scores into monetary values. Once this has been achieved, it will be possible to apportion a monetary value for each single point on the subjective scale. These values may then be applied to the increase in the scores which attributed to additional woodlands in chapter 8 to give a monetary value for the proposed woodlands.

A regression analysis was conducted between the mean landscape values from the initial survey and the gross value allocated to landscape (GVTL) (Bergin, 1993). The results are given in Fig. 9.7.

Fig. 9.7. Mean values for each site and Bergin's (1993) gross value to landscape.

Site	Landscape Value	GVTL
Llyn Llydaw	23.3	£37.63
Nant Gwynant	20.8	£31.90
Storey Arms	15.6	£25.56
Clywedog	13.7	£26.89
Llyn Alaw	10.7	£19.06

The regression analysis gave an r-squared value of 0.932 which suggests a strong correlation between the two scales. The regression equation was:

GVTL = 6.22 + 1.31 SCORE

This equation allows the transformation of values from one scale to the other. Multiplying each point on the Harding & Thomas evaluation scale by £1.31 gives the landscape value in monetary terms. This not only allows us to monetise landscape values but also to predict the added aesthetic benefit of proposed planting on a monetary scale.

Monetising the Predicted Value of Proposed Tree-planting

By utilising this monetary value it is possible to transform the values allocated for aesthetic improvement due to proposed tree-planting in chapter 8. Values are allocated in chapter 8 for increases in landscape quality due to new woodlands and their design. The following calculations relate to the mean value for those designs which would have a beneficial effect on the landscapes concerned. The mean value for improvement from an increase in additional planting in chapter 8 is a score of 2.5 points. If these woodlands were to be planted, the landscapes would improve on average by 2.5 points on the Harding & Thomas scale. Multiplying these 2.5 points by the £1.31 per point extracted from the above data gives an average value per visitor per day of £3.28 attributable to the proposed planting.

If we assume that all visitors have the same valuation as those in Bergin's (1993) study, then an overall monetary value attributable to the increased aesthetic value of such proposed woodlands could then be calculated by multiplying this aggregated value of £3.28 per visitor per day by the number of day visits to any particular area. What follows is a county by county breakdown of the increased aesthetic value attributable to proposed tree-planting of the type highlighted in chapter 8. This is achieved by multiplying the £3.28 per visitor per day by the number of "tourism day visits" per year (United Kingdom Day Visits Survey, 1996) to each of the 22 Welsh unitary authorities. Note also the bracketed (R) or (U) after each unitary authority, the (R) signifying the predominantly rural authorities, (U) being those authorities with a strong urban element.

Fig. 9.8. Monetary value of increased aesthetic value for landscapes of each unitary authority attributable to proposed new planting.

(Figures for "Tourism Day Visits" are for 1996, courtesy of United Kingdom Day Visits Survey, 1996).

Unitary Authority	Tourism Day Visits	Monetary Value of Proposed Planting to Landscape (£M)
Anglesey (R)	523,000	1.72
Blaenau Gwent (U)	547,000	1.79
Bridgend (U)	2,489,000	8.16
Caerphilly (U)	981,000	3.22
Cardiff (U)	8,184,000	26.84
Carmarthenshire (R)	1,850,000	6.07
Ceredigion (R)	1,997,000	6.55
Conwy (R)	4,130,000	13.55
Denbighshire (R)	3,725,000	12.22
Flintshire (U)	1,628,000	5.34
Gwynedd (R)	1,553,000	5.09
Merthyr Tydfil (U)	628,000	2.06
Monmouthshire (R)	1,779,000	5.84
Neath / Port Talbot (U)	849,000	2.78
Newport (U)	1,465,000	4.81
Pembrokeshire (R)	2,487,000	8.16
Powys (R)	4,165,000	13.66
Rhondda/Cynon/Taff (U)	1,901,000	6.24
Swansea (U)	3,478,000	11.41
Torfaen (U)	553,000	1.81
Vale of Glamorgan (U)	2,150,000	7.05
Wrexham (U)	884,000	2.9

These data give an overall monetary value for increased aesthetic quality attributable to proposed planting of £157.3 million per year for the whole of Wales. This translates to an average of £74.90 per hectare for the whole of Wales. This annual benefit can be roughly compared with a current cost of planting estimated at £2,000 per hectare at current grant levels.

As Bergin's data was based on rural sites and TCM data it is worth noting the value of £73.86 million for the total aesthetic quality increase for the predominantly rural unitary authorities (bracketed 'R' above). The urban figure for the value of amenity planting to visitors would be £84.42 million, but the significantly higher resident population of such urban areas would also benefit from urban planting and would raise this latter figure considerably.

These results are comparable with those of Price (1991). That study suggested that amenity trees improved the average grade by I on a scale –II to X (1 point accounting for 8.33% of the scale) whilst this study suggested an average increase of 2.5 points on a scale of 0-30 (2.5 points also accounting for 8.33% of the scale). Price (1991) also calculated the value of the amenity tree resource for the whole of Britain, at an annual value of £1,250 million for the whole of the population. This figure ties in with the valuation for added aesthetic value for the proposed amenity planting in Wales suggested previously. Given that the value of proposed woodlands for Wales was £157.3 million, and Wales accounts for approximately 8.5% of the area of Britain, the figures suggest that the Welsh figures may in fact be reasonable values albeit that the two figures are for different aspects of amenity tree value.

If such planting was to take place in Wales, then it would be more likely to be on a small, regional scale than on a country-wide level. Decisions would then need to be made as to which areas might best benefit from investment in tree-planting programmes. It might be decided that those areas most visited and hence most highly valued by the above TCM should take precedence. Alternatively, it might be that landscapes of low scenic quality which are less visited should be concentrated on to raise their landscape value. The following chapter utilises the county of Gwynedd in order to illustrate the usefulness of a landscape evaluation-based indicative forestry strategy in deciding on the best modes of tree-planting for landscapes of differing aesthetic value.

CHAPTER 10

LANDSCAPE EVALUATION OF THE GWYNEDD LANDSCAPE AS A BASIS FOR AN INDICATIVE FORESTRY STRATEGY.

We discussed, using examples, in chapter 8 how different types of tree-planting and woodland/forest design may or may not be appropriate in different landscape types. This chapter takes this a step further by using a landscape evaluation survey as a basis for an indicative forestry strategy and providing design prescriptions based on the quality and aesthetic values of existing landscapes.

The Value of Statistical Analysis in Predicting Aesthetic Quality.

It is impossible to predict with absolute certainty that any landscape, when classed by a particular variable, will be of a certain aesthetic standard. We are unlikely to be able to state unequivocally that all the landscapes in Wales which lie at an elevation of 800-1000 metres will be scored at between 20-25 on Harding & Thomas' landscape evaluation scale. Neither can we conclude (as proved in chapter 6) that all the Welsh landscapes which fall into the ITE's coastal Land Class 8 will score between 10-15 on the same scale. What we can decipher from the analysis of data concerning land class and previous evaluations of landscape is whether or not there is some correlation between variables. This could then be of some use in predicting the quality of landscapes yet to be evaluated. Whilst not all landscapes of 800-1000 metres in elevation will score between 20-25, it might be that most of these landscapes would be so valued or that they would be more likely to be allocated such a value than would a landscape of 50-200 metres in elevation. Equally, it might be possible to predict that landscapes within some of the ITE's land classes would score higher aesthetic values than those within other land classes. If a strong relationship existed between two variables, then this raises the possibility of using one set of variables to predict the probable value/level of the other set.

Through the predictive use of statistical analysis, it should be possible to gauge the likely aesthetic value of a landscape which has not been evaluated. If it proved possible to predict that landscapes of a specific character would probably earn a landscape value within a particular range, then such data could be used in development planning. The possible applications for such data manipulation could be myriad. In the urban scene, such analysis might be used to decide the appropriateness of certain architectural developments. In the rural environment, such data might prove useful in the designation and protection of areas of higher aesthetic value. In the context of this study, the statistical data will be used as a basis for an indicative forestry strategy for the evaluated area.

There will clearly be some obstacles which mean that aesthetic values for all landscapes can not be predicted accurately by means of relationships with another variable such as elevation or land class. The influence of visual detractors can be significant in any landscape type, possibly even more so in those of greater scenic quality. An ill-designed woodland or a scene of industrial dereliction is capable of greatly affecting the value of the otherwise highest quality landscape. However, if an indicative forestry strategy was to be based on such data as those discussed above, then the influence of aesthetic detractors (which are not accounted for by such classifications) would not be considered. Whilst such influences should be noted, they may not be of such importance as to invalidate the possible use of techniques such as this which do not take account of them.

Fig. 10.1. Connah's Quay. An example of landscape degradation due to industry.

Study Method and Area of Study.

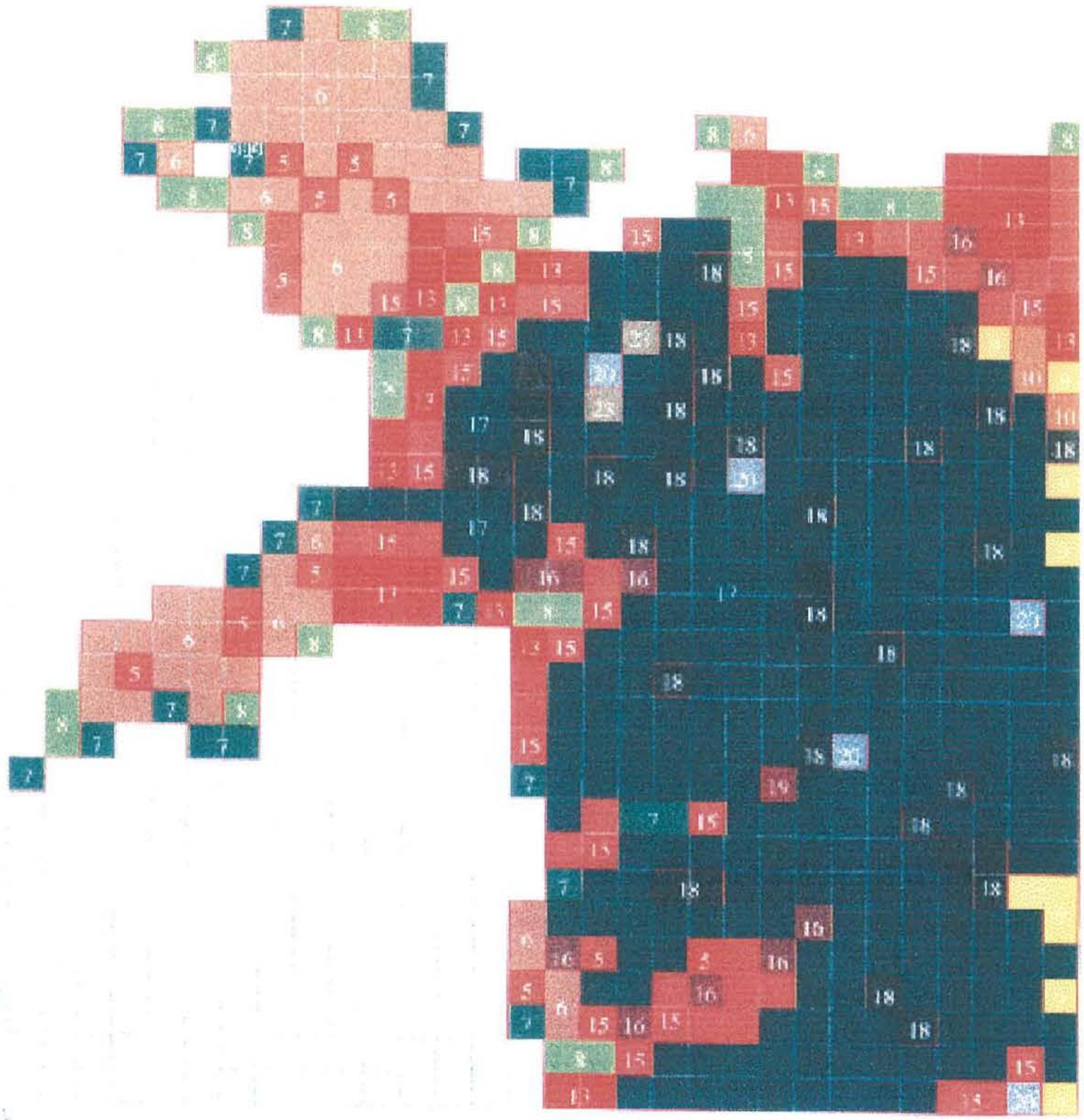
The area of study for the purpose of this analysis was the Welsh county of Gwynedd, prior to the local government reorganisation of 1995. The data utilised were originally commissioned by the pre-1995 Gwynedd County Council to be included in map form in the forthcoming "Gwynedd Atlas". It was decided between the author and the atlas's editorial team that a grid consisting of 3.33km × 3.33km squares would provide sufficient accuracy for the purpose of this study. Consequently, the area concerned was divided into a grid of 440 squares (or parts of squares) to provide a 100% survey of the area concerned. The landscape of each of these squares was evaluated by the author, in the field, and allocated a value based on the Harding & Thomas scale utilised in the earlier studies. Each landscape was evaluated by standing in the south-eastern corner of each grid-square and facing in a north-westerly direction.

Land Class Data.

A map of land class data for the area concerned was kindly produced by Dave Norris, of the Institute of Terrestrial Ecology (Bangor). The map divided Gwynedd by means of a 3.33km × 3.33km grid such as that of the landscape evaluation study. The land class number allocated to each grid square was chosen on the basis of which land class predominated in each square. The reason for this was that the original ITE survey was in the form of a $1km^2$ grid and, as a result, it was usually the case that more than one land class was found to fall within any particular 3.33km × 3.33km of the evaluation survey grid. However, this "generalisation" could not be said to be a serious source of error as, although variability existed within many squares, the predominant land classes for each grid-square tend to be clustered together as the map (Fig. 10.2) illustrates. It was decided that this method would give the most representative classification possible as, unlike a mean value for elevation for instance, an averaging of land class numbers would have been statistically meaningless.

Fig. 10.2. Land Class Map for Gwynedd.

(Reproduced by kind permission of D.Norris, ITE, Bangor).



Statistical Analysis of the Data

ANOVA

<u>Fig 10.3. Analysis of variance between land class and landscape values.</u>

```
One-Way Analysis of Variance

Analysis of Variance for SCORE
Source     DF       SS        MS        F       P
L.Class    11   1177.7     107.1     7.04   0.000
Error     428   6510.2      15.2
Total     439   7687.9
                                   Individual 95% CIs For Mean
                                   Based on Pooled StDev
Level       N     Mean     StDev   --+---------+---------+---------+---
 5         15   12.933     3.240       (---*---)
 6         69   12.652     2.925        (-*-)
 7         37   13.919     3.022          (--*-)
 8         34   12.941     3.054        (--*--)
13         28   12.857     2.990        (--*--)
15         39   14.949     3.960            (--*-)
16          6   16.167     2.137           (-----*------)
17        182   15.962     4.531                 (*)
18         24   16.958     4.894                 (--*--)
19          1   17.000     0.000   (--------------*--------------)
20          3   20.333     2.887                  (--------*--------)
23          2   21.500     0.707                  (----------*----------)

                                   --+---------+---------+---------+---
Pooled StDev =    3.900             10.0      15.0      20.0      25.0
```

An analysis of variance (ANOVA) was conducted on the results of the field survey, in order to gauge whether or not there was a relationship between the Institute of Terrestrial Ecology's (ITE) land class (LC) for each site and the site's aesthetic value as assigned in the survey. The pre-survey expectations might be that the landscapes in the high numbered land classes 20 and 23 (though the numbers themselves are merely labels, and are of no statistical significance) would score higher vales than the remainder. The results of the ANOVA appear to support this view. The mean values for these two land classes (20 and 23) are higher than any of the others, at 20.333 and 21.500 respectively. It is not possible to use regression or correlation analysis to gauge the relationship between an increase in scores and an increase in the land class number, as the fact that these higher scoring landscapes happen to fall within the higher numbered land classes is merely coincidental. Whilst land classes 20 and 23 are the highest numbered in Gwynedd, and also happen to be upland in character and of greater elevation than the other land classes in the county, the land class numbers themselves do not signify an increase in aesthetic quality, elevation or any other variable. In fact, land class 31, in the north of Scotland, is described by the ITE as "Drowned coastlines, indented with some coastal plains backed by low hills."

