Representing and Communicating Rural Futures through 3D Landscape Visualizations – Experiences from the RUFUS Project

Andrew LOVETT, Sonia CARVALHO RIBEIRO, Derek VAN BERKEL, Peter VERBURG and Ana FIRMINO

1 Introduction

An important attraction of landscape perspectives is that they provide a more holistic means of addressing environmental management or planning challenges (HAAREN ET AL., 2008). Increasing international interest in such approaches reflects the changing nature of rural areas in many countries, particularly a situation where “agriculture is no longer the backbone of the rural economy” (OECD, 2006). In the countries of the EU this has been associated with changes in agricultural policies, notably a decline in the relative importance of the ‘first pillar’ of the Common Agricultural Policy (CAP) concerned with direct support to farmers and increasing budgets for the ‘second pillar’ focusing on wider rural development issues (GALLENT ET AL., 2008).

The policy shift from agriculture to a more general rural development makes the relationships between the CAP and other sectors more significant. It is widely argued that more coordinated approaches to rural development are needed (i.e. a ‘place-based’ rather than sectoral focus, OECD, 2006). This also emphasises the concept of multifunctional landscapes (in terms of both the mixture of land uses present and the range of goods and services provided), as well as the need for effective mechanisms that assist in coordinating policies and planning for particular territories (SELMAN, 2006; MANDE ET AL., 2007).

The RUFUS (Rural Future Networks, http://www.rufus-eu.de/) project is investigating these issues of multifunctionality and policy integration through a series of eleven comparative case studies in six EU countries. These case studies involve the use of interviews and workshops to develop future scenarios for municipalities, explore the potential for multifunctional rural development and to identify current impediments and possible instruments to support progress. Landscape visualization techniques are being used in four of the case studies to assist with the presentation of scenario outcomes in workshops and act as prompts for discussion. Several different visualization techniques are being employed across the case studies (e.g. photomontages, computer-generated still images and real-time models, with variations in levels of realism and use of supporting indicators) to evaluate the merits of different approaches and add to the emerging literature on such comparisons (e.g. SCHROTH AND SCHMID, 2006; MILLER ET AL., 2008; WISSEN ET AL., 2008; SALTER ET AL., 2009). To assist in comparability, guidelines have been developed for the conduct of the case studies and a set of standard questions drawn up to assess the impact of using landscape visualizations.
2 Material and Methods

2.1 Portuguese case study area

An initial case study has been completed in the municipality of Melgaco, northern Portugal. The research focused on the parish of Castro Laboreiro which covers some 9200 hectares, ranging from 400 to 1300 m above sea level. Within the parish there is a steep valley and a higher plateau area to the north. Until recent years, the dominant activity in Castro Laboreiro has been pastoral agriculture with farmers moving to the valley in winter and living on the plateau in summer to take advantage of the open flat pastureland. However, this annual transhumance has now stopped, with permanent housing on the plateau and the valley settlements have been abandoned. In addition there is an aging population and substantial outmigration so that the population of the parish has declined from 1941 residents in 1961 to 995 in 1981 and 722 in 2001.

Castro Laboreiro also lies within the boundary of Peneda Geres National Park, which was established in 1971. This has advantages in terms of attracting tourists, especially in the summer, but restrictive planning regulations associated with this designation have strained relationships between the park, local residents and other authorities. There is currently interest in developing new strategies for economic development in the area, but these need to recognise (and ideally reconcile) the contrasting objectives of different parties. Castro Laboreiro therefore presents a microcosm of economic, environmental and social issues that are found in many rural parts of Europe and consequently provided a very appropriate setting for one of the RUFUS case studies.

2.2 Methodological approach

A total of 30 formal and informal interviews were conducted with stakeholders in the area during June and July 2009. These interviews provided background information on local issues and helped to identify various potentials for regional development in Castro Laboreiro. Based on the interview responses three separate storylines were developed that illustrated possible development pathways over the next 25-30 years. Thirteen stakeholders subsequently attended a parish workshop on 10th July 2009 where these storylines were introduced and the participants then developed two scenarios of their own. Each of the two sub-groups contained a cross-section of stakeholder interests and as part of the scenario development process they were asked to draw the associated landscape changes on a panoramic photo of Castro Laboreiro and a land use map of the parish. After this exercise each sub-group presented their vision for the future to the other participants. This prompted discussion and debate about the possibilities within the area.

The two scenarios were termed ‘Castro Laboreiro: Territorial Sustainability’ (TSU) and ‘New Communalism for the XXI Century’ (NC). TSU relied heavily on policy agencies cooperating with locals for implementation. It included large scale projects like a new improved road, tourist attractions and cultural events. The NC scenario reflected current trends and projected a future with moderate changes to the landscape. These included more woodland cover in the valley and changes in the plateau with some less suitable farmland becoming wild alongside more managed cattle grazing on the better pastures. This scenario also focused more on local partnerships between farmers and entrepreneurs with an
accompanying reduced involvement of central government. Both scenarios included Castro Laboreiro branding and training as part of future developments.

Landscape visualizations were created of the baseline situation and the scenarios developed in the first workshop to prompt and support discussion in a second workshop. Two contrasting forms of visualization were used, digital photomontages from valley and plateau viewpoints produced in Photoshop (ADOBE, 2010) and overview 3D models of the entire parish and surrounding area in ArcScene (ESRI, 2010). Figure 1 shows the three photomontages looking west across the plateau. Landscape changes in the NC scenario were reinforced by depicting grazing of cows and sheep in plateau areas, horseback riding in valley areas, marked trails, hiking and tourist attractions like traditional buildings. In the TSU scenario the photomontage shows a mosaic landscape in the valley with small plot agriculture. On the plateau there is an open landscape with grazing. The activities also include tourism with hikers enjoying the landscape, but in comparison to NC there is more emphasis on agricultural production and an expansion of urban settlement (reflecting increased population due to diversification of activities).

