ABSTRACT

Scenic landscapes are integral component of the forest resource base, those landscapes are identified and described in any forest development plan. A visual impact assessment is prepared when the forest development and access management plans are proposing harvesting, soil preparation, reforestation and road construction in scenic areas. It will be presented the visual landscape management of the "Serra of Monchique" (Northwest Algarve, Portugal) for some of the planned forest development projects in high aesthetic value areas. The use of geographic information systems based, visualization techniques historically has been used to help communities understand and manage their resources. Understanding impacts of planning policy in mountainous areas is often lost in the two-dimensional presentation. To facilitate this understanding new technologies, similar to that found in a flight simulator, were developed to help people visualize change. These simulations were created in Arcview using digital elevation data. Three-dimensional imaging for characterization of environmental sites was beneficial in perceiving the whole picture and in making better and quicker decisions because of the higher capacity in visualization. The development of a 3D geographic information system helped to minimize visual and other negative impacts of forest development projects on tourist attractions. Keywords: landscape management, visual impact, sustainable landscape, viewshed, visualization.

INTRODUCTION

Scenic landscapes are integral component of the forest resource base (Panagopoulos and Hatzistathis, 1995). Those landscapes are identified and described in any forest development plan. With the development of more stringer practices codes and environmentally based guidelines, land owners must provide more detailed and comprehensive visual impact assessments with their development plans. A visual impact assessment (VIA) is prepared when the forest development and access management plans are proposing harvesting, soil preparation, reforestation and road construction in scenic areas. The visual impact assessment should be made available for public review and demonstrate that the proposed operations will achieve the visual quality objectives (Lucas, 1991).

The use of geographic information systems based, visualization techniques historically has been used
to help communities understand and manage their resources (Pullar and Tidey, 2001; Sung et al. 2001). The development of mountainous areas must be environmentally friendly. GIS systems provide a remarkably efficient means of storing and retrieving information on ownership, vegetation, wildlife habitat, geology, slopes, zoning and a host of other attributes that can provide at least a gross understanding of the characteristics of large areas (Campbell and Ogden, 1999). The 1980s saw a great proliferation and adoption of GIS technology in the urban and regional planning community, assisting in different phases of the visual landscape planning and decision making processes (Leitão, 1996).

Forest and landscape management measures have impacts on the amenity value of forests. Understanding impacts of planning policy in mountainous areas is often lost in the two-dimensional presentation. When it comes to visualizing how something will look before it is actually made, three-quarters of the general population just cannot see it. Two-dimensional representations, model boards and artist renderings have proven inadequate (Panagopoulos, 1995). People may have certain attitudes towards management, in particular near urban areas (Tahvanainen et al., 2001). When people believe they understand what a project will look like, most of the time their perceptions are wrong. To facilitate this understanding new technologies, similar to that found in a flight simulator with an impact analysis extension, were developed to help people visualize change.

Computer graphics are playing an important role in giving lifelike information for the estimation of landscapes after finishing large-scale construction projects (Nakamae et al., 2001). Three-dimensional imaging for characterization of environmental sites is beneficial in perceiving the whole picture and in making better and quicker decisions because of the higher capacity in visualization. The citizens of many communities are often the visionaries and are ahead of the most government officials in their interest in developing sustainable landscapes. With this project we will give the opportunity to the government officials and interested citizens to have a look on the results of the planned projects before their implementation starts. In this study it will be presented a visual landscape management of the “Serra of Monchique” (Northwest Algarve, Portugal) and a computer visual landscape design simulations and an evaluation method of the visual impact assessment in the context of forest development and access management planning.

MATERIALS AND METHODS

To create the database of the project was used digital land use and topographic maps, forest development and regional development plan maps and digital orthophotomaps from the Forest Service Department of Algarve. After the above it was prepared a visual landscape inventory where it was identified, classified and recorded the locations and quality of visual resources and values of the study area (Serra of Monchique, Northwest Algarve). Also it was made digital maps of the visual sensitivity, visual absorption capability, existing visual condition and visual quality objectives from existing maps and with the assistance of geostatistics in Arcview geographic information system program and the Spatial Analyst extension. On those maps was transferred the visual landscape unit boundaries and existing landscape alteration such as cutblocks and roads on to a larger scale topographic base map. These provided landmarks to facilitate positioning and sketching of the proposed operations. It was identified the location of key viewpoints on the topographic maps.

The visual impact assessment was conducted in every key viewpoint using the means of travel used by the average forest visitor or traveller (car, bicycle or on foot). The location of key viewpoints selected in the office and identified on the field. At each viewpoint was taken pairs of photographs offset by few meters so a stereographic pair could provide a three-dimensional image that could be used for landform analysis. A Global Positioning System (GPS) was used to more accurately determine the x, y and z UTM coordinates of
each viewpoint. It was estimated the visible portion of the proposed operations on the topographic base map. It was competed a photography data form and a form of submission criteria for digital terrain models that was used in a computer simulation.

Visual quality and visual impact assessment was developed with the use of two techniques: Technique One: The landscape was studied in detail, and then was characterized by reducing it down to simple elements based on artistic interpretations of their form, line, colour, and texture. Technique Two: It was emphasized the perceptual or emotional aspects of a view (Mystery, Variety, Legibility, Harmony, Order). In each key viewpoint it was tried to document people's feelings or emotions as they view an area. Descriptors were applied to characterize a person's opinion. Pleasure, anxiety, nervousness, anger influence the perceptual attitudes of people viewing places and they were identified in each key viewpoint.