Pairwise Comparisons.

As the ANOVA suggested strongly ($p = 0.000$) that there are significant differences between the means of the landscape values for some land classes, an analysis in the form of pairwise comparisons was made.

Fig. 10.4. Fisher's pairwise comparisons between land class and landscape values.

```
    Family error rate = 0.717
Individual error rate = 0.0500

Critical value = 1.966

Intervals for (column level mean) - (row level mean)
```

	5	6	7	8	13	15
6	-1.903 2.466					
7	-3.333 1.361	-2.829 0.296				
8	-2.385 2.369	-1.896 1.318	-0.844 2.799			
13	-2.377 2.530	-1.923 1.513	-0.859 2.982	-1.873 2.041		
15	-4.345 0.314	-3.833 -0.760	-2.789 0.730	-3.807 -0.208	-3.991 -0.192	
16	-6.937 0.470	-6.778 -0.251	-5.622 1.127	-6.621 0.170	-6.759 0.140	-4.580 2.145
17	-5.088 -0.968	-4.393 -2.225	-3.425 -0.660	-4.453 -1.588	-4.661 -1.548	-2.366 0.340
18	-6.549 -1.501	-6.123 -2.489	-5.049 -1.030	-6.061 -1.973	-6.234 -1.968	-3.999 -0.020
19	-11.986 3.852	-12.071 3.375	-10.852 4.689	-11.838 3.721	-11.946 3.660	-9.817 5.714
20	-12.249 -2.551	-12.203 -3.159	-11.017 -1.812	-12.010 -2.774	-12.134 -2.818	-9.979 -0.791
23	-14.339 -2.795	-14.348 -3.348	-13.148 -2.015	-14.138 -2.980	-14.255 -3.031	-12.110 -0.992

	16	17	18	19	20
17	-2.976 3.387				
18	-4.291 2.708	-2.662 0.668			
19	-9.115 7.449	-8.727 6.650	-7.867 7.784		
20	-9.588 1.255	-8.835 0.091	-8.070 1.320	-12.187 5.520	
23	-11.594 0.927	-10.990 -0.087	-10.185 1.102	-13.891 4.891	-8.166 5.833

When a Fisher's pairwise comparison test was conducted, it was discovered that of the 66 pairwise comparisons, zero did not fall within a total of 26 of the confidence intervals. Consequently, it is possible to reject the null hypothesis that there is no significant difference (at the 95%) level between the mean values for these 26 comparisons, and to suggest that the land class may have some bearing on aesthetic landscape values. The results suggested significant differences in Fisher's pairwise comparisons between the following:

LC15 and LC6	LC20 and LC5
LC16 and LC6	LC20 and LC6
LC17 and LC5	LC20 and LC7
LC17 and LC6	LC20 and LC8
LC17 and LC7	LC20 and LC13
LC17 and LC8	LC20 and LC15
LC17 and LC13	LC23 and LC5
LC18 and LC5	LC23 and LC6
LC18 and LC6	LC23 and LC7
LC18 and LC7	LC23 and LC8
LC18 and LC8	LC23 and LC13
LC18 and LC13	LC23 and LC15
LC18 and LC15	LC23 and LC17

The critical value for the Fisher pairwise comparison was as follows:

Fisher's critical value = 1.966

As was previously noted, the land class numbers themselves are of no statistical relevance, which disqualifies their use for regression analysis. However, the data above do illustrate that the higher scoring landscapes, particularly land classes 18, 19, 20 and 23, are mostly to be found in areas of higher elevation, almost all of which fall within the boundaries of the Snowdonia National Park. The lowest scoring landscapes, particularly those in land classes 5,6,7,8 and 13, are almost exclusively lowland and predominantly coastal. Another point worth noting is that these latter landscapes, in the main, fall outside the Snowdonia National Park, a large proportion being on Anglesey and the Llŷn peninsula.

The Effect of Other Variables on Landscape Values.

Whilst it is clear that no positive causal relationship exists between land class number and landscape aesthetic values, it does appear that some land classes consistently score higher aesthetic landscape values than others. If the land class number itself can not be used as a predictor, then it is possible that those variables which influence aesthetic quality can be identified by returning to the very beginning of the landscape evaluation work. This leads us to look at the different variables which were considered by the ITE when classifying landscapes into land classes in the first place. This may suggest which variables would be worth utilising in performing correlation analysis with the landscape values. For the data to be used in simple correlation analysis, it is necessary that the chosen variable will be in numerical form. According to the ITE, the classification of the data was based on the "analys(is) by Indicator Species Analysis to produce the 32 land classes which reflect arbitrary but reproducible separations of the land surface", (Bunce et al. 1980). Records were made "of vegetation, soils, land used and ecological features", (Bunce et al. 1980). The difficulty with such descriptive data, is in their inappropriateness for the purpose of correlation and regression analysis. However, as it appears that land class has some bearing on landscape value, it is possible that the variable partly responsible for aesthetic values also played a significant part in the formation of the descriptive variables utilised in the ITE's land classification. The variable concerned is that of land elevation. It is instrumental in the formation of all four of the ITE's descriptive data categories listed above by Bunce et al (1980) and may well have a significant influence on the aesthetic quality of landscape.

It is probable that elevation alone does not explain an increase in values, the effect of relief might also have a bearing on such scores. It is also probable that the influence of the latter is greater than that of the former, though landscapes of higher elevation will tend, also, to be those illustrating more dramatic changes in relief. It might be worthwhile to conduct an ANOVA and regression analysis of landscape values against elevation or relief as it appears that either or both these variables might have some bearing on values. If it was discovered that there was a strong correlation between either elevation or relief and landscape values, such information could be useful in the construction of indicative forestry strategies. Statistical analysis concerning relief is not pursued in this study due to the lack of data availability.

Statistical Analysis of Landscape Values Against Elevation Data.

The landscape values used here were those previously used in the statistical analysis with the land class data. The land elevation data were gathered from the Ordnance Survey's 1:50 000 scale "Landranger" series of maps. Each 3.33km × 3.33km grid square's elevation was noted by means of a scale divided at 50 metre intervals. The elevation at the central point of each grid square was selected for reference.

Regression analysis was conducted between landscape scores and land elevation (at 50 metre intervals). The scatter plot is given below.

Fig. 10.5. Scatter plot of landscape values against elevation (at 50 metre intervals).

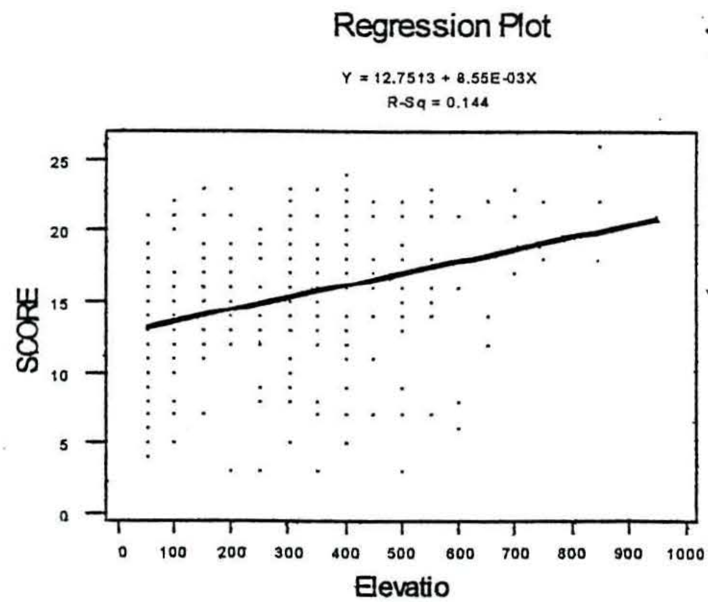


Fig 10.6. Regression analysis for landscape values against land elevation (at 50 metre intervals).

```
The regression equation is
SCORE = 12.8 + 0.00855 Elevation2

Predictor        Coef       StDev          T        P
Constant      12.7513      0.2983      42.74    0.000
Elevatio    0.0085493   0.0009962       8.58    0.000

S = 3.876       R-Sq = 14.4%     R-Sq(adj) = 14.2%

Analysis of Variance

Source         DF          SS          MS         F        P
Regression      1      1106.6      1106.6     73.65    0.000
Error         438      6581.3        15.0
Total         439      7687.9
```

The data were also analysed to discover the correlation between the aesthetic landscape values and the elevation. The correlation co-efficient of 0.379 showed that a positive correlation exists between these two variables, albeit a moderately weak one. It is also worth noting from the scatter plot that there is less variability in values for the higher elevated landscapes than for the lower ones.

Conclusions on the Statistical Analysis.

The nature of the land class data was inappropriate for the purpose of regression analysis. However, the ANOVA did suggest that landscape values were related to land class. The weakness of the relationship between land class and landscape aesthetic values does not eliminate the usefulness of such data as the basis for indicative forestry strategies, which is to be the ultimate application for these data for Gwynedd in this thesis. What this does mean, is that it is not feasible for a land class map to be utilised as a substitute for a landscape evaluation survey/map on which to base such a forestry strategy.

The results of the statistical analysis conducted on the landscape values and land elevation were not dissimilar to those between landscape values and land class (though the nature of the data meant that one could take this elevation data analysis further by conducting regression analysis). The analysis suggested that the two variables were related, but the weakness of the relationship did not lead one to the conclusion that elevation was largely responsible for differences in aesthetic value. As with the land class data, the conclusion is that elevation data could not be used as a substitute for landscape evaluation surveys. However, although the results proved to be of insufficient strength to support such applications as those aforementioned, they suggested that the elevation of the landscape concerned can have a substantial influence on aesthetic value and should probably be borne in mind when constructing indicative forestry strategies. One further point worth considering, that might follow on from this work, is the possibility of using regression analysis between relief and landscape values. For example, measuring the length of contour lines within each grid square by means of GIS and plotting the results against landscape values may shed further light on matters.

AN INDICATIVE FORESTRY STRATEGY FOR GWYNEDD.

As was discussed in previous chapters, the planting of new woodlands and forests will not be desirable in all landscapes, from an aesthetic standpoint. Some landscapes will benefit from any new planting, such as those evaluated in the groups "unsightly" or "undistinguished". Even single aged, single species conifer plantations will often have a positive impact on such landscapes. Conversely, those landscapes evaluated as being of "superb / excellent" or "spectacular / exceptional" aesthetic quality may not be as accommodating to land use change and would be likely to suffer aesthetically if planted with anything other than sympathetically designed amenity trees or woodlands.

Once it is accepted that different landscapes have differing needs where the planting of trees is concerned, it is useful to provide foresters and land managers with a plan, in map form, which represents the landscape quality of the area in question. This, as part of an indicative forestry strategy, will highlight those areas where tree-planting might be most desirable and, even more importantly, those areas where only the most carefully designed tree-planting should take place. As Clwyd County Council (1995) state, "The Indicative Forestry Strategy is concerned with..... identifying preferred opportunities for the creation of new woodlands on a significant scale; identifying areas where such expansion would be inappropriate in terms of present or alternative land use; providing a framework for responses when consulted by the Forestry Authority on application for establishment grant under the Woodland Grant Scheme". Such a strategy provides foresters and planners with a framework which identifies a landscape's differing tree-planting needs in a similar way to that by which urban structure plans identify a town or city's architectural needs.

The first example of an indicative forestry strategy was that produced by Strathclyde Regional Council in 1988 (Strathclyde Regional Council, 1988). Its purpose was to identify those areas of the region where forestry would be most appropriate. Price (1993) based his introduction to the subject on the method used in the Staffordshire County Council Study of 1991. He highlights the substantial role played by landscape assessment in forming an indicative forestry strategy and the importance of an objective approach to the assessment of landscape character. Price (1993) stated that, "it is essential that a landscape assessment is dictated by the scale and character of the landscape" as the assessment itself is not the same as the strategy, although it does play a substantial role in its construction. He is also careful to distance such work from the more subjective field of landscape evaluation, stating that the purpose of assessment is, "to describe the visual appearance of the landscape, not to establish quality standards". However, he also recognises that "the landscape is composed of.....the components....their attributes.....and the way they are arranged." Whilst the classification of components and their attributes are accounted for by landscape assessments, the way in which they are arranged is a much more visual, aesthetic and subjective consideration.

A Role for Landscape Evaluation.

The evaluation and recognition of an area's landscape quality could play an important role when drawing up such strategies. It might be decided that those areas of the highest aesthetic quality should be preserved as they are, or that only the highest quality amenity planting should be allowed. It might also be decided that the introduction of any type of woodland would benefit lower quality views. This might lead planners to decide on pure amenity planting to substantially increase the quality of such low quality landscapes or to earmark such land for conifer plantations in order to direct such tree-planting away from landscapes of higher quality.

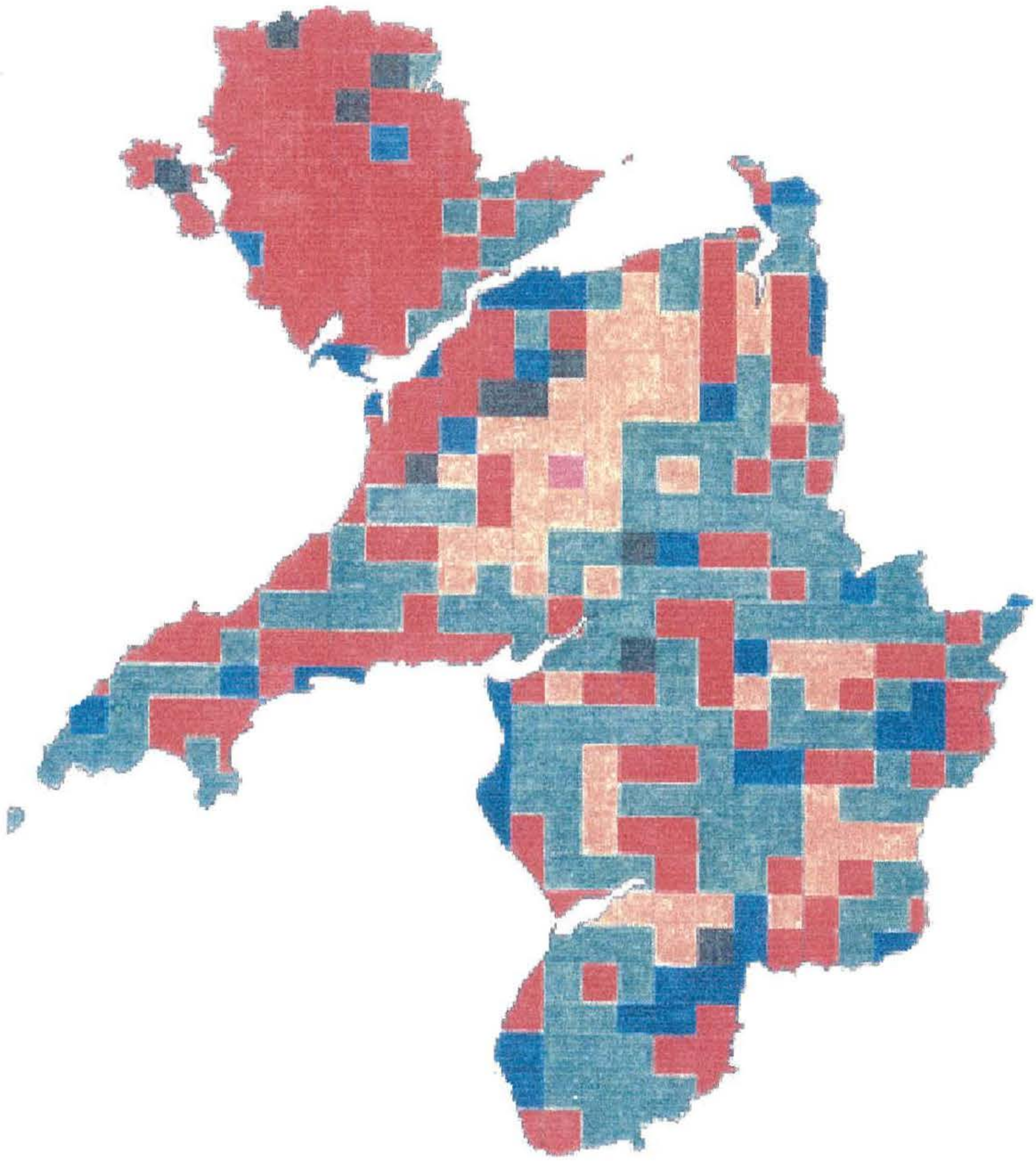
An Indicative Forestry Strategy for Gwynedd.