Fig. 1: Photomontages looking across the plateau, a) current situation, b) New Communalism scenario, c) Territorial Sustainability scenario
A 3D model of the study area was initially developed in ArcScene by overlaying a 30 m
digital elevation model derived from ASTER GDEM data (NASA, 2010) with a Landsat 7
pan-sharpened image (dated 24/6/2000) obtained from GLOVIS (USGS, 2010). Land use
maps developed by the stakeholders in the first workshop were digitised and then
converted to raster grids for draping over the satellite image. It was deliberately decided to
present the land use categories as simple colour shadings as a contrast to the detail in the
photomontages. In addition, a key purpose of the ArcScene models was to provide a
overview of the projected changes across the entire parish with an element of interactivity
that include both the ability to select viewpoints and sliders where the user could fade from
one land use map to another. It was anticipated that this later capability would help to make
the land use changes more explicit. Figure 2 below shows a screenshot of how ArcScene
was set up to display the different scenarios and depicts the current land use. Figure 3
illustrates how the land use was expected to change under the two scenarios.

The landscape visualizations were employed in a second workshop on 8th September 2009
attended by 12 stakeholders. In this workshop the two scenarios were initially described on
a verbal basis and then the visualizations were introduced to prompt further discussion and
to help clarify that the drivers and desired outcomes of the scenarios had been correctly
understood by the research team. During the event, participants had the opportunity to
examine the visualizations during coffee/lunch breaks. They were also asked to complete
short questionnaires regarding their opinions on the different ways of representing the
scenarios, first after the verbal description and then after examining the visualizations.
3 Results

Table 1 below summarises results to several questions where the workshop participants were asked respond on a five point scale (1-not at all; 2-not well; 3-unsure; 4-quite well; 5-very well). The average ratings are all between 3 and 4, with no consistent increase for the two visualization methods compared to the initial verbal presentation. There is a suggestion that the photomontages were better in helping people imagine the changes, while the wider perspective provided by the ArcScene models was beneficial in understanding the underlying drivers. In addition, responses to the question ‘Did seeing the visualizations help you understand the storylines?’ were overwhelmingly in the affirmative.

<table>
<thead>
<tr>
<th>Question</th>
<th>Verbal Description</th>
<th>Photomontage</th>
<th>ArcScene Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well can you imagine the appearance of the changes (that are being visualized)?</td>
<td>3.0/3.3</td>
<td>3.6/3.3</td>
<td>3.0/3.1</td>
</tr>
<tr>
<td>How well do you understand the reasons for the change?</td>
<td>3.3/3.5</td>
<td>3.6/3.2</td>
<td>3.7/3.7</td>
</tr>
<tr>
<td>Did seeing the visualizations help you understand the storylines?</td>
<td></td>
<td>10 ‘yes’ out of 10 responses</td>
<td>7 ‘yes’ out of 9 responses</td>
</tr>
</tbody>
</table>
Fig. 3: Responses to the question ‘How well can you imagine the appearance of the changes that are being visualized?’

The averages in Table 1 do, however, conceal some variations in ratings between respondents. Figure 4 combines the results for the two scenarios on a question regarding ‘ability to imagine the changes’ and shows the number of respondents in each rating category for the three presentation methods. From the frequency distributions it is apparent that the number of responses in the ‘3-unsure’ category decreased for the two visualization methods, but with increases in both higher and lower ratings. As a generalisation, there was a tendency for younger and/or more technically inclined participants to favour the visualization methods, whilst elderly ones had more reservations. When asked ‘What type of visualization helped you to understand the scenarios most?’ six participants favoured the ArcScene model, three the photomontages and three said ‘both’.

The complementary nature of the two approaches to landscape visualization was also apparent in answers to other questions when participants were asked to describe ways in which the visualizations helped them understand the storylines or were confusing. Quotes regarding the photomontages included ‘It contextualised the ideas in one picture’; while a more negative comment was that they ‘Did not show all the aspects’. Some respondents liked the ArcScene model because ‘It was quick to understand the patterns of land use that each scenario introduces’, while for others ‘It is confusing because it had many colours’. One of the stakeholders who regarded both types of visualization as equally useful explained this in the following terms.

‘Both, they should be used together. 3D [ArcScene] gives an idea of land use pattern and photomontage allows us to see the activities’. 
A final question asked the participants ‘As a whole do you think that these visualisation are a helpful way of presenting rural futures? Why?’ There were no negative responses to this question with answers including the following.

‘Yes, I can now understand the two storylines better’.
‘Yes, makes us discuss about the same things’.
‘Yes, because we can better understand the different possibilities for rural development’.

4 Conclusions and Future Work

The results of this initial RUFUS case study clearly indicate that landscape visualizations can play a useful role in discussions about rural futures. This includes both illustrating different scenarios and helping to make the concept of multifunctional landscapes more explicit. The findings also suggest that audience members may vary in their reactions, that different types of visualizations may perform complementary functions and that a focus simply on high levels of photorealism or interactivity may not be especially beneficial. Future case studies in the project will include the use of other visualisation tools such as Visual Nature Studio (3D Nature, 2010) and Google Earth/SketchUp (Google, 2010a, 2010b) with the intention of providing a comparative assessment of a range of techniques for supporting rural development and planning activities.

5 Acknowledgements

RUFUS is funded under Theme 8: Socio Economic Sciences and Humanities of the European Commission 7th Framework Programme (Contract No. 21781). The assistance of Kasia Posen, Katy Appleton, Trudie Dockerty and Gilla Sünnerberg with aspects of the research described in this paper is also much appreciated.

References


