Visual Discourse Analysis for Exploring Socio-Ecological System Management Dynamics

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Abstract

The interdependency between human society and the earth system are shadowed by the urgency to navigate management strategies and thus the governance pattern of any socio-ecological systems so as to make these flexible, adaptive, and effective which are bound by two main challenges: 1) natural environment systems are constantly changing in which processes high degree of uncertainty and complex dynamics is involved, and 2) the pressure to fully incorporate social and economic dimensions into the overall picture becomes even greater. Conflict of interests is inevitable which arguably builds on the nature and the extent of socio-ecological system dynamics discourse held by different groups of actors (stakeholders). Failure to address this may result in any associated policy recommendations suffer low buy-in if not being rejected by certain groups of stakeholders. This paper presents an alternative tool, *Visual Discourse Analysis*, which can arguably better capture different stakeholders' perspectives on the dynamics of a given environmental system from social, ecological, and economic dimensions. Areas of shared perceptions and differences in the magnitude of the discourse are explored and subsequently reconstructed through visualisation (conceptual models). The approach in principle takes elements from dynamic modelling, mediated modelling, and grounded theory. The distinct feature of Visual Discourse Analysis rests on its usefulness in visualising drivers, mediating factors, processes and impacts or outcomes which are inherent to any complex and dynamic socio-environmental systems. The application of the tool is situated in the UK uplands landscape management context with a particular reference to the Peak District National Park. The outcomes of the study have meaningfully highlighted variables that policy/decision makers should put emphasis on if their associated policies in managing the environmental system of concern are to be effective, sound, and eventually witness a wide acceptance. Limitations of the tool and directions for future research are also discussed.

Keywords: Visual discourse analysis, Socio-ecological system management, Stakeholders, System complexity and dynamics.

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Introduction

Human societies at various scales from the local to the global are facing increasing challenges in managing their environment. It is obvious that long term maintenance and improvement of the environment in terms of providing goods and services is critical in securing the future of the human race (Costanza et al., 2000; and Lambin, 2005). This notion is especially striking when the scale is viewed from a global interconnectedness perspective (Millennium Ecosystem Assessment (MA), 2005). Undeniably, human society in different parts of the world has played significant roles in altering and shaping the way in which the environmental system works (Steffen et al., 2004; Kirch, 2005; and Folke, 2006) and responds to human interventions. In many cases (if not all) these anthropogenic interventions have inter-temporal and inter-regional consequences. With this in mind, it is then clear that the challenge in environmental management does not simply rest on the complexity and uncertainty of natural systems but also on the capability to incorporate social and economic dimensions into them. In the end, it is the integration of insights from biophysical and social aspects, inclusive of interests and behaviours of those 'stakeholders' in a given system (e.g. Gross et al., 2006), that should receive the highest priority ranking in attempts to develop effective and widely accepted management design and thus governance pattern.

With the mounting pressures from environmental change which is to a large extent unpredictable, along with the presence of groups with conflicting interests, the task of environmental management is a highly demanding one. It serves as a tool and system that carries with it the potential to provide venues for the process of learning (Pahl-Wostl, 1995; Levin, 1998; Hartvigsen et al., 1998; Berkes et al., 2002; Pahl-Wostl, 2006; and Senge, 2006) and ideally to channel inputs into a policy recommendation discourse. As such, it has to strive towards developing approaches for managing environmental systems with such flexibility that the management tools can adapt with changes to achieve desirable outcomes. Failure to address this central element may lead to the degradation and eventually the collapse of the system into which these management tools are subjected. There is mounting research focusing on adaptive management strategies (e.g. Gross et al., 2006 and Noble and Walker, 2006). This aspect of environmental management research has used and benefited from computational modelling to explore various environmental/ecological state scenarios and to identify sound management options.

On the other hand, there is also considerable pressure to fully incorporate the aspirations of various interest groups. By doing so, the rate of buy-in and ownership over such management tools will be greater. Significant transformation has been taking place in environmental management that is from a conventional 'top down' or 'command and control' (Holling and Meffe, 1996) approach to a management framework that places more emphasis on recognising the voice of those people on the ground. Furthermore, given the complex nature of environmental management nowadays, some have advocated that it should be embraced from an interdisciplinary,

pluralistic, and participatory mode (Fraser et al., 2006). By so doing it is clear that more opportunities emerge for social learning processes and that there is room to marry latest, up-to-date scientific understandings from both natural and social sciences with insights from stakeholders (Nygren, 1999; Thomas and Twyman, 2004; Dougill et al., 2006; Prell, et al., 2006; and Reed et al., in press). While the latter helps to increase the relevance of the desired management framework to the intended localities, the former is still essentially required to further examine and thus ensure the consistency of stakeholders' construction of reality with factual facts (Pahl-Wostl, 2006). Addressing consistency becomes especially crucial when the management framework is to be replicated elsewhere for broad scale application.