When producing the map on which an indicative forestry strategy is to be based, it is necessary to provide a full survey which covers the whole of the land area in question. As the landscape evaluation survey of Wales utilised only a sample of Welsh landscapes, the results could not be depicted in map form to provide a strategy for the whole of Wales. Consequently, the basis for the indicative forestry strategy is the landscape evaluation survey conducted for the whole of the Gwynedd land area (the county of Gwynedd prior to the 1995 re-organisation of local government).

As the whole of the land area concerned was evaluated, the results of the survey can be depicted in map form. The results show, as might be expected, a normal distribution of values with a lower number of landscapes grouped at each end of the scale, in the group classed "unsightly" where there were 11 squares, and the group classed "spectacular / exceptional", where there was only 1 square. There was an increased number of squares in the groups "undistinguished" and "superb / excellent" with 50 and 53 squares respectively. The great majority of landscapes fell into the groups labelled "pleasant" (184 squares) and "distinguished / attractive" (155) squares which accounted for 74.67% of the total. Percentage totals for each category are given below:

Unsightly	2.42%
Undistinguished	11.01%
Pleasant	40.53%
Distinguished / Attractive	34.14%
Superb / Excellent	11.67%
Spectacular / Exceptional	0.22%

Fig. 10.7. Landscape Evaluation Map for Gwynedd

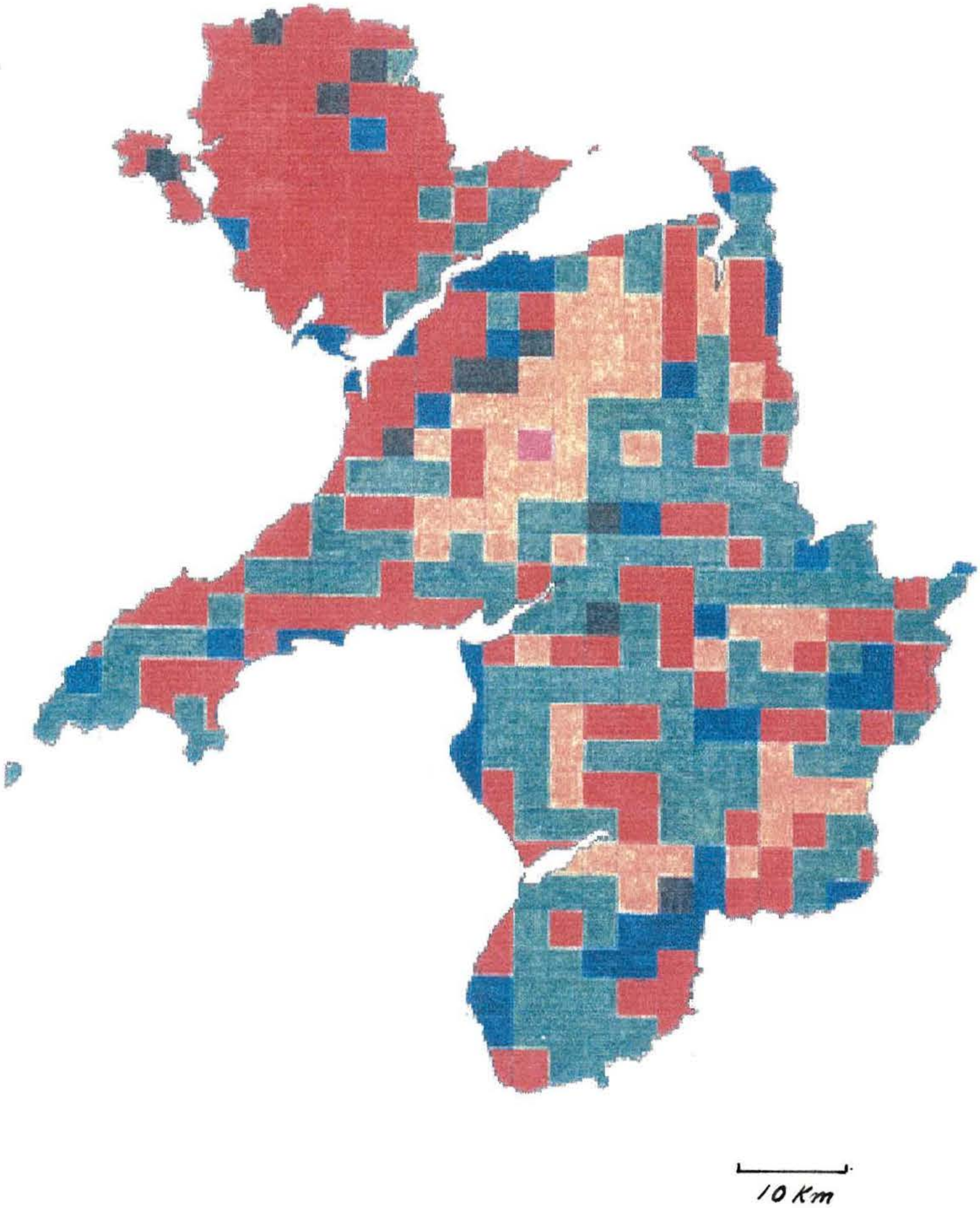


0-5	Unsightly
6-10	Undistinguished
11-15	Pleasant
16-20	Distinguished / Attractive
21-25	Superb / Excellent
26-30	Spectacular / Exceptional

When the data were depicted in map form it became clear that the squares did not appear as a random scatter but, rather, in patches or groups of landscapes of similar aesthetic quality. Many of the landscapes classed as "unsightly" are seen to follow the slate beds of north-west Snowdonia, although most of the other squares in this group are individual man-made constructions such as power stations, and their locations are random. Many of the landscapes in the group "undistinguished" are in coastal areas where there may be a strong human influence, urbanised or otherwise, whilst most of those to the south of the county are landscapes with a strong element of coniferous planting with a lower degree of naturalness in their design than those in the higher scoring groups. What is most noticeable is the high uniformity in the perceived aesthetic quality of the Anglesey landscapes. Apart from the areas of mainly broadleaved parkland to the south of the island, the conifer woodlands to the south-west and the four human-influenced "unsightly" views, the whole of the remaining landscapes fell into the group "pleasant". These are mainly areas of pastoral or arable land without a particular strong woodland element. Landscapes of similar land use and aesthetic quality are to be found in the valley bottoms throughout the county and also predominate on the Llyn peninsula. The landscape evaluated as "distinguished / attractive" are relatively evenly distributed throughout the county. These are views of slightly more undulating landform than many of those in the group discussed previously and there will often be a greater sense of wooded character to these landscapes. As the map illustrates, there is a high concentration of landscapes classed as "superb / excellent" in the area which forms the north of the Snowdonia National Park. Whereas the previous group of landscapes were of undulating landform, these could be said to be more rugged and mountainous in nature. These include the valleys of Nant Ffrancon and Nant Peris as well as Cwm Pennant. Towards the south are Cader Idris and the Arenig range near Dolgellau and Bala respectively. Only one landscape was classed as "spectacular / exceptional ", this being the view of the Snowdon horseshoe from the south-east. This is a view of the highest quality, not only illustrating the rugged grandeur of Snowdon at its very best, but also being a well constructed composition as a whole.

The Indicative Forest Strategy.

Fig. 10.8. An indicative forestry strategy map for Gwynedd.



GROUP 1. 0-5. Unsightly
GROUP 2. 6-10. Undistinguished
GROUP 3. 11-15. Pleasant
GROUP 4. 16-20. Distinguished / Attractive
GROUP 5. 21-25. Superb / Excellent
GROUP 6. 26-30. Spectacular / Exceptional

With the landscape evaluated, it is possible to utilise the evaluation map as a framework in deciding which types of tree-planting might be appropriate for landscapes of varying aesthetic quality. Saxby's (1993) indicative forest strategy for the Llyn peninsula resulted from a GIS based landscape assessment. Maps were produced for different types of planting and the land was classed into one of six groups depending on which type of woodland or plantation was under consideration. The six groups relating to tree-planting were "existing", "unavailable", "unacceptable", "sensitive", "potential" and "preferred".

By using the aforementioned evaluation data and map for Gwynedd it is possible to construct an indicative forest strategy which can be depicted in single map form, by making prescriptions for planting dependent on the aesthetic quality of the existing landscape.

The groups and labels used in the landscape evaluation scale provide a useful starting point in constructing the groupings for the indicative forest strategy. It would not be possible to utilise Saxby's (1993) labels as some of the titles, such as "Existing" and "unavailable" for tree-planting, are not as applicable to the evaluation based strategy as they may be to one based on assessment. What follows is a group by group discussion of the types of landscape quality involved and the effect on forest and woodland selection.

Group 1. "Unsightly". These are landscapes of the lower aesthetic quality. They are mostly areas with a strong element of human activity, this being in the form of extractive industries, large scale industrial constructions or derelict land. They are the types of landscapes which would benefit from almost any land use other than that which presently exists. Where tree-planting is concerned, any planting would prove beneficial to the visual quality of such areas. Some amenity planting could certainly prove beneficial, as is being done in some of the areas adjoining the Penrhyn Quarry in Bethesda. Such planting can soften the visual impact of slate heaps, for example. Counterfoil planting, groundshaping and even some screening might be options where constructions such as power stations are concerned. There is a case to be made that even large scale block conifer planting could prove beneficial. In truth, it is difficult to envisage any type of tree-planting which might be to the aesthetic detriment of landscapes such as these.

Group 2. "Undistinguished". This group includes a number of landscapes which have a strong element of conifer plantation forestry. There may be a presumption towards extending such planting in such areas if the character of the existing landscape is not negatively affected. It is conceivable that conifer plantations would also be visually acceptable on the coastal flats of south-west Gwynedd. It might be argued that if additional conifer plantations were deemed necessary within this area, that such planting should be mostly restricted to landscapes such as those within this group, many of which support existing plantations. Whilst plantations should not have a detrimental effect on the landscapes in this group, the planting of amenity trees could certainly prove aesthetically beneficial, pushing some views up into the next group ("pleasant"). The basis for planting in such landscapes should be to seek, where possible, to increase aesthetic value, rather than to view them as areas where any type of tree-planting would be visually acceptable. There are certainly examples of existing plantation landscapes in this group which could benefit from some amenity planting and re-design. There are other landscapes included here where plantation form has been largely responsible for the landscape being categorised as "undistinguished" rather than "pleasant" or "distinguished / attractive", such is their capacity to affect landscape values.

Group 3. "Pleasant". Some landscapes in this group may be able to accept some sympathetically designed and well integrated conifer planting. Many of these landscapes are lowland, farmed areas which possess some trees, either in the form of small woodlands or hedgerows. Any planting of conifers, for example in a farm woodland enterprise, should be on an intimate scale and well-related to the surrounding woodland pattern. Planting amenity broadleaves would increase the aesthetic value of many such landscapes. This is particularly visible in Anglesey where most of the landscapes scored in this band, but those with a higher broadleaved constituent fell into the group "distinguished / attractive". A design consideration which is of particular importance to such landscapes is that of visual interlock. Many of the landscapes classed as "pleasant" possess a strong element of hedgerow or small woodlands. Any new planting should aim to continue the sense of interlock and balance between hedgerows and woodlands, as well as between open spaces and wooded areas. It is unlikely that most types of tree-planting would greatly enhance the quality of these landscapes. However, the genius loci and character of such areas depends heavily on the existence and retention of a strong element of broadleaf woodland and/or hedgerows. The aim should be to maintain such character by restocking when necessary.

Group 4. "Distinguished / Attractive". Many of these landscapes are of undulating landform and include areas of well-stocked broadleaved woodlands as well as some of the better designed conifer forests where form and species mix have been considered. Any new planting should be in harmony with the existing woodland pattern. Any conifer planting would need to be of the highest aesthetic quality to avoid degrading the landscape's aesthetic value. There are examples of landscapes, particularly to the south of the country, where insensitive conifer planting has been responsible for relegating views which would otherwise have been grouped here to the group labelled "undistinguished". Amenity planting with broadleaves, as well as sympathetically designed conifer plantations, should lessen the visual effect of tree-planting in such landscapes.

Group 5. "Superb / Excellent". These are landscapes of very high quality. Additional planting should usually be confined to planting where the primary objective would be landscape enhancement. There will often be a strong sense of genius loci in landscapes of this quality and the composition of the setting will often be a significant contributor to the quality of the overall view. Consequently, even the smallest landscape change might disturb the equilibrium. However, in landscapes such as the existing landscape, additional planting of similar species and of sensitive design could be accommodated without detriment to the landscape value. In the long term, some restocking of broadleaves might also be necessary in order to maintain the existing quality of the landscape.

In those landscapes where very few, if any, woodlands currently exists, for instance in some of the more mountainous areas of Snowdonia, any planting should be strongly related to the design principle of integrity and harmony. Woodland edge form should, for instance, be "spiky" rather than rounded to replicate the forms of the surrounding landform. Tidily arranged clumps of broadleaved woodland, whilst being appropriate for many other landscape types, would not be in keeping with the serrated forms of much of Snowdonia and could affect the genius loci of such areas.

Group 6. "Spectacular / Exceptional". These are the highest quality landscapes that one might see. It might be that such views are of sufficient quality that one might decide that any change should be avoided. The only landscape in Gwynedd which was classed in this group was the view of the Snowdon Horseshoe. This view gained a high aesthetic value due to the rugged grandeur of the scene, and even the amenity planting with broadleaves which was suggested as a possibility for the previously discussed groups would not be in keeping with this landscape's genius loci.

Conclusion.

There is certainly a strong case for allowing landscape evaluation to be considered as a factor when drawing up indicative forestry strategies. The example above illustrates how a complete evaluation survey for an area can be adapted into a map on which to base such a strategy, and how landscapes of differing aesthetic quality have different needs where tree-planting is concerned. There may be scope for adding additional information to such a map, for example overlaying data for existing woodland / forestry such as that which Saxby (1993) included in the group "existing" or to note "unavailable" land which may be built-up. What is clear is that an evaluation based forestry strategy could assist in earmarking landscapes which are suitable for new woodlands and forests and, perhaps more importantly, identifying those landscapes where certain types of tree-planting should be avoided.

CHAPTER 11

SUMMARY AND CONCLUSION

The diverting of agricultural land into forestry and woodland establishment provides an excellent opportunity for rural landscape design to be applied. Modern agriculture has, in many areas, had the effect of decreasing the sense of regional aesthetic character. Bland plantation design and inappropriate species selection for planting would be capable of causing further rural homogenisation. However, sensitive woodland design and considered species selection could be utilised for the benefit of rural landscapes by strengthening their regional identity and adding to their aesthetic value.

The first step is to accept that, visually, any type of tree-planting is not necessarily a "good thing" in all landscapes. Landscapes differ in their capability to support different types of woodlands aesthetically, and recognising the type of planting which will be appropriate for any area is a considerable influence in ensuring visual integration.

The principles of landscape and forest landscape design discussed in chapter 4 provide a basis for designing new woodlands, whilst discussion on regional landscape character in chapter 3 highlights the important influence of design cues in existing landscapes. It might be fair to say that landscape design is now, to a large degree, a mature subject where accepted principles are practised by most. However, there may well be some scope for more public participation in rejecting / approving such design principles. The evidence in chapter 7 suggests broad approval and consensus on what constitutes landscape quality and good design, though the results were from an atypical group of respondents.

This thesis outlined methods by which the value of visual landscape may be measured in descriptive (Fines, 1968) and numerical (Harding & Thomas) terms (chapter 5). The method was demonstrated by means of a study of a sample of 89 landscape views located throughout Wales. The majority of these landscapes were selected to provide examples from Wales' different ITE land classes, whilst others consisted of views from the "prestige" visitor sites utilised in Bergin (1993). If there was a weakness in the selection of sites for evaluation it would be that the sample was not totally random, but only random within a stratification. This was due to the need for a selection of landscapes for Wales' different land classes as well as landscapes from a sample of designated areas such as the national parks. For a sample of this restricted size, a totally random selection would, therefore, have been impossible (this problem was addressed in the Gwynedd study by evaluating the total of the county's land area). The landscapes were initially evaluated by the author in the field, then re-evaluated by a group of university students by means of a photographic slide presentation. Both surveys utilised the Harding / Thomas scale of evaluation. Whilst this scale proved satisfactory in use, if the study was to be repeated today then the method would probably be dropped in favour of the scale proposed by Price (chapter 5) which allows for negative scoring of the lowest quality landscapes. However, as both scales are graded equally the results could quite easily be transformed from one to the other.

