Classification of Landscape Sensitivity for Visual Impact Assessment of Forestry

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Summary

The landscape issue of greatest overall significance in Ireland at present is forestry. Large scale forestry development is increasing due to recent reduction in the viability of conventional agriculture. With growing emphasis upon leisure pursuits as well as on environmental quality, forestry is no longer regarded as a purely commercial enterprise, but also as an amenity, both inherently and visually in the landscape.

Relatively little serious research is being carried out on the visual impact of forestry upon the landscape, yet this impact is increasingly being recognised as critical, particularly as forestry is often located in visually sensitive mountain regions. With growing public sensitivity to the integrity of the rural landscape and tightening of control of development by county planning authorities, a systematic and thorough procedure must be developed for the assessment of this impact. As the scope of forestry expands to include amenity development, such assessment will become more critical. The positive development of forestry, especially in visually sensitive areas, will require long term planning and will likely have to conform to an overall land use and landscape policy which indicates the extent and type of forestry acceptable.

In order to determine which landscapes require strict control with respect to visual impact, it is necessary to first establish the visual sensitivity of the landscape. Visual sensitivity levels determine whether or not forestry development in a particular landscape is acceptable and are established by examining the following: landscape susceptibility, key viewpoint distance, landscape quality, aesthetic experience. Assuming that forestry is acceptable, a forest design is next produced, followed by the production of visual simulation. Visual impact assessment (VIA) is finally carried out on the site from key viewpoints based upon the visual simulation facilitating systematic assessment of the aesthetic relationship of forestry to the landscape.

Introduction

The landscape issue of greatest overall significance in Ireland at present is forestry. Timber volumes from coniferous plantations are increasing rapidly and will reach 4.4 million cubic metres by the year 2010, which is seven times more than what it was 30 years ago (Carbonnier, 1990). In addition, support for agriculture is declining due to the CAP reform, and forestry development, by removing land from primary food production, is seen as particularly relevant to the EC's problem of surplus of agricultural products (Conway, 1990). Due to the imminence of transition from small mixed farming activity to forestry, there is growing concern about the

environmental consequences (Farrell, 1990). Research is currently being carried out at University College Dublin (UCD) in conjunction with other bodies in the EC on edaphic and ecological impacts of forestry as well as socio-economic impacts. One of the most critical impacts, but receiving relatively little attention in terms of serious research, is that of the visual impact of forestry, whether in isolation or integrated with amenity. The visual transformation of landscape character by forestry from planting through thinning to harvesting can be enormous and is one of the first impacts to be immediately and directly experienced, especially by the public.

Changing Attitudes Towards Forestry

The objective to maximise timber yields has resulted in forestry being carried out primarily on pragmatic grounds. Plantation design has conventionally been determined by practical considerations such as soils, drainage, elevation, aspect, access and gradient. Until recently forestry has been practised with little or no cognisance being taken of the ultimate visual impact on the surrounding landscape. While a plantation can be regarded simply as another crop in the landscape, clearly it is distinguished by both the duration of its existence and its three dimensional character, and thus has considerable visual implications in the long term. If, therefore, the forest designer is asked to step back and view the site in the context of the surrounding landscape, taking into serious consideration the visual implications of, for example, existing landform, vegetation, structures and amenities, the original design is likely to be affected.

Gradually forestry is no longer being regarded purely as a commercial crop but also as a visual and recreational amenity. This shift in attitude can be attributed to factors including increasing public sensitivity to the integrity of the rural landscape as a whole and tightening of control of developments in the landscape by county planning authorities, including the likely future emergence of a national landuse policy with incentives for the conservation of rural landscape, as are provided in Britain.

Public Concern

The public often perceives commercial coniferous plantations, particularly in scenically attractive mountainous regions, as a monotonous and visually dominating land cover or as an accumulation of scattered postage stamp plots disrupting the flow and destroying the traditional character of the landscape. Such public perception is all too often validly founded upon the prevalence of banal coniferous plantations comprising homogenous colour and texture and where overall plantation form is geometric and in visual conflict with the natural contour. The perception of forestry as an amenity, both visual and recreational, arises due to the increasing

consciousness among an expanding urban population of the quality and integrity of the rural environment and also increased leisure time and demands for accessible rustic amenity. The outcry against commercial plantations does not come only from the urban population concerned about the conservation of the rural landscape and its preservation for visual and physical amenity, but also from the farming community which can regard forestry as a land grabbing" activity. The emotive response that forestry illicits from people, whether latent or explicit, positive or negative, cannot be ignored when planning plantations.