Photos of trees, natural autochthonous vegetation, and other landscaping objects were used for digital vegetation modelling. Digital vegetation models were developed with “RAPIDsite Producer” of “Landscape creator” (Ard, 2000). Those modeling workshops are allowing users to generate and visualize landscapes with a large number of plant models at various growth stages. Those programs linked with Arcview GIS can be used in landscape architecture from professionals who seek to simulate very accurately the architecture and growth behaviour of plants, in a natural or a designed environment.

The authors introduce rendering techniques for visual impact assessment using computer graphics and video sequence images. The techniques were: computer generated images and montages for visualizing landscapes with photo-realistic rendering techniques, panoramic images and panoramic montages employing image-based rendering techniques made from video sequence images, and zoomed video sequence images composed with computer generated images. The 3D extension of Arcview and Photoshop were used for the implementation of the above.

The development of more than one design option for each proposed operation may make the design and visual impact assessment process more efficient and cost effective, so it was prepared a visual simulation for each of the design options: sketch, photographic manipulation, computer model, therefore, free hand sketching was used in low risk situations to estimate and draw the shape and position of the proposed operation and photomontages created from juxtaposed and mounted photos create a panoramic view when placed on backup maps to provide the visual context necessary to assess the overall visual impact.

RESULTS AND DISCUSSION

A Digital Terrain Model (DTM) was generated from digitised contour maps and the altitude of specific points in those maps (Ormsby and Alvi, 1999). From the DTM was studied the potential intervisibility of the area and the viewshed of each of the proposed forest development projects. Figure 1 shows the four forest development projects on the study area and the visible portion of the area from one observation point that is considered strategic since it is attracting high number of visitors every year. For this observation point it was used 100° visibility angle and maximum distance 4000 meters. Maximum distance is the most important factor that has to be taken in consideration in a viewshed analysis, because the longer the distance the lower the visual impact that an object can bring to the landscape depending always on the size, form, texture, line and colour of it (Hatzistathis and Ispikoudis, 1992; Matos, 2001). The above maximum distance was considered sufficient to not decrease the truthfulness of the results, thought the size of the area of the proposed forest projects was less than 100ha and it was not bringing considerable changes in the other landscape elements.
Viewshed analysis of the four proposed forest development projects showing what areas of the disturbed surface can be seen by observers for any visible position and how many observers can see the position. The result was a grid theme with visibility attributes assigned to every cell (figure 2). The proposed and existing cutblocks and roads was also digitised and inserted in the DTM as it is described from Buckley and Ulbricht, (1998). It was produced simulations from every key viewpoint.

The digital vegetation models developed with the "Landscape creator" were placed in landscapes created at each key viewpoint to visualize the area with plant models at various growth stages. The results were comparable with photorealistic images computed with the Atelier de Modélisation de l'Architecture des Plantes (AMAP) software as described from Perrin et al. (2001), but precision, detail and simplicity in execution were better with Arcview GIS.

Three variables were used to evaluate whether a proposed operation would achieve the Visual Quality Objectives of the Algarve region. The evaluation was conducted at all key viewpoints. The three variables were:
1. Visual quality objectives for every visual landscape unit (met or not).
2. Visual design of proposed operations (exist elements of good visual design).
3. Scale of proposed operations (proportion in every view).
Those 3 variables compared with Visual Quality Objectives manually and on the computer using the spatial modelling application of the Arcview program. The results of the above comparison were used to create a report for visual impact assessment so governmental officials that approve forest development and access projects could check this report in the approval of the future proposed operations. The report content included: maps, photographs and a copy of the visual landscape simulation (sketch, photographic manipulation or computer simulation depending on the visual sensitivity and importance of the affected area).

Finally a video merging of the DTM and the scanned photographs was used to simulate in a realistic way the appearance of the proposed operations. Digital fly-over video should be asked when high public concern and expectations require public presentation and consultation. A snapshot of one fly-over video made from the DTM of the study area can be seen in figure 3. The report and the evaluation method could help governmental officials to take the appropriate decision: accept, reject or suggest aesthetical modifications in any proposed project in the study area. Honjo and Lim (2001) describe how three-dimensional information of the virtual landscape can be easily placed and transferred through the Internet by VRML technology (virtual reality modeling language). This method can be utilized both for the design of and for the public discussion on landscape planning. Similar visual landscape management plans could be made for the rest of the territory using the visual management plan for the area of "Serra of Monchique" as a model. Three-dimensional imaging for characterization of environmental sites is beneficial in perceiving the whole picture and in making better and quicker decisions because of the higher capacity in visualization. The development of a 3D geographic information system will help to minimize visual and other negative impacts of forest development projects on tourist attractions. At the same time the landscape ecology concepts of edge habitat, patches, fragmentation, corridors, connectivity and mosaics will be easily understood and incorporated in the forest management planning.
FIGURE 1. The four forest development projects on the study area and the visible portion of it from one observation point.

FIGURE 2. View shed analysis of the four proposed forest development projects. The
shadowed area is showing what areas can be seen by observers for any visible position of the disturbed surfaces.

FIGURE 3. A photo captured from the fly-over digital video made to visualize the location of the four forest development projects on the study area.

REFERENCES