The survey results appeared to support the case for a single expert evaluator. The strong correlation between the results of the initial survey and the results of the group survey from photographs suggests that the values found in the initial survey were representative of the values for the group as a whole, though it must be noted that the evaluating group were not typical of the general public. This was strengthened further by the strong correlation between the results of the "prestige sites" in the initial evaluation and Bergin's (1993) travel cost method results for the same sites. Whilst the use of photographs appeared to give a satisfactory means of evaluation, the subject of picture quality and weather conditions was raised by one respondent to the survey who made what seems a valid point about the need for all photographs to be of equal quality in order to ensure that it was landscape rather than photographic quality which was being evaluated.

The increase/decrease in aesthetic value for proposed woodland designs for a sample of the evaluated landscapes was predicted and the values given on the Harding & Thomas scale. By using the methodology utilised by Bergin (1993), the data were transformed to give a prediction of the added monetary value per visitor per day which might be attributed to the proposed tree-planting. The added benefit per visitor per day was calculated at £3.28. Data were extrapolated on a county level giving a total monetary value for the additional aesthetic value of proposed woodlands for the whole of Wales (using 1996 Wales tourism figures) of £157.3 M (£72.86 M for rural planting, £84.41 M for urban planting). This is based on the entire landscape being improved by tree-planting. The results are comparable with those of Price (1991). Whilst the method appears to provide a workable means by which to predict the monetary benefit of proposed woodlands, it is heavily dependent on the availability of data for the numbers of visitors/consumers to any particular landscape. It is most useful in valuing landscapes of higher tourist value, such as those valued by Bergin (1993), but its effectiveness may be limited in less visited areas and areas visited largely for non-landscape reasons.

As the data of the Wales evaluation survey consisted only of a sample of landscapes, a further survey was conducted , in the field, for the whole of the pre-1995 county of Gwynedd, the results of the survey also being commissioned for use in the forthcoming "Gwynedd Atlas". The data consisted of the evaluation of a grid of 440 landscapes which accounted for the whole of the county area.

The data were initially analysed to discover whether land class or land elevation could be used to predict landscape values. Whilst the analysis of variance (ANOVA) suggested that there might be a relationship between some land classes and landscape values, the nature of the data (that is that the land class numbers are of no statistical significance) meant that it was not possible to take this analysis further by conducting correlation or regression analysis. It also proved that a positive correlation, albeit a weak one, existed between increases in landscape values and increased land elevation, for the Gwynedd survey data. However, the results proved not to be of sufficient strength to suggest that land elevation alone could be used to predict a landscape's aesthetic value. The results of the statistical analysis did not therefore offer any secure means of predicting landscape quality based on regression of either land class or land elevation. There might be scope for further studies to analyse the possible relationship between landform relief and landscape values. However, it seems improbable that such data could replace landscape evaluation as the subjective nature of landscape (chapter 5) means that simply measuring any single component within a view is unlikely to prove a reliable substitute for the subjective approach. Further research would certainly be beneficial, if only to discover the differing degrees of influence of elevation and relief on landscape values.

The previous chapter of this thesis suggests a means by which the subjective landscape evaluation approach may be utilised to provide a framework for indicative forestry strategies (IFS). The evaluation data of the Gwynedd area were used as a basis for a strategy, rather than the landscape classification data usually associated with IFS. Fines' (1968) landscape evaluation labels appeared to provide satisfactory groupings for each landscape quality type, as did the Harding & Thomas numerical scale. Landscapes differed according to their grouping, and they will have differing needs where tree planting is concerned. Consequently, each landscape quality group is discussed individually in order to assess the likely aesthetic influence of different planting designs and species selection. Design prescriptions are provided for these landscapes according to their present quality. It may be decided that landscapes of lower quality should be earmarked for more commercial forms of forestry, even though they may be of the type more likely to benefit most from amenity planting. The highest quality landscapes, often in the uplands, could then be saved from such planting, though planting to increase visual quality might be desirable in such areas.

There might be a case for taking planting guidance further, for instance by providing a firmer prescription for each landscape type within each quality group. This would be particularly relevant in relation to a landscape's genius loci.

The advantage of providing such a strategy would be to ensure a tree planting framework for a whole area, where the present landscape quality would be considered as one of the most important elements. This would aim to increase rather than decrease regional variation and character as it would highlight areas of particular aesthetic importance as well as indicating those where planting with indigenous species was vital to their genius loci.

Conclusion

This study contributes, as far as is known, to the field of landscape evaluation the largest analysis conducted between landscape values and landscape character in the form of the ITE's land class data (both in the Wales sample survey and the Gwynedd county survey).

The monetary valuation of landscape quality suggests what appears to be a workable method for predicting the cash value of landscape change due to tree planting. This work can probably be fairly described as the "first shot" in trialling such a method of relating aesthetics to monetary values. There is certainly evidence to suggest that those landscapes of high quality tend to attract a higher willingness to pay for travel and accommodation. However, more studies are now needed to refine the technique, and particularly to increase the precision of the level of willingness to pay per point of the Harding & Thomas scale. Where the statistical analysis is concerned, observation of the constant regression would be helpful in order to achieve this, the aim being for the value of the constant being as close as possible to zero. In particular, more observations are needed of willingness to pay for landscape at sites where the landscape component has low quality, and probably therefore plays a small role in the decision to visit.

The IFS appears to provide the first example of a solely subjective landscape evaluation-based IFS on a county scale. For any rural authorities / councils wishing to utilise such a method, the results of the statistical analysis (chapter 6) supports the use of single expert for the field survey work (though the strong correlation between the field survey and the group evaluation from photographs suggests there may also be a role for photographic evidence). It is also worth noting that I myself as the evaluator of the Gwynedd landscape could be said to be indigenous to this area, and that there may be a greater need for a calibrator from outside such a familiar background (though there is a possibility that an unfamiliar calibrator might be unaware of an area's cultural landscape, for instance). In other applications, the method would benefit from some adaptation and/or recalibration to suit local perceptions of what constitutes "landscape quality". This might be affected both by the quality of individuals' familiar landscapes and/or by cultural associations instance.

We are now at a time where large sums of money are spent both on landscape enhancement and tree planting. Much of this thesis has aimed to illustrate the significant influence that such developments are capable of having on a landscape. A relatively small effort in the field of landscape evaluation might help to ensure that this is done to the greatest possible effect.

APPENDIX I

TRANSLATIONS FOR CHAPTER 3 POEMS

The following are translations for the Welsh poems given in the section concerning the cultural landscape in chapter 3. The first translation is for the two verses taken from Eifion Wyn's "Cwm Pennant" (c.1905). I have attempted to provide a translation which retains a similar rhyming pattern to the original. This, however, is not the case with the second work, "Yr Wyddfa", by Robin Ddu, c.1450. This earlier work was written in "cynghannedd" and also contains a number of compound words which would lose much in translation. Consequently, this poem is translated here in rather a basic form as I believe an attempt to recreate the compound words in English and the inability to translate cynghannedd would mean that anything other than providing a rough meaning of the work and the poet's basic sentiments would be superfluous. In conclusion, if either poem sounds rather uninspiring in its translated form please do not assume that this was the case for either when presented, as their authors intended, in their original Welsh.

(from) "Cwm Pennant" (orig. Eifion Wyn, c.1905).

Nestling in the lonely old mountains,
In the fairest of valleys I walk, -
The home of the stoat and the foxes,
And dwelling to wood-wren and hawk:
I own not the merest part of it,
Not a lamb or a sheepdog to hail;
But feel as I sit by my fire at night
That I am the lord of the vale.

I shall love the vale of my childhood
For as long as I love any-thing;
As I cherish its hillsides and slopes more and more
With each passing day that life brings;
But my question remains at each dawning,
As I tread the high ridges in grief,
Why Lord was Cwm Pennant created so fair,
And the life of a shepherd so brief ?

"Yr Wyddfa" (orig. Robin Ddu, c.1450).

Snowdon, towering refuge,
Head proudly held aloft above the curtain of land,
Old adornment, ruler of landforms,
Finest nurturer of its inheritors,
Shielding Gwynedd from all threat,
Finest fortress to its people,
Forever clothed in icy robes,
Purest white beneath the falling snow.

APPENDIX II

LANDSCAPE DESIGN BOOK REVIEW

The literature currently available on landscape design in forestry is sparse to say the least. The subject is often fleetingly covered in the form of short chapters within the more general texts concerning arboriculture though it is rare to find a work of any real weight which is devoted solely to the subject of forest design. The literature currently available tends to be in booklet form and no one could be regarded as the definitive guide to forest landscape design in Britain.

We have previously discussed some of the more relevent texts elsewhere but for anyone with an interest in forest design, the following offers a "book review" style introduction to the texts which were consulted during the research for this thesis.

General Landscape Design.

Whilst textbooks covering landscape design are generally useful in the field of urban planting their application in the wider context of countryside landscape design is somewhat restricted. Such works include Weddle (1967), Hackett (1979), Matlock (1991) and Zion (1979). The same can be said of Tandy (1981), Miller (1988) and Lisney and Fieldhouse (1990a; 1990b). Hazlett (1988) approaches the subject from a sculptural, abstract point of view. Although it gives some insight into designing spaces, particularly urban, it is largely aimed at those most experienced in the field of design. One of the most recent design texts is that by Ingels (1992). Though it offers little additional guidance than that previously available the passages aimed at "Analyzing the Landscape Type" provide a very useful introduction to the subject and into the need for a good understanding of the landscape in question as a basis for the ensuing design. Whilst most of these texts provide essential reading matter for anyone with aspirations towards planting trees in the built environment or, similarly, those seeking guidance in the more formal art of garden design, students of the more informal discipline of rural design will not discover much enlightenment here.

Bye (1983) studies the subject of design in a glossy, "coffee table" manner and as a result although his book is very attractive it is rather lacking in depth. Motloch's

(1991) publication is, in most part, a technical work presumably aimed at other landscape architects: however, it also offers an insight into the reasoning behind today's design principles, an aspect which is sadly omitted in most publications of this genre.

Preece (1991) offers more to the countryside designer than any of the aforementioned works and is, probably, the most readable of recent texts on the subject. Crowe and Mitchell (1988) approach the subject from a different angle from most other texts by viewing the landscape as habitat and judging the attempts of the human race in reconcilling development with the larger, natural landscape pattern which predominates. It is not meant as a comprehensive guide to landscape design though it raises some useful points for discussion. Lavishly illustrated throughout, its main fault is the omission of placenames for most of the plates (although someone had attempted to note landscapes familiar to themselves on the copy I found). Anyone wishing further illumination of the ecological approach need search no further than Steiner's work of 1991. Described by the author as a "middle ground approach to landscape planning somewhere between a purely organic and a truly rational one" the accent is towards much deeper analysis of the existing environment / landscape as the main constituent of the design plan. Manning (1975) and McCluskey (1985) both provide brief but informative introductions to the main principles of landscape design.

History of Design.

Hunter (1985) offers a historical account of landscape development. Beginning with the Greeks and glancing at the Roman and Renaissance periods amongst others he gauging their influence on pioneer designers of Britain's house and garden designers, the forerunners of those involved with landscape design today. Despite the undoubted quality of most of the works listed above there are two volumes which should be regarded as the essential introductions to landscape design. Colvin (1970) comprehensively discusses the development and principles of both urban and rural design without delving too deeply into the more technical aspects of the subject. None of the above, however, are written with the enthusiasm in the subject present in Fairbrother's (1974) book. She not only succeeds in more than adequately introducing the subject of landscape design she also manages to instil her own enthusiasm for the subject into the reader. As a result she produced a volume so inspiring it should be the starting point for anyone wishing to study this subject. Thomas (1983) also looks at how landscape design through the use of trees and woodlands has developed in Britain. He acknowledges the significant contribution made by the country landowners of the past and illustrates this with examples of planting from some of their estates as well as offering an insight to some of the species that might be utilized by today's designers.

Plant Form.

There also exists a selection of works which discuss aspects of plant form in design without necessarily giving much guidance on forest design. These include Carpenter et al (1975), Hackett's aforementioned offering of 1979, Zion (1979) and Walker (1991). They discuss plant design with an architectural slant though they do raise some useful points. Plant form is one consideration of the Arboricultural Association's (1990) booklet which allocates values to different types of planting within various landscape types and can be a useful tool in landscape planning. This latter text is useful for valuing both single trees and groups of trees or even woodlands whereas the other works listed above tend only to discuss the use of trees as single, sculptural entities rather than their use as a more influential and often very significant element in the rural scene when utilized by the countryside designer.

Design in British Forestry.

For an historical perspective on design in British forestry Miles (1967) ia a useful starting point. This text as well as Hackett (1974), Downing (1972) and Thomas (1983) offer landscape descriptions as well as an insight into the development of forest design. The Forestry Commission (1968) provides similar information in pictorial form and is a useful companion to Crowe's (1978) more theoretical booklet on the subject. Brown (1851) also offers an insight into early design at a period when forestry became fashionable amongst the aristocracy as a development of garden planning. Of the recent publications Rackham's (1991) text may probably be regarded as the most authorative work in this field. Rackham's knowledge of the subject matter is of a depth unrivalled in similar texts and he produces substantial evidence on subjects such as woodland clearance in attemping to dispel the often cited arguments as to how

Britain's tree cover became so sparse by supporting the view that it was a case of much more gradual clearance than others might claim to be the case and that the effect of felling for the purpose of war efforts was not as important an impact as we might have been led to believe.

Of the publications produced by the Countryside Commission the most useful regarding trees and the landscape is, probably, their report into farm woodlands (1983) which is also interesting as it was used to gauge farmers' attitudes to aspects of landscape as well as describing that which was viewed. Reference is also made to landscape design and change in various other Commission publications many of which are devoted to particular British locations and they provide a thorough introduction to many of our most cherished landscapes. Their reference to cultural and historical aspects of landscape are of particular relevance to the designer where genius loci is an important design consideration. An insight into the effect of genius loci itself may be sought from Norberg-Schulz's (1980) text on the subject. Overall, the work slants towards the built, architectural environment but it does, nevertheless, offer a balanced view of the importance of retaining regional identity which includes a section on "the recovery of place" which supports Hough's (1990) argument for a movement away from the functional ideals of modernism towards increasingly vernacular and indigenously formed landscapes.

Forest Landscape Design.

Forestry in twentieth century Britain has been dominated by the Forestry Commission. The same is applicable to publications on forest design during this period. The aesthetic aspect of forestry was largely ignored until fairly recently, though some might argue that landscape design continues to be the poor relation where woodland planning is concerned (McCluskey, 1986). As a result the Commission has been responsible for some visually disastrous forests in the past. However, they have learnt much from past mistakes (Patterson, 1986) and are, therefore, in a strong position to advise others on future planting. Most of their publications concerning landscape design provide some insight into forest design though their capacity for self-criticism where past planting is concerned is minimal.

Of the Forestry Commission publications which concentrate solely on forest design Crowe's (1966) groundbreaking text is a useful starting point as is her updated and retitled edition published in 1978. Both Crowe and Colvin contributed to Clouston's (1990) guide to the use of plants in landscape design and both their chapters are worth studying. Other offerings of value are the "Guidelines" series (Forestry Commission, 1989; 1990; 1992) which provide a brief yet informative view of the main principles of forest and woodland design. Further advice is found in the form of chapters in more general arboricultural texts (Forestry Commission, 1984; 1988a; 1988b and 1991). Of the non-Forestry Commission publications Price (1987), Richards et al (1988) and Blyth et al (1991) give some insight into the design of small plantations. Also Hart (1991) and Gilg (1978) include some passages which may be of benefit. The only work of any real weight devoted to the landscape of forestry is Lucas' (1991) book, a must for anyone interested in the subject though as the author is an employee of the Commission his treatment of the subject can not be said to be totally unbiased. However, the book succeeds in the fact that it gathers together much of the relevant material which was previously only available in the form of short papers, for example Lucas (1987). Bell (1993) should be read as a prerequisite to Lucas' book as it provides an excellent view into "why" landscape design is necessary rather than "how" it is accomplished which is Lucas' main concern. These are, therefore, complementary volumes which, as a set, offer a deeper insight into forest design through an understanding of wider design principles.