Planning Guidelines and Legislation

Planning authorities in Ireland are attempting to constructively control development in order to safeguard the integrity of the rural landscape. This is being helped by the recent regulations incorporating the environmental impact assessment (EIA) process as outlined in EC Directive 85/337 which have been incorporated into the Irish planning code. Procedural regulations are contained in S.I. No. 25 of 1990 and the 200ha. threshold under which primary afforestation requires EIA is set by S.I. No. 349 of 1989. The majority of afforestation proposals are, however, small enough not to require an EIA. Nevertheless, the positive development of forestry on a broad scale throughout the landscape, especially in visually sensitive areas, will in the future likely require long term planning of land use and include an overall land use and landscape aesthetics policy.

A national landuse policy, an objective of which should be to ensure that specific developments are appropriate, would incorporate aesthetic controls based upon visual sensitivity levels and would indicate the extent and nature of development suitable for each area. Visual sensitivity levels can be determined by examining landscape susceptibility, key viewpoint distance, landscape quality and aesthetic experience. Sensitivity levels can establish the degree of visual sensitivity, indicating whether forestry is acceptable, and if so, whether the site is located in a sufficiently sensitive landscape as to require a visual impact assessment (VIA) as part of a submission for approval to granting bodies such as the Forest Service or to the Planning Authorities.

Assuming that the assessment of a particular landscape for visual sensitivity indicates that forestry is acceptable in a visually sensitive area, a design is then produced. The design should be informed by the understanding previously gained of the site and context during the process of analysis for the establishment of sensitivity level. The design should then be visually simulated in order to undergo a systematic VIA. Such assessment forms a vital part of any EIA and would be particularly important for forestry in the landscape. The VIA process is most useful as a means of identifying weaknesses in the design and for further refinement. Large

scale forestry in any scenically sensitive area would particularly benefit from a detailed VIA.

Research on VIA and Design of Forestry

While criteria for the design of forests and the aesthetic judgement of existing forests abounds, relatively little has been published which provides detailed methodologies for the VIA of forests. Publicly available literature, such as in the *Forestry and the Landscape Guidelines* booklet by the Irish Forest Service (For. Serv. 1992), *Forest Landscape Design Guidelines* booklet by the Forestry Commission (For. Com. 1989) and *The Design of Forest Landscapes* written by O. W. R. Lucas (Lucas, 1991), focus upon design criteria rather than the visual sensitivity of landscape with regard to forestry and VIA of forestry proposals. One of the earliest publications to explore forest landscape visual analysis was *Forest Landscape and Inventories – A basis for Land Planning and Design* by R. B. Litton (Litton 1968). Much of this work, such as visibility of landscape with regard to distance and angle of view, continues to be used as a reference in more recent literature. *The Forest Landscape Handbook* by the Recreational Management Board of the Ministry of Forestry, British Columbia (Min. For., 1981) does formulate a guideline for the establishment of visual sensitivity levels. The procedure followed in the guideline is similar to that followed in an earlier case study on the forests of Victoria, Australia (Williamson and Calder, 1979). Both pursue a procedure comparable to that used for VIA in general (Yeomens, 1986). The procedure outlined below incorporates the findings of this research and is intended to serve as an indication of the kind of considerations necessary in VIA.

Visual Sensitivity Levels

While the need for embracing factors other than the purely pragmatic in the planning of forestry is by now clear, the question must be asked whether all landscapes require the same level of control and attention to aesthetic design. Not all sites would necessitate detailed assessment, but those in visually sensitive areas may while yet others in very sensitive areas, perhaps, should not be planted at all. Three possible categories of landscape are listed below, including a suggestion of the official documentary requirements for a proposal presented for approval:

- In areas of very high visual sensitivity afforestation would not be acceptable. It is envisaged that this category would obtain for relatively few sites.
- In areas of high visual sensitivity afforestation would be acceptable subject to submission of a VIA to the planning authorities and Forest Service. It is envisaged that this would pertain to the majority of

scenically attractive sites, especially in upland or mountain regions in high demand for amenity. The VIA should include a systematic analysis of, for example, layout, ride lines, roads, fire breaks, felling coups and replanting patterns on a phased basis, covering the forthcoming 150 years where relevant. All of this should be presented in plan and also visually simulated as a three dimensional representation.