Also, Robinson (1992), though mainly devoted to planting as a means of blending new development, provides a useful section on the structure of woodland and high forest. Another useful text comes from Price (1994). The elements of design here are shown, mainly, in pictorial / diagramatic form and though the work is in leaflet form it, nevertheless, manages to cover most aspects of forest design, a task which Lucas managed to stretch to a 350+ page text. The principle of integrity and the discussion on dialogue and interaction between elements provide a view on an aspect of forest landscape design which is all too often omitted from other texts.

Journals and Papers.

Further enlightenment may be sought from papers published in journals such as "Landscape Research" and "Landscape Design." Brush (1976), Patterson (1986), Brotherton and Duvall (1987) and Campbell (1987) all briefly discuss aspects of forest design. Halliday (1989) views the subject in the wider context of countryside design as a whole while McCluskey's aforementioned paper on the necessity to learn from previous planting errors offers a healthy balance to the Forestry Commission's own publications. Concerns about present forest and forest design policies are also expressed in the Council for the Protection of Rural Wales' report of 1990 as well as in that of the British Association of Nature Conservationists published three years prior in 1987. Such publications may appear to some to be overtly critical of British forest policy but they must not be overlooked as they give voice to the views of the conservation lobby as well as the many others concerned about the manner in which the rural landscape has been shaped in recent decades and their criticism is largely constructive.