- In areas of moderate and low visual sensitivity afforestation would be acceptable subject to submission of detailed proposals to the planning authorities and Forest Service. These proposals would include, for example, layout, ride lines, roads, fire breaks, felling coups and replanting patterns on a phased basis covering the forthcoming 150 years, where relevant. This would pertain to flat landscape of relatively low population and with low demand for amenity.

In order to determine to which of the above categories a site might belong, it is necessary to first establish the visual sensitivity level of the landscape in question. Some landscapes are in scenically attractive areas with high user numbers and close to urban areas or heavily used roads, others are also scenically attractive but remote and relatively inaccessible, while yet others are not visually sensitive. Four variables in the establishment of visual sensitivity levels are identified, namely landscape susceptibility, key viewpoint distance, landscape quality and aesthetic experience (Williamson and Calder, 1979). The results of the analysis under each of these variables are combined in a matrix to establish the visual sensitivity level.

In analysing the landscape for visual sensitivity a thorough understanding of the visual integrity of the site and its context is obtained which will prove useful in both producing the forest design and also assessing that design. For example, appropriate response to such features as rocky crags, water bodies or adjacent hedgerows will likely become clear while examining the landscape under the four variables listed.

Landscape Susceptibility

Each area of landscape is subject to particular demands by the public, reflecting its function, location and character. Depending, for example, upon the intensity of use of an area and public interest in, or attitude towards, the landscape, the site for proposed forestry development may be classified in one of three susceptibility levels, high, moderate or low (Alonso, Aguilo and Ramos, 1986). A site such as Glendalough, for example, would experience both high intensity of use and high public interest, resulting from it's proximity to Dublin as well as it's cultural significance. Clonmacnoise, however, a site of comparable cultural significance, experiences a relatively low intensity of use due to the remote location of the site from any large centres of population or major travel routes. For the purpose of analysis of intensity and nature of use much data

is provided by O.S. and road maps, but the analysis should be substantiated by ground investigation.

Key Viewpoint Distance

Specific points in the landscape where the public gathers or moves should be identified from the analysis of user intensity levels. For example, a site may be viewed from places of amenity such as golf courses, centres of population, such as towns or villages, or busy thoroughfares, such as commuter roads or waterways used for amenity. Such points are called key viewpoints and the closer they are to the landscape under analysis the higher the sensitivity level. The distance of each key viewpoint to this landscape is measured and assigned to one of three categories, namely foreground, middleground or background.

Landscape Quality

The aesthetic quality of the landscape is determined by examining the physical components, comprising landform (including water), vegetation and structures. The aesthetic quality of each of these physical components must be systematically assessed and quantitatively rated. The criteria identified for high physical landscape quality includes (Williamson and Calder, 1979; Steinitz, 1990):

- prevalence of semi-wild land such as moors and heaths, along with agricultural land with minimum evidence of population or structures;
- presence of water;
- vistas providing opportunity to view distant landscapes;
- high relief and rugged landscapes, such as hills and mountains;
- diverse and well maintained vegetation distribution in the foreground and middleground.

Following this assessment carried out from each key viewpoint, the landscape can be assigned to one of three landscape quality categories, high, moderate or low.

Aesthetic Experience

Research identifies not only the physical or bio-physical landscape as being central in landscape assessment, but also the aesthetic experience of the user, including how he/she is affected emotionally and psychologically by the landscape and the cultural meaning which is embodied in the site and its context. (Bourassa, 1988; Schauman, 1988; Lamb and Purcell, 1990; Lange, 1990). Assessment of aesthetic experience provides a significant basis in understanding aesthetic value which any landscape has for the user, and thus indicates the degree of sensitivity. While the aesthetic experience of the site is derived from the physical landscape, the assessment of this

experience is less tangible than the assessment of that landscape. In order to determine the emotional and cultural components of aesthetic experience such factors as intrigue, fascination, delight, enchantment, awe and symbolic content must be systematically assessed and quantitatively rated. These various factors are encapsulated by the 'spirit of place' or *genius loci.* The cumulative score for these factors can then be allocated to one of three categories of aesthetic experience, high, medium or low.