APPENDIX III

PHOTOGRAPHS FOR SITES EVALUATED IN CHAPTERS 6 AND 7

POINT 1

POINT 2

POINT 3

POINT 4

POINT 5

POINT 6

POINT 7

POINT 8

POINT 9

POINT 10

POINT 11

POINT 12

POINT 13

POINT 14

POINT 15

POINT 16

POINT 17

POINT 18

POINT 19

POINT 20

POINT 21

POINT 22

POINT 23

POINT 24

POINT 25

POINT 26

POINT 27

POINT 28

POINT 29

POINT 30

POINT 31

POINT 32

POINT 33

POINT 34

POINT 35

POINT 36

POINT 37

POINT 38

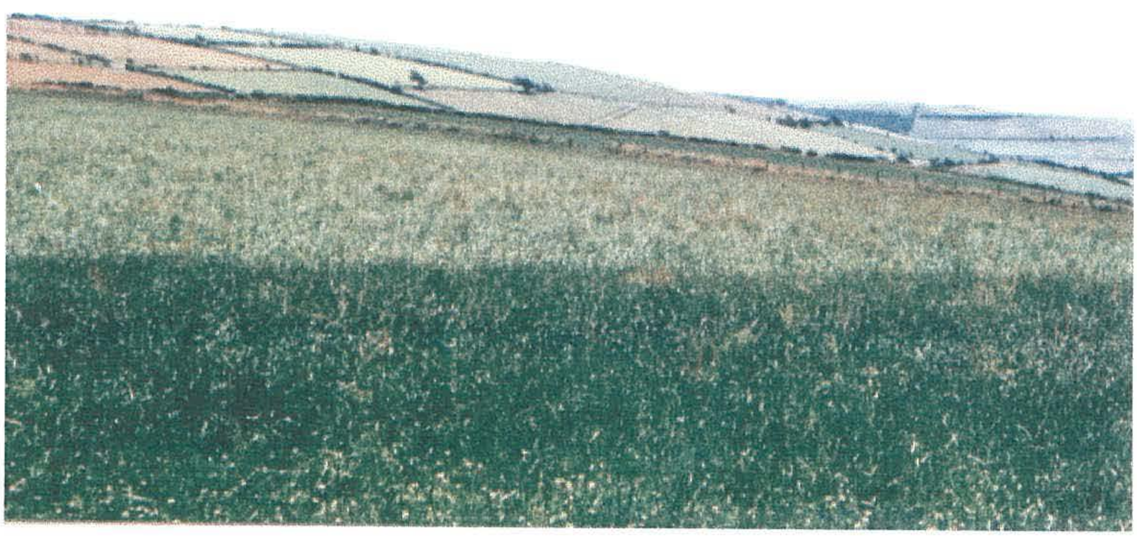
POINT 39

POINT 40

POINT 41

POINT 42

POINT 43



POINT 44

POINT 45

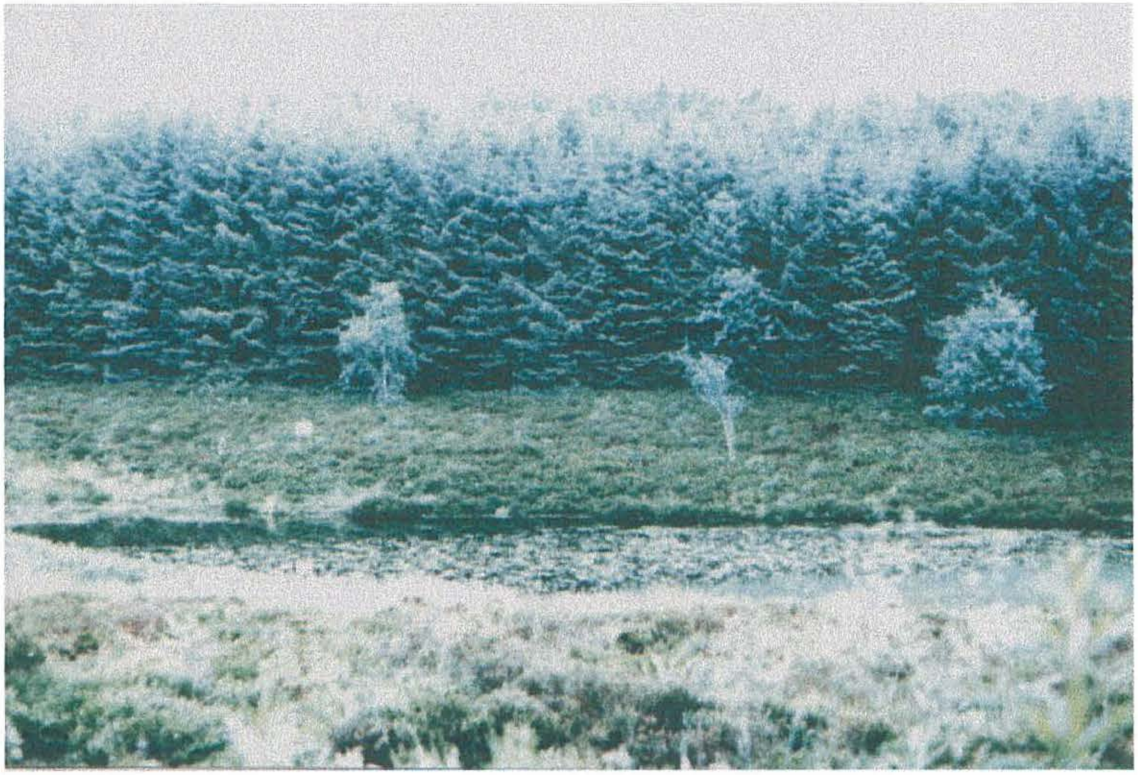
POINT 46

POINT 47

POINT 48

POINT 49

POINT 50



POINT 51

POINT 52

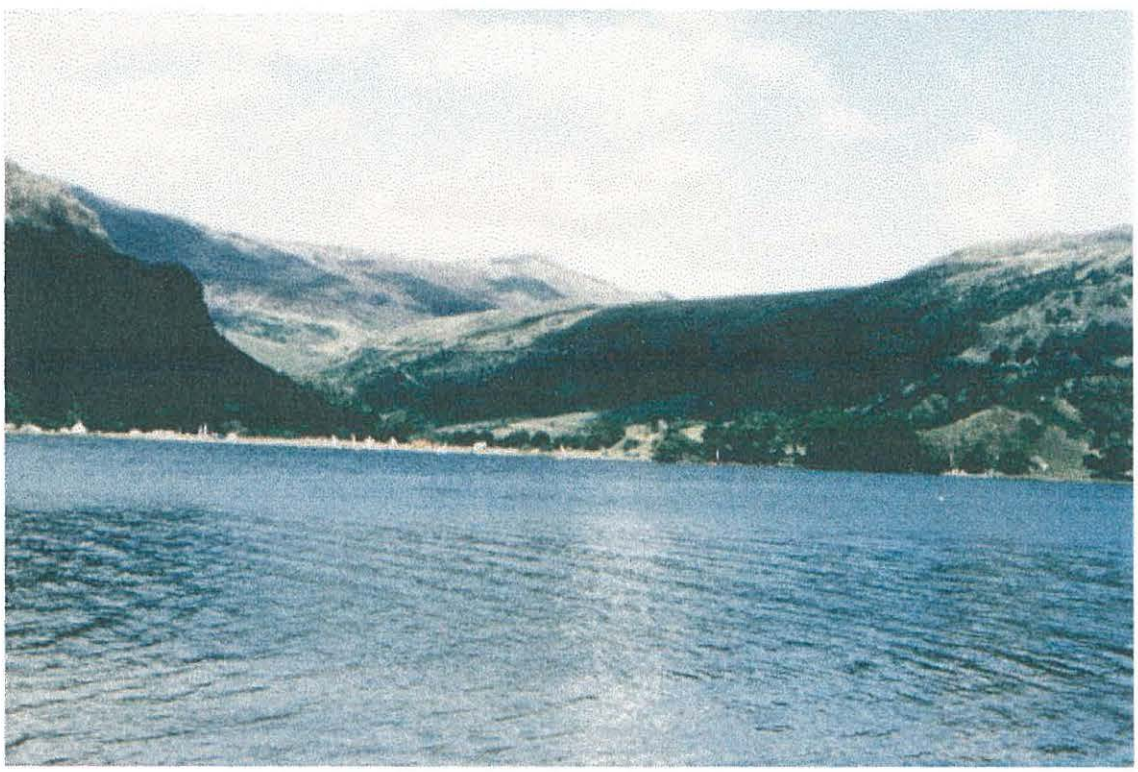
POINT 53

POINT 54

POINT 55

POINT 56

POINT 57



POINT 58

POINT 59

POINT 60

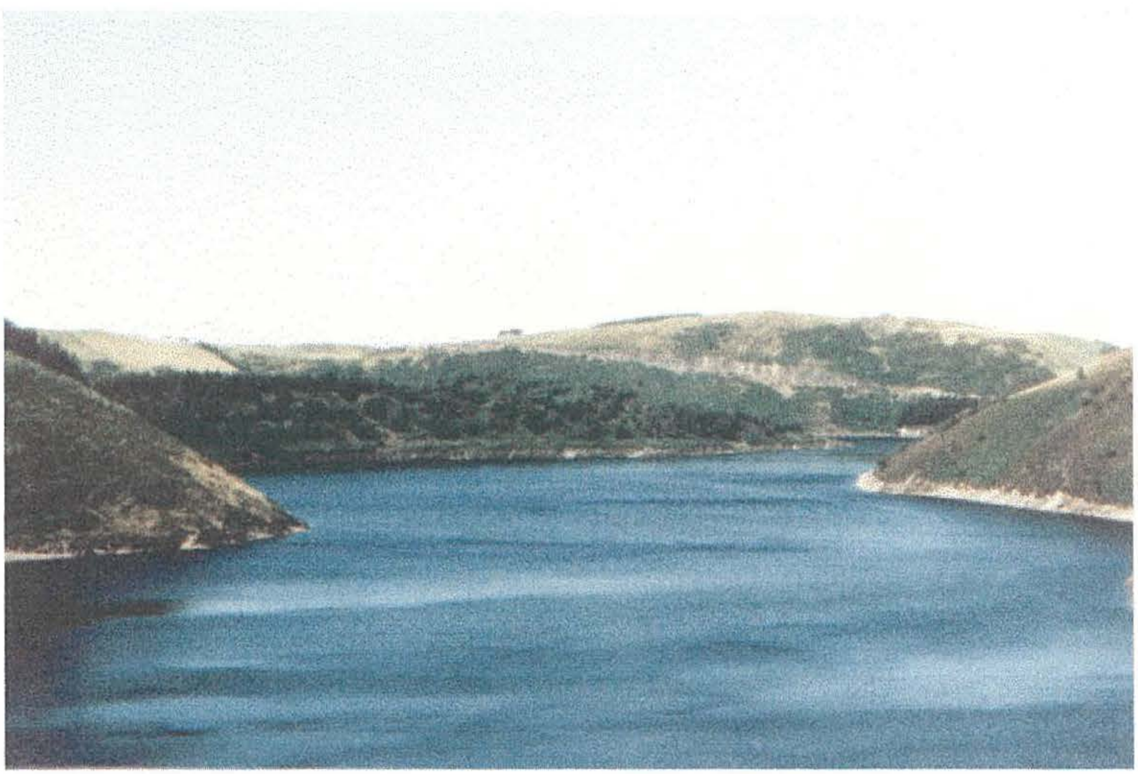
POINT 61

POINT 62

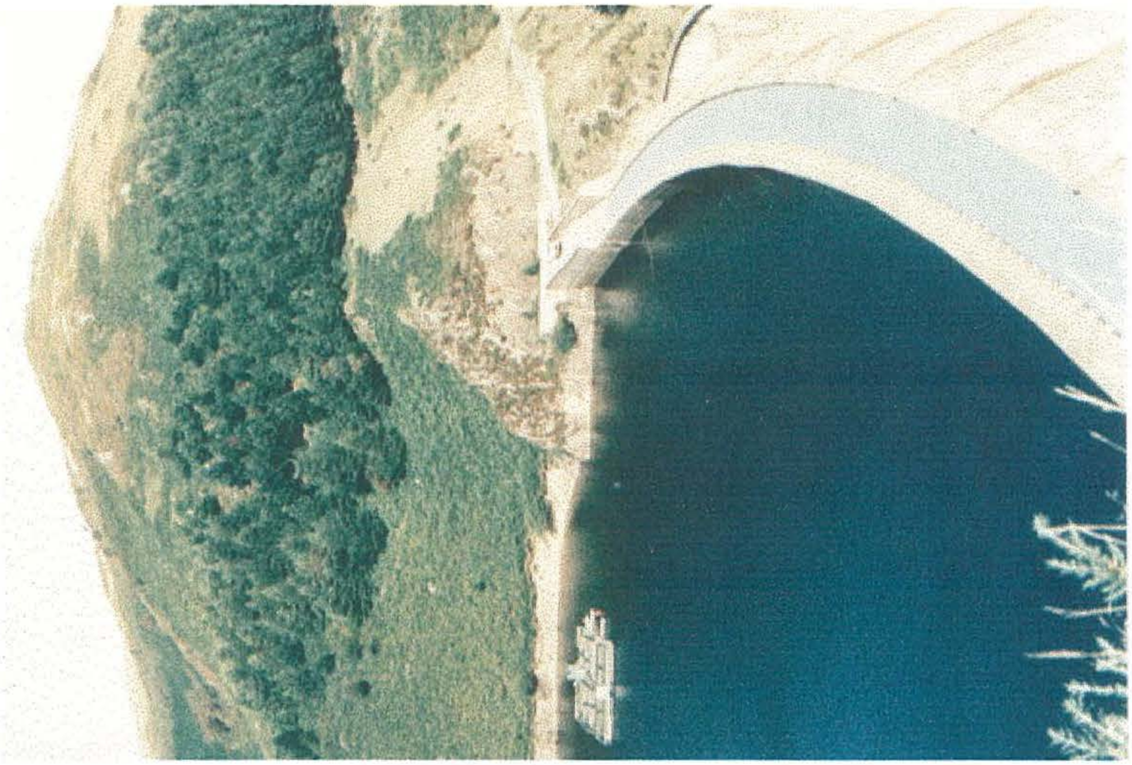
POINT 63

POINT 64

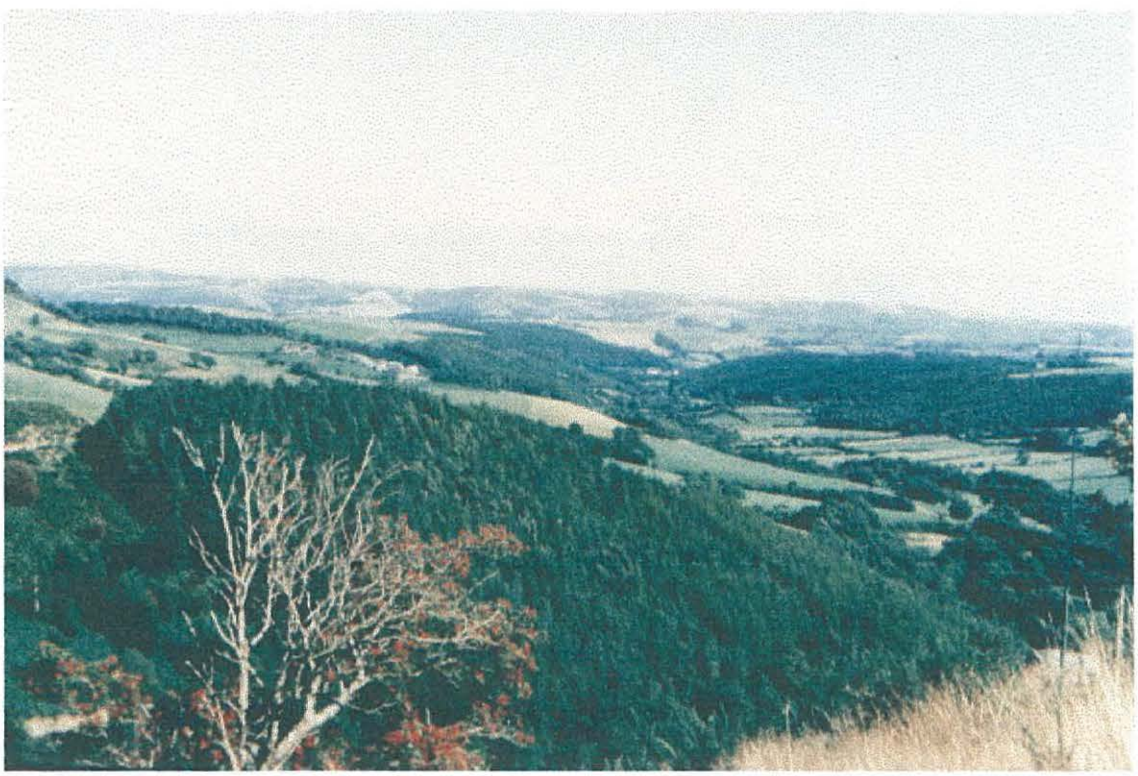
POINT 65



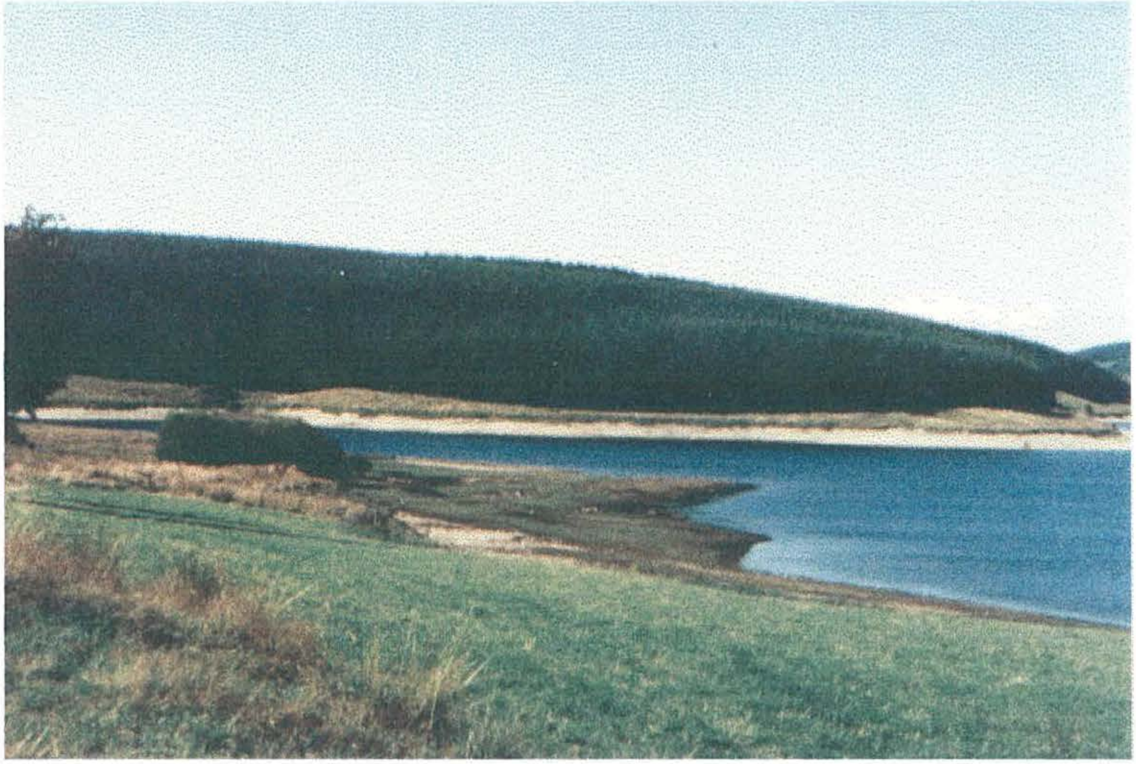
POINT 66



POINT 67



POINT 68



POINT 69

POINT 70

POINT 71

POINT 72

POINT 73

POINT 74

POINT 75

POINT 76

POINT 77

POINT 78

POINT 79

POINT 80

POINT 81

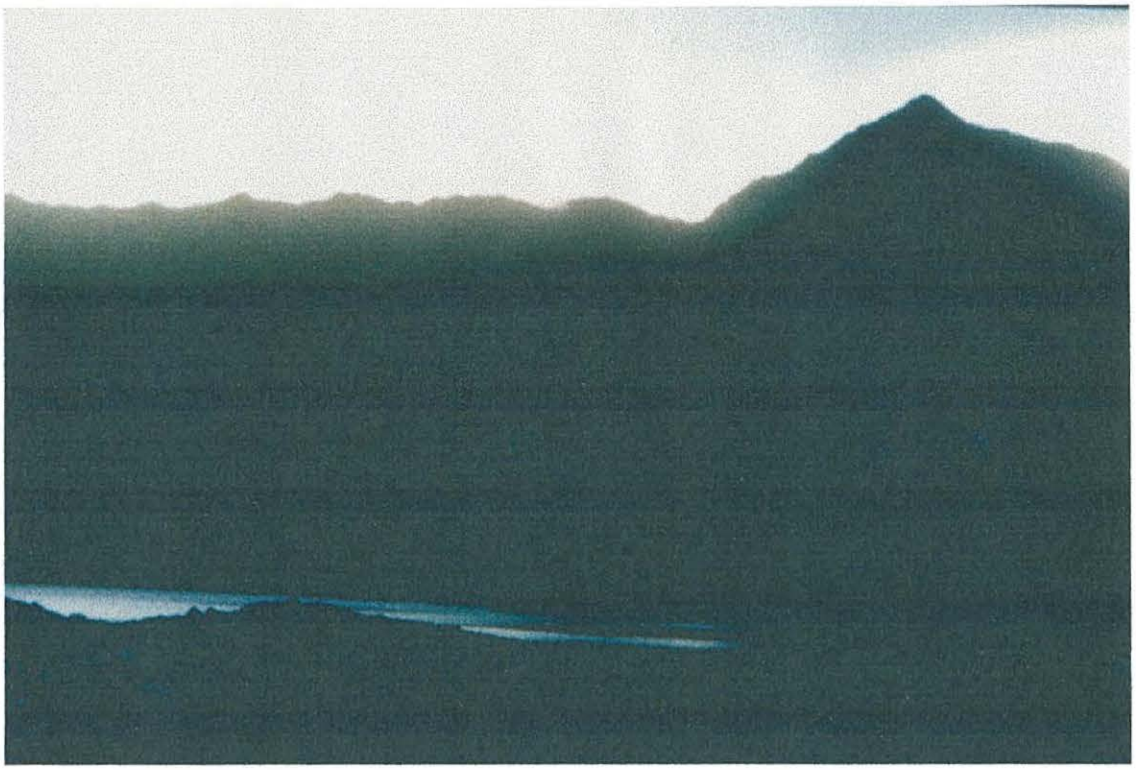
POINT 82

POINT 83

POINT 84

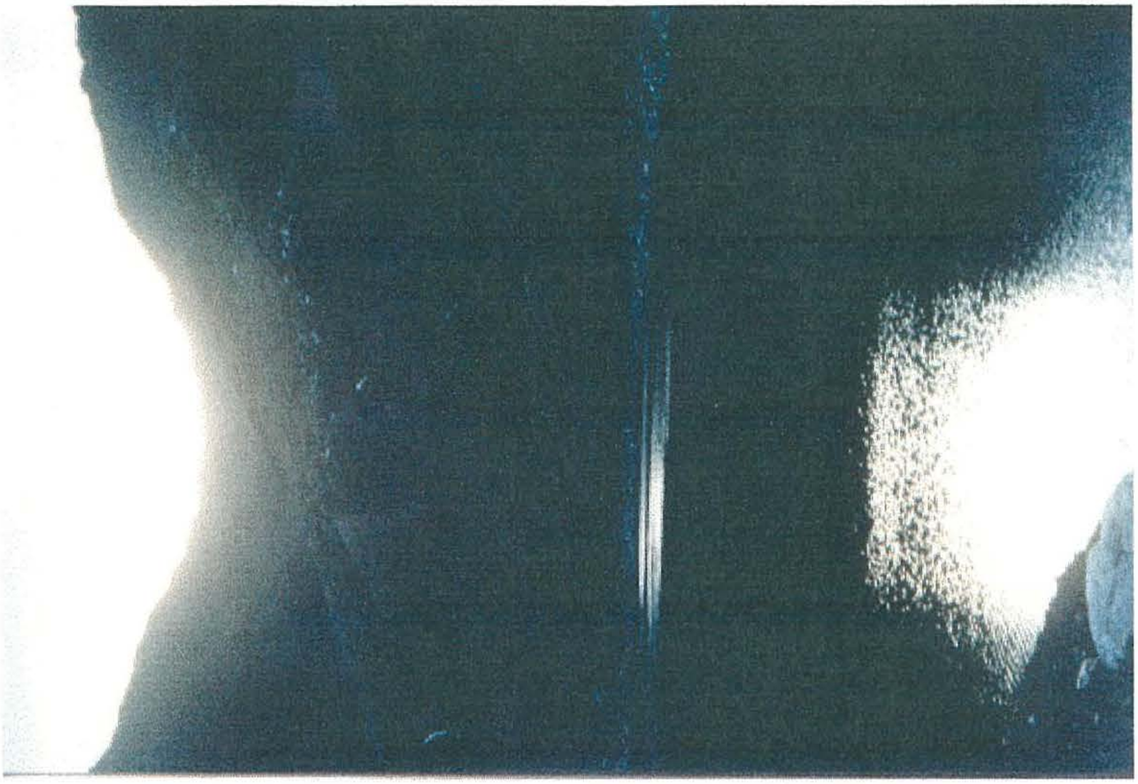
POINT 85

POINT 86



POINT 87

POINT 88



POINT 89

APPENDIX IV

Example of the survey / questionnaire sheet.

THE EVALUATION OF WELSH LANDSCAPES

PLEASE COMPLETE THE QUESTIONNAIRE ON THE NEXT PAGE BY ASSESSING THE LANDSCAPE QUALITY OF THE SLIDES SHOWN ACCORDING TO THE FOLLOWING SCALE OF VALUES BY ALLOCATING A VALUE FROM O (THE WORST VIEW THAT COULD BE PRESENTED IN PICTURE FORM) TO 30 (THE BEST VIEW THAT ONE WOULD EXPECT TO SEE) FOR EACH VIEW. THE DESCRIPTIVE SCALE MAY PROVIDE A GUIDE TO THE USE OF THE NUMERICAL SCALE IF NEEDED.

MALE / FEMALE............

COUNTRY OF ORIGIN..............

PLACE OF RESIDENCE DURING LAST FIVE YEARS.................

1.....	2.....	3.....	4.....	5.....	6.....
7.....	8.....	9.....	10.....	11.....	12.....
13.....	14.....	15.....	16.....	17.....	18.....
19.....	20.....	21.....	22.....	23.....	24.....
25.....	26.....	27.....	28.....	29.....	30.....
31.....	32.....	33.....	34.....	35.....	36.....
37.....	38.....	39.....	40.....	41.....	42.....
43.....	44.....	45.....	46.....	47.....	48.....
49.....	50.....	51.....	52.....	53.....	54.....
55.....	56.....	57.....	58.....	59.....	60.....
61.....	62.....	63.....	64.....	65.....	66.....
67.....	68.....	69.....	70.....	71.....	72.....
73.....	74.....	75.....	76.....	77.....	78.....
79.....	80.....	81.....	82.....	83.....	84.....
85.....	86.....	87.....	88.....	89.....	90.....

POINTS FOR DISCUSSION.

1. PLEASE LIST LANDSCAPE FEATURES AND ELEMENTS WHICH YOU BELIEVE TO :

    (a) MAKE A POSITIVE CONTRIBUTION TO LANDSCAPE QUALITY.

    (b) HAVE A NEGATIVE EFFECT ON LANDSCAPE QUALITY.

2. IDENTIFY EXAMPLES, FROM THOSE LANDSCAPES EVALUATED PREVIOUSLY, HOW ADDITIONAL WOODLANDS / FORESTRY MIGHT :

    (a) DIMINISH LANDSCAPE QUALITY.

    (b) CONTRIBUTE TO LANDSCAPE QUALITY.

3. IS THERE ROOM FOR THE REFINEMENT OF THE EVALUATION METHOD USED ? (e.g. ALLOCATING NEGATIVE SCORES AT THE LOWER END OF THE SCALE).

APPENDIX V

REFERENCES - CITED

A.D.A.S. (1988). Shelterbelts in the Uplands. leaflet No.3154. (MAFF)

Adamowicz, V. (1995). Alternative valuation techniques: A comparison and movement to a synthesis. In "Environmental Perspectives", Willis, K.G. & Corkindale, J.T. (CAB International).

Allanson, P. & Whitby, M. (Ed) (1996). The Rural Economy and the British Countryside. (Earthscan).

Anderson, J. & Muirden, L. (1997). Monthly Economis Survey. (Scottish Agricultural Colleges.)

Appleton, J. (1975). The Experience of Landscape. (John Wiley and Sons, London).

Appleyard, D., Lynch, K., & Myer, J.F. (1963). The View From the Road. (M.I.T. Press, Cambridge, Mass.).

Arboricultural Association. (1990). Amenity Valuation of Trees and Woodlands. (Arboricultural Association.)

Arnold, D. (1993). "Literature and the landscape." Landscape Design, 217, p.33-5.

Arthur, L.M. (1977). "Predicting scenic beauty of forest environments: some empirical tests." Forest Science, Vol.23, No.2, p.151-160

Bacon, Sir F. (1612). On Gardens. (Spedding et al. 1905).

Bateman, I. (1994). "Contingent valuation and hedonic pricing: problems and possibilities". Landscape Research, 19, p.30-32.

Bateman , I. & Langford, I.H. (1998). "Budget-constraint, temporal, and question-ordering effects in contingent valuation studies". Environment and Planning, 29, p.1215-28.

Bebb, W.A. (1942). Llywodraeth y Cestyll. (Hughes a'i Fab).

Bell, S. & Lucas, O. (1989). "Farm woodland design." Landscape Design, Sept.1989, p.17-20.

Bell, S. (1993). Elements of Visual Design in the Landscape. (E. & F.N. Spon.)

Benefield, C.B. & Bunce, R.G.H. (1982). A Preliminary Visual Presentation of Land Classes in Britain. (Institute of Terrestrial Ecology).

Benson, J.F. (1991). "Value of non-priced recreation on theForestry Commission estate in Great Britain." Journal of World Forest Resource Management, 6, p.49-73.

Benson, J.F. (1994). "Values for forest landscapes using travel cost and tokens." Landscape Research, Vol. 19, No. 1, p.23-25.

Benson, J.F., & Willis, K.G. (1990). Aggregate Value of the Non-Priced Recreation Benefits of the Forestry Commission Estate. (Report to the Forestry Commission, Edinburgh).

Benson, J.F. & Willis, K.G. (1992). Valuing Informal Recreation on the Forestry Commission Estate. Forestry Commission Bulletin 104. (H.M.S.O.).

Bergin, J. (1993). Recreation and the Value of Landscape. (Unpublished M.Sc. thesis, University College of North Wales, Bangor).

Bergin, J. & Price, C. (1994). "The travel cost method and landscape quality." Landscape Research, 19, p.21-23.

Bilsborough, S. (1994). "Management agreements: Indicators of social values?" Landscape Research 19, p.5-6.

Blyth, J., Evans, J., Mutch, W.E.S. and Sidwell, C. (1991). Farm Woodland Management. (Farming Press.)

Body, R. (1987). Red or Green for Farmers. Broad Leys.

Bogle, J. (1990). Artists in Snowdonia. (Y Lolfa, Talybont)

Boon, E. (1981). Integrating Agriculture and Forestry: Land Use and the Landscape. Occasional Series in Environmental Forestry No.1. (Department of Forestry and Wood Science, University College of North Wales, Bangor.)

Borrow, G. (1862). Wild Wales. (Collins, London).

Bourassa, S.C. (1991). The Aesthetics of Landscape. (Belhaven Press, London)

Bowen, D.Q. (1977). "The Land of Wales" in Thomas, D. (Ed.) Wales: A New Study. (David & Charles, London).

Bowen, D.Q. (1990). Geology map 1.1. in Carter, H. (Ed.) The National Atlas of Wales. (University of Wales).

Bowers, J.K. & Cheshire, P. (1983). Agriculture, the Countryside and Land Use. (Methuen, London).

Bowers, J.K., Bristow, A.L. & Hopkinson, P.G. (1991). The Treatment of Landscape in Public Investment Appraisal. (Report to the Countryside Commission, Cheltenham).

Bowers, J. & Hopkinson, P. (1994). "The treatment of landscape in project appraisal: consumption and sustainability approaches." Project Appraisal, vol. 9, no. 2, p.110-7.

Brookshire, D.S. & Coursey, D.L. (1987). "Measuring the value of a public good: an empirical comparison of eliciting procedures." American Economic Review, 77, p.554-66.

Brotherton, I. and Duvall, N. (1987). "More forestry: problem or opportunity?" Landscape Design, October 1987, 49-50.

Browell, M. & Mead, H. (1987). "Tree shelters." Landscape Design, Vol.166 p.59.

Brown, J.L. from "Correx - Galemaster" leaflet. (reprinted from "Forestry and British Timber.")

Brown, J. (1882). The Forester. (Blackwood & sons.).

Brown, T.C & Daniel, T.C. (1986). "Predicting scenic beauty of timber stands". Forest Science, Vol. 32, No.2, p.471-486.

Brush, R.O. (1976). "Spaces within the woods". Journal of Forestry, 744-747.

Bunce, R.G.H., Barr, C.J., Clarke, R.T., Howard, D.C, & Lane, A.M.J. (1996). "Land classification for strategic ecological surveys", Journal of Environmental Management, 4, p.37-60.

Bunce, R.G.H., Peters, J.C., Barr, C.J. & Howard, D.C. (in prep.). The Application of a Rural Information System For Land Use Planning at a Strategic Level. (Institute of Terrestrial Ecology).

Burke, H.D., Lewis, G.H. & Orr, H.R. (1968). A Method for Classifying Scenery from a Roadway. Parks Practice Development Guideline, U.S.D.A. Forest Service, Washington.

Bye, A.E. (1983). Art Into Landscape Landscape Into Art. P.D.A. Publishers Corporation.

Caborn.J.M. (1965). Shelterbelts and Windbreaks. (Faber & Faber)

Campbell, D. (1987). "Landscape design in forestry". Landscape Design, 166, p.31-6.

Campbell, S & Bowen, D.Q. (1989). Geological Conservation Review: A Quaternary of Wales. (Nature Conservancy Council, Peterborough).

Carpenter, P.L., Walker, T.D. and Lanphear, F.O. (1975). Plants in the Landscape. (W.H. Freeman and Company).

Carroll.M.R. (1978). Multiple Use of Woodlands. (University of Cambridge, Dept.of Land Economy).

Carter, E.S. & Stansfield, J.M. (1994). British Farming: Changing Policies and Production Systems. (Farming Press).

Clawson, M. (1959). Methods of Measuring the Demand for an Value of Outdoor Recreation. (Resources For The Future, Washington).

Clwyd County Council. (1974). An Evaluation of the Landscape Quality of Clwyd. (Clwyd County Council, Mold).

Clwyd County Council (1995). Clwyd Indicative Forestry Strategy. (Clwyd County Council).

Colvin, B. (1970). Land and Landscape. (John Murray).

Commission of the European Communities. (1991). The Development and Future of the CAP. (1/2/91) Ref: COM (91) 100. Commission of the European Communities.

Commission of the European Communities. (1993). Our Farming Future. (Office for Official Publications of the European Communities.)

Cooper. (1987) quoted in Bourassa, S.C. (1991). The Aesthetics of Landscape. (Belhaven Press, London)

Countryside Commission. (1983). Small Woods on Farms. CCP 143. (Countryside Commission).

Countryside Commission. (1991). Landscape Change in the National Parks. (Countryside Commission)

Countryside Council for Wales. (1991). Protected Sited in Wales map. (Countryside Council for Wales, Bangor).

Countryside Council for Wales. (1992). Tir Cymen. (Countryside Council for Wales).

Crabtree, B. & Cumming, D. (1989). Farm Woodland Enterprise- Planning, Establishing and Managing Small Woods. (Scottish Agricultural Colleges. 1989.)

Craig, G.M., Jollans, J.L. & Korbey, A. (1986). The Case for Agriculture: An Independent Assessment. (Centre for Agricultural Strategy).

Crowe, S. (1966). Forestry in the Landscape. Booklet 18. (Forestry Commission.)

Crowe, S. (1978). The Landscape of Forests and Woods. Forestry Commission.

Crowe, S. & Mitchell, M. (1988). The Pattern of Landscape. Packard Publishing.

Daniel, T.C., & Boster, R.S. (1976). Measuring Landscape Aesthetics: The Scenic Beauty Method. USDA Forest Research Service Paper RM-167 (Rocky Mt Forest and Range Exp Stn, Fort Collins, CO).

Davies, B. (1991). "Building on Our History and Landscape". Rural Wales, Spring 1991. p.40.

Dearden, P. (1981). "Public Participation and Scenic Quality Analysis." Landscape Planning, p.3-19.

Dearden, P. (1986). "Philosophy, theory and method in landscape evaluation." Canadian Geographer, 19, p.263-5.

Downing, M.F. (1972). "Forestry and the Picturesque Tradition". Quarterly Journal of Forestry, 66, 103-112.

Dunn, M.C. (1975). "Landscape with Photographs: Testing the Preference Approach to Landscape Evaluation." Journal of Environmental Management, 4, 15-26.

Edwards, S.F. & Anderson, G.D. (1987). "Overlooked biases in contingent valuation surveys: some considerations." Land Economics, 63, 168-78.

Evans, J. (1985). "Tree Shelters." (article in "Advances in Practical Arboriculture : Proceedings of a Seminar held at the University of York, 10-12 April 1985." Forestry Commission Bulletin 65. (H.M.S.O.).

Evernden, N. (1978). "The Ambiguous Landscape". Geographical Review, 71, p.147-57.

Fairbrother, N. (1970). New Lives, New Landscapes. (The Architectural Press, London)

Fairbrother, N. (1973). The Nature of Landscape Design. Architectural Press.

Fines, K.D. (1968). "Landscape Evaluation: A Research Project in East Sussex". Regional Studies, 2, p.41-55.

Forestry Commission. (1968). Forestry in the British Scene. Forestry Commission.

Forestry Commission. (1988a). Farm Woodland Planning. Bulletin 80. Forestry Commission.

Forestry Commission. (1988b). Farm Woodland Practice. Handbook 3. Forestry Commission.

Forestry Commission. (1988c). 68th Annual Report and Accounts. (H.M.S.O.).

Forestry Commission. (1989). Forest Landscape Design Guidelines. Forestry Commission.

Forestry Commission. (1991a). Forests and Water Guidelines. Forestry Commission.

Forestry Commission. (1991b). Community Woodland Design Guidelines. Forestry Commission.

Forestry Commission. (1991c). Forestry Practice. Handbook 6. Forestry Commission.

Forestry Commission. (1992). Lowland Landscape Design Guidelines. Forestry Commission.

Garrod, G.D. (1994). "Using the hedonic pricing model to value landscape features." Landscape Research, 19, p.26-28.

Garrod, G.K., & Willis, K.G. (1991). "Assessing the impacts and values of agricultural landscapes: an application of non-parametric statistical methods." Planning Outlook, 34, p.68-71.

Garrod, G.K., & Willis, K.G. (1992). "Valuing goods' characteristics: an application of the hedonic pricing method to environmental attributes." Journal of Environmental Management, 34, p.59-76.

Gaskell, P. & Winter, M. (1998) "Editorial: emerging landscapes of agricultural policy reform." Landscape Research, vol. 23, no. 3, p.221.

Gilg, A.W. (1975). "The Objectivity of Linton Type Methods of Assessing Scenery as a Natural Resource." Regional Studies, 9, p.181-91.

Gilg, A.W. (1978). Coutryside Planning. (Methuen & Co.)

Green, D.A.G. & Jones, W.D. (1986). Forestry as an Alternative to Farming in the Hills and Uplands of Wales. Department of Agricultural Economics, The University of Wales, Aberystwyth.

Gritten, R. (1986). Survey of Rhododendron Ponticum in the Snowdonia National Park. (Snowdonia National Park.)

H.R.H. The Prince of Wales. (1990). A Vision of Britain. (Doubleday).

Hackett, B. (1974). "Forestry and the Landscape". Scottish Forestry, 27, 256-60.

Hackett, B. (1979). Planting Design. (E. & F.N. Spon.)

Halliday, J. (1989). "Designing a New Countryside Landscape." Landcape Design. 43-6

Hamill, L. (1971). "Classification of Forest Land for Recreational Potential and Scenery." The Forestry Chronicle, June 1971, p.149-153

Hanley, N.D., & Ruffel, R. (1993). "The contingent valuation of forest characteristics." Journal of Agricultural Economics, 44, p.218-229.

Harrison, H.A. (1962). "Co-ordination Problems - Dispersed Areas." Unpublished paper presented to the U.S. Service Timber Management - Recreation Meeting, Bend, Oregon.

Hart, C. (1991). Practical Forestry for the Agent and Surveyor. (Alan Sutton).

Hazlett, T.C. (1988). Land Form Design. P.D.A. Publishers.

Helliwell, D.R. (1967). "The Amenity Value of Trees and Woodlands". The Arboricultural Association Journal, 1, p.128-131.

Helliwell, D.R. (1993). "The patterns of Nature." Landscape Design, 217, p.33-5.

Hodge, S.J. (1995). Creating and Managing Woodlands Around Towns. Forestry Commission Handbook 18. (H.M.S.O.).

Hough, M. (1990). Out of Place - Restoring Identity to the Regional Landscape. (Yale University Press).

Hull, B. & Buyhoff, G.J. (1984). "Individual and Group Reliability of Landscape Assessments." Landscape Planning, 11, p.67-71.

Hunter, J.M. (1985). Land into Landscape. (George Godwin).

Ingels, J.E. (1992). Landscaping: Principles and Practice. (Delmar).

Institute of Terrestrial Ecology. (1982). The Use of Land Classification in Resource Assessment and Rural Planning. (The Institute of Terrestrial Ecology).

Jones, G. & Jones, T. (Ed.) (1978 ed.) The Mabinogion. (Dent, London).

Kahneman, D. & Tversky, A. (1979). "Prospect theory: an analysis of decisions under risk". Econometrica, 47, p.263-91.

Kaplan, R. & Kaplan, S. (1989). The Experience of Nature: A Psychological Perspective. (Cambridge University Press, New York).

Kellomaki, S. & Pukkala, T. (1989). "Forest Landscape: A Method of Amenity Evaluation Based on Computer Simulation." Landscape and Urban Planning, 18, p.117-125.

Laslett, R. (1995). "The Assumptions of Cost-Benefit Analysis". in Willis, K.G., & Corkendale, J.T. (Ed) Environmental Valuation: New Perspectives. (CAB International).

Lee, (1990). Attitudes Towards and Preferences for Forestry Landscapes.

Linton, D.L. (1968). "The Assessment of Scenery as a Natural Resource." Scottish Geographical Magazine, 84, p.218-38.

Lisney, A. & Fieldhouse, K. (1990a). Landscape Design Guide Volume 1. (Gower Technical).

Lisney, A. & Fieldhouse, K. (1990b). Landscape Design Guide Volume 2. (Gower Technical). Lucas, O.W.R. (1987). Landscape Design in Forestry. In Good, J.E.G., Environmental Aspects of Plantation Forestry in Wales. pp.57-63. (Institute of Terrestrial Ecology).

Louviere, J.J. (1991). "Experimental choice analysis: introduction and overview." Journal of Business Research, 23, p.291-7.

Louviere, J.J. (1994). "Relating stated preference measures and models to choices in real markets." Paper presented at the DOE/EPA workshop on using contingent valuation to measure non-market values, Herndon, Virginia, May 1994.

Lucas, O.W.R. (1991). The Design of Forest Landscapes. (Oxford University Press).

Macia, A. (1979). "Visual perception of landscape: sex and personality differences." in G.H. Elsner and R.C. Smardon, eds. Proceedings of Our National Landscape: A conference on applied techniques for analysis and management of the visual resource, USDA Forest Service Technical Report PSW-35.

Mackie, J. (1978). in Crowe, S. (1978).

Manning, O.D. (1975). "The Nature of Landscape and Landscape Design". Landscape Design, 111, 19-20.

Matloch, J.L. (1991). Introduction to Landscape Design. (Van Norstrand Reinhold, New York).

McCall, I. (1988). Woodlands for Pheasants. (The Game Conservancy).

McCluskey, J. (1985). Principles of Design, Spacial Design: Space and Landscape. Landscape Design, 154, 17-19.

McCluskey, J. (1986). "Shroud for the Scottish Landscape". Landscape Design, 164, 48-51.

Miles, R. (1967). Forestry in the English Landscape. (Faber & Faber).

Miller, R.W. (1988). Urban Forestry. Prentice Hall.

Mitchell et al. (1988). A Review and Empirical Test of Bias in Contingent Valuations of Wildlife Resources. (Newcastel upon Tyne, The University).

Muir, R. (1993). Reading the Landscape. (Michael Joseph, London).

Norberg-Schulz, C. (1980). Genius Loci: Towards a Phenomenology of Architecture. (Rizzoli, New York).

Novell, A. (1993). "Leading from the Front." Landscape Design, 218, p.10-13.

O'Riordan et al. (1992). Landscapes for Tomorrow: Interpreting Landscape Futures in the Yorkshire Dales National Park. (Yorkshire Dales National Park).

Patterson, G. (1986). Forestry Design. Landscape Design, 159, 29-31.

Pennant, T. (1883). Tours in Wales Vols. 1, 2 & 3. (H. Humphreys, Caernarfon).

Penning-Rowsell, E.C. & D.I. Hardy. (1973). "Landscape Evaluation and Planning Policy: A Comparative Study in the Wye Valley Area of Outstanding Natural Beauty." Regional Studies, 7, 152-60.

Porteous, J.D. (1985). "Smellscape." Progress in Human Geography, 9, (3), p.356-78.

Porteous, J.D. & Mastin, J.F. (1985). "Soundscape." Journal of Architecture and Planning Research, 2, (3), p.169-86.

Potter, M.J. (1991). Treeshelters. Forestry Commission Handbook 7 (H.M.S.O.).

Preece, R.A. (1991). Designs on the Landscape. (Belhaven Press).

Price, C. (1978). Landscape Economics. (The Macmillan Press Ltd).

Price, C. (1987). Landscape Design and Farm Forestry. Proceedings of the Fourth Welsh Agricultural Research and Development Conference.

Price, C. (1991). Landscape Valuation and Public Decision Making. (School of Agriculture and Forest Sciences, University College of North Wales, Bangor).