Forest Design

Assuming that the visual sensitivity levels for a given landscape establishes forestry development as acceptable, the next step is to produce a design for the forest. While it is not the main intention of this article to produce detailed design guidelines, some fundamental considerations will be discussed briefly.

Forest design should be carried out with the aim to create aesthetic harmony and balance and ensure not only a positive relationship to, and effect upon, the immediate landscape, but also a visual enhancement of the surrounding environment. Well designed forestry becomes a visual amenity, a particularly critical necessity in visually sensitive areas.

In designing for a particular landscape, advantage should be taken of the insight provided during the analysis for the establishment of visual sensitivity. While the design should be informed by these specific details, some general objectives are listed below:

- Production of a design which responds appropriately to topography.
- Creation of forestry so shaped as to appear harmoniously integrated with adjacent woodlands, hedgerows and field patterns.
- Designing appropriately in relation to adjacent structures, such as farm buildings and roads.
- Holding an ecologically credible yet economically practical balance between disposition and configuration of coniferous stands and indigenous deciduous species and hedgerows.
- Amelioration of the visual impact of straight lines and geometric patterns, such as roads, tracks, and boundaries, by breaking continuity or screening.
- Working within the limits of existing forest compartments (ownership boundaries) in order to modify existing rectilinear plantations through re-structuring at thinning stage. An existing plantation can be modified to improve integration with its surrounds, achieve the appearance of natural harmony, improve amenity value and increase ecological diversity.

Design of forest landscapes can be executed using three scales of aesthetic relationship of internal aesthetics, aesthetics of local relationships and aesthetics of broadscale relationships outlined below. The proposal, in

principle, is judged in terms of the visual integrity of the landscape and whether the development enhances or detracts from it.

- Internal aesthetics covers the visual integrity and spatial interrelationships of not only the forest but also possible associated amenity development, eg. clearings, blocks, roads and vistas.
- Aesthetics of local relationship is concerned with the relationship between the forest development and its immediate surrounds, eg. edge conditions and access points.
- Aesthetics of broadscale relationships is concerned with the effects the proposed development has on the surrounding landscape as a whole, eg. the mass of forestry in the landscape as viewed from a distance.

Visual Simulation of Proposals

In the event that the establishment of visual sensitivity levels indicate that a VIA of the forestry proposals is required, once the design is created, the next step is to produce a visual simulation. Such simulations should depict the development in three-dimensions from each key viewpoint at various stages of the forest rotations. Visual simulations of forestry proposals succinctly annotated can prove to be of great value in regard to design, as they facilitate both planning and granting authorities in visualising the changes in the landscape resulting from a proposed development relative to existing conditions. Thus, the submission for approval to relevant authorities should include depiction of the site prior to planting and simulation of the site at such stages as planting, thinning, semi-mature, felling and replanting. Accurate simulation should be the objective, and this is especially critical where proposals are contentious and are being subjected to a tribunal.

Traditional techniques of visual simulation of proposals comprised the artist's impression, often using photographs of the existing site as a basis for comparison between existing conditions and proposed. Alternatively, such photographs have been used for the creation of a photomontage whereby layers of coloured drawings depicting the proposed development are physically stuck on to the photographs. Such manual techniques cannot be relied upon for accuracy and have thus been superseded by computer graphic simulation which can provide far greater accuracy. Ideally, visual simulation should satisfy two criteria of accuracy, namely visual accuracy and physical accuracy.

Visual Accuracy

Visual accuracy involves the photorealistic depiction of a development in context such that the simulated image is both credible and legible, especially to non-professionals. Details of, for example, vegetation,

fencing and roadways, both existing and proposed, are depicted in colour with photograph-like definition. Photographs taken from key viewpoints depicting existing site conditions are scanned into a computer. Simulation is achieved by using computer "painting tools" in combination with the manipulation of elements of landscape from the same or other photographs scanned into the computer.