Price, C. (1994). "Economic Valuation of Landscape - Editorial", Landscape Research, 19, p.1-2.

Price, C. (1994, unpbl.) Forest Design Lecture Notes. (University of Wales, Bangor).

Price, C. (1995a). "Economic evaluation of financial and non-financial costs and benefits in agroforestry development and the value of sustainability." Agroforestry Systems, 30, p.75-86.

Price, C. (1995b). "The Pros and Cons of Alternative Evaluation Techniques." in Willis, K.D. & Corkendale, J.T. Environmental Evaluation. (CAB International)

Price, C. & Willis, R. (1995). A Review of Farm Woodland Research. (University College of North Wales, Bangor).

Price, G. (1993). Landscape Assessment for Indicative Forestry Strategies. (Forestry Commission).

Pukkala, T. (1988). "Methods to Incorporate the Amenity of Landscape into Forest Management Planning". Silva Fennica, Vol.22, No.2, p.135-146.

Pukkala, T., Kellomaki, S. & Mustonen, E. (1988). "Prediction of the Amenity of a Tree Stand". Scandinavian Journal of Forest Research, 3, p.533-544.

Radford, G.L., Norris, D.A. & Reynolds, B. (1994). Critical Loads Assessment for Wales. (The Institute of Terrestrial Ecology).

Rackham, O. (1991). Trees and Woodland in the British Landscape. (J.M. Dent & Sons.

Randall et al. (1974). "Bidding games for valuation of aesthetic environmental improvements." Journal of Environmental Economics and Management, 1, p.132-49.

Randall et al. (1978). "Reclaiming coal surface mines in central Appalachia: a case study of the benefits and costs." Land Economics, 54, p.472-89.

Randall, A. (1994). "Contingent valuation: an introduction." Landscape Research, 19, (1), p.12-14.

Reading University Agricultural Club. (1987). Conserving the Farmer. Reading University Agricultural Club.

Rees, I.B. (1987). The Mountains of Wales. (University of Wales Press, Cardiff)

Richards, E.G., Aaron, J.R., Savage, G.F.D.A. & Williams, M.R.W. (1988). Trees as a Farm Crop. (BSP Professional Books).

Robertson, P.A. (1992). Woodland Management for Pheasants. Forestry Commission Bulletin 106. (H.M.S.O.).

Robinson, N. (1992). The Planting Design Handbook. Gower.

Rowe, R.D. & Chestnut (1983). "Valuing environmental commodities: revisited." Land Economics, 59, p.404-10.

Saxby, C.J. (1993). An Indicative Forestry Strategy for the Lleyn Peninsula using GIS. (MSc Thesis, University of Wales, Bangor).

Shroeder, H. & Daniel, T.C. (1981). "Progress in Predicting the Percieved Scenic Beauty of Forest Landscapes". Forest Science, Vol.27, No.1, p.71-80.

Sievänen, T., Pouta, E. & Ovaskainen, V. (1992). "Problems of Measuring Recreation Value Given Everyman's Rights." Scandinavian Forest Economics, 33, p.231-243.

Skidmore, I. (1986). The New County Series Vol. 1: Gwynedd. (Hale, London)

Snowdonia National Park. (1987). The Spread of Rhododendron Ponticum: A National Problem. (Snowdonia National Park).

Snowdonia National Park. (1991). Conservation Map of Snowdonia. (Snowdonia National Park)

Steiner, F. (1991). The Living Landscape: An Ecological Approach to Landscape Planning. McGraw Hill.

Strathclyde Regional Council. (1988). Forestry Strategy for Strathclyde. (Strathclyde Regional Council).

Swanwick, C. (1991). Landscape Assessment: Principles and Practice. Report to the Countryside Commission for Scotland.

Talbot, J.F. & R. Kaplan. (1984). "Needs and Fears: The Response to Trees and Nature in the Inner City." Journal of Arboriculture, 1984, p.281-91.

Tandy, C. (1981). Handbook of the Urban Landscape. (The Architectural Press).

Taylor, A.J. (1990). Land Quality, Map 1.7 in Carter, H. (Ed) National Atlas of Wales. (University of Wales).

Thomas, G.S. (1983). Trees in the Landscape. (Jonathan Cape Ltd).

Thompson, S. & Cumming, D.G. (1983). "A Shelterbelt for Stock on Hill Farms." Scottish Forestry, 37 (3) p.180-4.

Tracy, M. (1989). Government and Agriculture in Western Europe 1880-1988. Third Edition. (Harvester Wheatsheaf).

Tracy, M. (1996). Agricultural Policy in the European Union. (APS, Belgium).

Trueman, A.E. (1971). Geology and Scenery in England and Wales. (Penguin, England).

Tuley, G. (1983). "Shelters improve the growth of trees in the forest." Quarterly Journal of Forestry, Vol.77, p.84.

Tuley, G. (1985). "The growth of young oak trees in shelters." Forestry, Vol.58, p.181.

Turner. (1976). cited in Dearden, P. (1981)

van Pelt, J. (1950). "Landscape Analysis and Design for Conifer Plantations." quoted in Australian Forestry, Vol.43, No.3.

Vaughan-Thomas, W. & Llewelyn, A. (1969). The Shell Guide to Wales. (Joseph & Rainbird, London)

Wales Tourist Board. (1974). More Money From Tourism: A Practical Guide For Welsh Farmers. Wales Tourist Board.

Wales Tourist Board. (1985). Attitudes to Wales as a Tourist Destination. (Wales Tourist Board, Cardiff)

Walker, T.D. (1991). Planting Design. (Van Nostrand Reinhold, New York).

Weddle, A.E. (1979). Landscape Techniques. (Heinemann).

Welsh Affairs Committee. (1994). Welsh Affairs Committee: First Report, Forestry and Woodlands Vol 1. (H.M.S.O.).

Welsh Office. (1980). A Landscape Classification of Wales. (Welsh Office Planning Services, Cardiff).

Welsh Office. (1992). Welsh Agricultural Statistics No.14. (H.M.S.O.)

Williams, M. (1990). Y Fforest Gonifferaidd. Y Faner, January 26, p.10-1

Willis, K.G. (1994). "Contingent valuation in a policy context". Landscape Research, 19, p.17-20.

Willis, K.G & Benson, J.F. (1989). "Recreational values of forests". Forestry, Vol.62, No.2. p.93-110.

Willis, K.G. & Garrod, G.D. (1992). "Amenity value of forests in Great Britain and its impact on the internal rate of return from forestry." Forestry, 65, p.331-346.

Winter, M., Gaskell, P. & Short, C. (1998). "Upland landscapes in Britain and the 1992 CAP reforms." Lsndscape Research, vol. 23, no. 3, p.273-287.

Zion, R.L. (1979) Trees for Architecture and the Landscape: Condensed Edition. (Van Nostrand Reinhold, New York).

APPENDIX VI

BIBLIOGRAPHY OF TEXTS CONSULTED BUT NOT CITED

A.D.A.S., The Royal Bank of Scotland & N.F.U. Woodland Grants for Farmers. A.D.A.S., The Royal Bank of Scotland & N.F.U.

Aberconwy Borough Council. (1982). Llandudno / Conwy District Plan. (Aberconwy Borough Council).

Blacksell & Gilg. (1981). The Countryside : Planning and Change. (Allen & Unwin.)

Boyce, S.G. (1995). Landscape Forestry. (John Wiley & Sons, New York).

Brecon Beacons National Park. (1977). Brecon Beacons National Park Plan. (Brecon Beacons National Park).

British Association of Nature Conservationists. (1987). Forests for Britain. (Packard Publishing Limited.)

Bromley, P. (1990). Countryside Management. (E. & F.N. Spon.)

Brooks, A. (1988). Woodlands: A Practical Handbook. (British Trust for Conservation Volunteers.)

Bunce, R.G.H., Barr, C.J. & Whittaker, H.A. (1981). Land Classes in Great Britain: Preliminary Descriptions for users of the Merlewood Method of Land Classification. Merlewood Research and Development Paper No. 86. (Institute of Terrestral Ecology, Merlewood).

Burnett, C. (1989). "The Trouble With Trees". Landscape Design, 178, 40-1.

Burrell, A., Hill, B. & Medland, J. (1990). Agrifacts. (Harvester Wheatsheaf).

Carruthers, S.P. (1986). Land-use Alternatives for UK Agriculture. C.A.S. Report 12. Centre for Agricultural Strategy.

Charlton, P. (1990). "An Airport in the Countryside." Landscape Design, 190, p.24-7.

Clouston, B. (ed.) (1990). Landscape Design with Plants. (Heinemann Newnes).

Coed Cymru. (1989). Grazing and Stock Exclusion in Upland Broadleaved Woodlands. (Report of Seminar hosted by Coed Cymru at Gregynog, Newtown, 16/3/89.)

Cortner, & Shannon, (1993). "Embedding Public Participation in its Political Context." Journal of Forestry, 7, p.14-16.

Council for the Protection of Rural England. (1975). Landscape-The Need for a Public Voice. C.P.R.E.

Council for the Protection of Rural Wales. (1990). A Forest Policy for Wales. C.P.R.W.

Countryside Commission. (1974). New Agricultural Landscapes." CCP 76. (Countryside Commission).

Countryside Commission. (1983). The Changing Uplands. CCP 153. (Countryside Commission).

Countryside Commission. (1984). Agricultural Landscapes, A Second Look. CCP 168. Countryside Commission.

Countryside Commission. (1984). Agricultural Landscapes, An Approach To Their Improvement. CCP 169. Countryside Commission.

Countryside Commission. (1984). Agricultural Landscapes : A Policy Statement. CCP 173 (Countryside Commission).

Countryside Commission. (1986). The New Forest Landscape. CCP 220. Countryside Commission.

Countryside Commission. (1989). The Countryside Premium. CCP 267. Countryside Commission.

Countryside Commission. (1989). The Blackdown Hills Landscape. CCP 258. Countryside Commission.

Countryside Commission. (1990). The Cambrian Mountains Landscape. CCP 293. Countryside Commission.

Countryside Commission. (1990). The Cotswold Landscape. CCP 294. Countryside Commission.

Countryside Commission. (1991). The North Pennines Landscape. CCP 318. Countryside Commission.

Countryside Review Committee. (1979). Conservation and the National Heriatage - A Discussion Paper. Topic Paper No.4 (H.M.S.O.)

Crowe, S. (1967). Site Planning. In A.E. Weddle, (ed.) Techniques of Landscape Architecture. Heinemann. pp.1-31.

Cunningham, I. (1979). "Keeping and planting trees on development sites." In T.Aldous, (ed) "Trees & Buildings; Complement or Conflict ?" (R.I.B.A. publications, The Tree Council.).

Davidson, J. & Lloyd, R.A. (1977). "Conservation and Agriculture." (Wiley). (Chapter 7 by Leonard, P.L. & Stoakes, C.).

Davies, R.J. (1987) Trees and Weeds. (Forestry Commission Handbook 2, H.M.S.O.)

Dearden, P. (1987). "Consensus and a Theoretical Framework for Landscape Evaluation." Journal of Environmental Management, 24, p.267-78.

Dyfed County Council. (1976). Pembrokeshire Coast National Park: Consultative Document. (Dyfed County Council).

Evans, J. (1984). Silviculture of Broadleaved Woodland. Forestry Commission Bulletin 62. (H.M.S.O.)

Evans, J. & Shanks, C.W. (May 1987). Treesheleters. (Forestry Commission research note 63/87 SILS)

Flintshire County Council. (1972). Flintshire Countryside Report. (Flintshire County Council, Mold).

Forestry Commission. (1984). Silviculture of Broadleaved Woodland. Bulletin 62. Forestry Commission.

Forestry Commission. (1986). Guidelines for the Management of Broadleaved Woodland. (H.M.S.O.).

Forestry Commission. (1989). Urban Forestry Practice. Handbook 5. (H.M.S.O.).

Gwynedd County Council. (1991). Gwynedd Structure Plan. (Gwynedd County Council.)

Halliday, S. (1987). "In Defence of the Forests." Landscape Design, 166, 37.

Hampton, R.E. (1994). Introductory Biological Statistics. (W.C, Brown).

Helliwell, D.R. (1994). "Expert Judgement Quantified". Landscape Research, Vol. 19, No. 1, p.7-9.

Hibberd, B.G. (1988). Farm Woodland Practice. Forestry Commission Handbook 3. (H.M.S.O.)

Hibberd, B.G. (1989). Urban Forestry Practice. Forestry Commission Handbook 5. (H.M.S.O.)

Hibberd, B.G. (1991). Forestry Practice. Forestry Commission Handbook 6. (H.M.S.O.)

Hill, P. (1987). "Farm Woodlands: Facing the Facts". Landscape Design, 154, 17-9

Houldershaw, D.A. (1988). "Treeshelter Celebrates 10th Birthday." Forestry and British Timber, Vol.17, No.10. p.23-28.

Howarth, R.W. (1990). Farming for Farmers ? (The Institute of Economic Affairs).

Insley, H. (1988). Farm Woodland Planning. Forestry Commission Bulletin 80. (H.M.S.O.)

Jacques, D.L. (1980). "Landscape Appraisal: The Case for a Subjective Theory." Journal of Environmental Management, 10, p.107-13.

Jellicoe, G. (1970). Studies in Landscape Design. (Oxford University Press).

MacEwen, A & M. (1982). National Parks- Conservation or Cosmetics. The Resource Management Series No.5. (Allen & Unwin).

MacEwen, A & M. (1987). Greenprints for the Countryside ? (Allen & Unwin).

M.A.F.F., D.o.E. & Welsh Office. (1989). Planning Permission and the Farmer. (H.M.S.O.).

Marsh, J.S. & Swanney, P.J. (1980). Agriculture and the European Community. (George Allen and Unwin).

National Farmers Union. (1990). A Guide to the GATT Talks. (30/8/90) Ref: Econ 54/90. N.F.U.

National Farmers Union. (1991). The Commission's Proposals for CAP Reforms. (9/7/91) Ref: Econ 38/91). N.F.U.

National Parks Review Panel. (1991). Fit For the Future.CCP 334 (Countryside Commission).

Nature Conservancy Council. Hedges and Shelterbelts. (Nature Conservancy Council leaflet.)

Pepper, H.W. (February 1987). Plastic Mesh Tree Guards. (Forestry Commission Research note 5/87 WILD).

Potter, M.J. (1987). "Shelter Questions and Answers." Forestry and British Timber, Vol.16, No.10, p.28-35.

Potter, M.J. (1988). "Treeshelters Improve Survival and Increase Early Growth Rates." Journal of Forestry, Vol.86, p.39-41.

Price, C. (1989). The Theory and Application of Forest Economics. (Blackwell).

Rowntree, D. (1991). Statistics Without Tears. (Penguin).

Shafer, E.L., & Richards, T.A. (1974). A Comparison of Viewer Reactions to Outdoor Scenes and Photographs of Those Scenes. U.S.D.A. Forest Service Research Paper NE-302. N.E. Forest
Exp. Station, Upper Darby, P.A.

Shanks, C.W. (November 1989). Treeshelters; A guide to their use and information on suppliers. (Forestry Commission paper.)

Shoard, M. (1980). The Theft of the Countryside. (Maurice Temple Smith).

Shuttleworth, S. (1984). "Consensus and Perception of Landscape Quality." Landscape Research, 9, 17-22.

Snowdonia National Park. (1977). Snowdonia National Park Plan. (Snowdonia National Park).

Soper, M.H.R. & Carter, E.S. (1991). Farming and the Countryside. (Farming Press).

Thomas, A.L. (unpbl.) Coed-Cyfrwng i Hagru neu Harddu. Undergraduate thesis, Normal College, Bangor.

Thomas, R.S. (1990). Blwyddyn yn Llyn. (Gwasg Gwynedd, Caernarfon).

Turner, T. (1987). Landscape Planning. Hutchinson.

Weller, J. (1983). "Farm Buildings." Landscape Design, 144, p.20-2.

Westmacott, R. (1987). "Real Farming in the Landscape." Landscape Design. 169, p.45-8.

Wiliam, E. (1992). Hen Adeiladau Fferm. Llyfrau Llafar Gwlad 22. (Gwasg Carreg Gwalch).

Williams, J. (1985). Digest of Welsh Historical Statistics Vol. 1 & 2. (Welsh Office, Cardiff).