Physical Accuracy

Physical accuracy is concerned with measurement and the precise location of objects in three dimensional space. Such simulations can withstand scrutiny during tribunals. They can also provide a reliable basis for on site implementation of forest design, particularly where the forestry layout, rather than being determined by existing rectilinear field boundaries, is more fluid in response to landscape contour. The physical accuracy results from the use of OS maps with contours. These maps are digitised into a computer, including elevation data, in order to produce a vector or line drawing representing the landscape, otherwise know as a digital terrain model (DTM). The particular advantage in terms of accuracy of simulation is the ability to identify any point in space three dimensionally with respect to OS data and the National Grid.

Combining Image and Vector Based Data

Photorealistic images, while visually accurate, cannot be relied upon for physical accuracy as no method of measurement is inherent. DTM's are physically accurate but provide minimal information on detail such as ground cover and none on colour or texture. The combination, however, of both image and DTM is possible and overcomes their respective shortcomings, producing a visual simulation which is both visually and physically accurate.

Visual Impact Assessment

The assessment of the visual impact of the proposed forestry development comprises the examination of the aesthetic relationship of the forestry proposal to the landscape based upon the visual simulations produced. The proposed forestry development is systematically examined from each key viewpoint, the amount of detail visible being a function of viewing distance. Each of the following criteria are used to systematically determine if the proposed design is deemed to be acceptable or not acceptable:

- *Colour*
  Colour is concerned with the relationship of the forest to the surrounding landscape with respect to hue and value. Pure mono-culture coniferous plantations tend to be of uniform colour and can

often visually conflict with the indigenous colours of the landscape. Alternatively, combining different species, particularly broadleaf and deciduous, will help to increase colour variation.

- *Texture*
  Texture is concerned with superficial variation of the surface of the forest canopy. Pure monoculture coniferous plantations tend to be of uniform bland texture, while the combination of different species and/or age classes will help to increase textural variation.
- *Line*
  Line includes edge and internal ride lines, fire breaks, roads and internal felling coupes. A positive relationship to the surrounding landscape might be, for example, feathering the transition between broadleaf and conifer stands or creating non-rectilinear edge to stands at boundaries, roads and transmission lines.
- *Form*
  Form is concerned with the relationship of the shape of the plantation to the surrounding landscape, including response to changes in landform. Deciduous trees can help to blend a plantation with surrounding fields, hedgerows and woodland.
- *Silhouette*
  Where forestry breaks the skyline, appearing in silhouette, the natural flow of the landscape may be disrupted. This can be particularly severe where a mature stand covers a significant portion of a hill or mountain and terminates abruptly at a boundary near the crest.
- *Scale*
  Scale is concerned with the extent of cover of the forest relative to the overall visible landscape, and is measured with regard to other areas of vegetation and diversity.
- *Spatial Dominance*
  Spatial dominance is concerned with the spatial impact of the three dimensional mass of the forest relative to the space in which it is viewed.

The design process should incorporate the VIA, using it to highlight possible aesthetic weaknesses. In addition, it should reflect the understanding of the site and context obtained during the analysis of visual sensitivity. For example, while coniferous plantations are often criticised for creating a serrated profile in silhouette, depending upon the form of the landscape, they may create a certain "alpine" appearance which can be attractive in suitable locations.

The result of the examination of aesthetic relationships may facilitate mitigation of adverse visual impacts, where appropriate and feasible, allowing modification of the design prior to submission for approval to the relevant authorities. Visual improvement may not always be possible,

however, due to silvicultural considerations or the existence of physical constraints, such as transmission line routes and existing public roads.

The VIA report should, finally, be submitted to the relevant authorities. This should comprise the following:

- Outline of the description and analysis procedure.
- Results of the aesthetic relationship assessment.
- Annotated simulations of the site before and after afforestation stages, including an indication where adverse visual impacts occur but, due to other considerations, cannot be ameliorated.

Conclusion

Visual sensitivity levels can be regarded as a local or small scale regional land use policy. Categories of visual sensitivity provide a basis for developing specific design objectives for any given site. When these objectives are incorporated in a design they can be visually simulated and tested and refined through the VIA process. Such a means can ensure higher design standards and overall enhancement of the environment. With the recent tendency to shift from purely commercial forestry towards more integrated developments involving amenity, the creation of visually well designed forests must inevitably be an objective.

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