This paper attempts to develop, explore and eventually offer an alternative tool that can be used to effectively extract and to meaningfully reconstruct environmental management discourses in which various interest groups are engaged. Barry and Proops (1999, p.338) and Proops (2001, p.17) define 'discourse' as the way different groups of people in a given society within a particular spatial confinement and time frame 'see and talk about something'. In other words, discourse is inseparable and thus reflects the rich perceptions held by these groups of people on a particular subject matter. An alternative methodological approach developed through this project is subsequently called 'Visual Discourse Analysis', and is where the perceptions being explored are captured and visually displayed as conceptual models. This working methodology incorporates techniques found in grounded theory (e.g. Strauss and Corbin, 1998), mediated modelling (e.g. van den Belt, 2004), and system dynamics (Hannon and Ruth, 2001) approaches. A particularly important feature of this discursive analytical tool is its ability to visualise drivers, mediating factors, processes, and impacts or outcomes which are inherent to any complex and dynamic socio-environmental systems.

The specific objective of this study is to explore the perceptions of various stakeholders on the complexity and dynamism of interaction between management intervention, and the eventual characteristics of the landscape as the result of this intervention as well as other factors. The UK upland case study examining the Peak District National Park, hereafter PDNP, has been selected as a reference point for 'landscape' as a surrogate for the system boundary under investigation. It has been recognised as an important socio-ecological system due to its potential to bring numerous benefits for human society at local and global levels. Some of these include agriculture (farming), wildlife conservation, tourism, water supply (hydrological function), as well as potential terrestrial banks for trapping and storing carbon from the atmosphere (e.g. Hubacek et al., 2005). With this in mind, it is therefore critical to ensure the capacity of the system to deliver various functions and hence goods and services for present generations and future generations to come.

As with other types of ecosystem, the UK upland does not remain static but undergoes change over time. While environmental change occurs naturally at spatial and temporal

scales, anthropogenic forces intensify the extent of such alterations. In fact, it has even been argued that the upland as a socio-ecological system with its current features is not natural, in that it has been subjected to profound human interventions in the past (Holden et al., 2006). It is these interventions that actually make this system unique. Ultimately, the characteristics of this system as a whole at a landscape level are the result of various factors interacting together in a way that is complex and whose direction is often variable. It is therefore the understanding of the dynamics of this system which incorporates insights from different stakeholders which is crucial if a sound and accommodative long term sustainable management plan is to be developed and realised. On the course to achieve such a challenging, ultimate goal, the visual discourse analysis is deemed relevant with its premise to offer richer and easily accessible and highly communicable insights for effective integration of stakeholders' voice(s) into a desirable framework.

To meet the objectives of this study, while attempting to pick up themes and to establish links between different elements, the following research questions were constantly kept in mind as a source of guidance:

1. What factors drive current and future landscape management in the PDNP?
2. What subsequent factors mediate and thus control the extent of the impact that these factors have on management practice and thus landscape characteristics?
3. What main biophysical features do different interest groups emphasise for long term sustainable management of this landscape?

Discourse analysis as a bottom-up approach

Deliberating the voice of a group or groups of people that belong to various relevant interest domains has received growing attention from both scientific and political communities. In this case the term 'interest groups or domains' is preferred to 'stakeholders' as the former phrase is used for the purpose of establishing contexts for the study rather than situating them in a project or program that involves external parties interference (Brown, 1998). Interests have been recognised, at a global scale, as one of the drivers that shape the contribution of 'different nations and differentiated social groups', on the emergence of environmental problems and the efforts to find ways to tackle them at the same time (Taylor and Buttel, 1992, p.405).

Although in practice one may question the extent to which this 'voice' has been adequately captured by scientific groups and then fed into relevant policy development processes in representative contexts, more and more similar processes need to be encouraged and supported; not to mention that the complex variation in the nature of inherently individual stances, improved access to information and freedom to express preferences all undoubtedly contribute to the content of such voices over a particular issue. (The way such information is packaged and delivered, which is arguably shaped by the agenda of those involved, is in itself another matter). At the very least, by fully taking this voice into account, conflicts and resistance can be minimised and thus the

likelihood of an introduced policy being accepted will be substantially higher. As argued by Bengston et al., (2005), based on their study on urban sprawl in the US, the enormity of public concern to some extent can be seen as a gauge that reflects public willingness to take on board policies and initiatives to address an emerging issue. Furthermore, a study by Bunce (1998) suggested that the subject matter of a given discourse can suffer contention for a long period of time when critical interest group(s) are not actively engaged and their voice was therefore barely included in the discourse itself. Clearly, the study of human perception and thought about a given issue, along with verbal expressions associated with it (in other words 'discourse analysis'), gains increasing relevance.

In the context of this paper, discourse can be simply defined as 'a way of seeing or talking about something' (Barry and Proops, 1999, p.338; Proops, 2001, p.17) held and exercised by a defined group of people in a given society. There is no doubt that different people view things and express their responses in different ways. The discourse that an interest group identifies itself with has been reported to have a partly determinative influence on the 'actions', 'strategies', and 'directions' adopted by the group (McGregor, 2004). Barry and Proops (1999) illustrate examples of how such different perspectives and indication of stances are evident, and how these are subject to influence by varying paradigms (including sets of values, beliefs, attitudes, and priorities that certain groups of people can cling to in their lives) (Hajer, 1995; Barry and Proops, 1999; and Wilkins, 2003). To illustrate, some people may have very little belief that they can make a significant contribution to solve an environmental problem that is considered too great a task to handle, while others may hold more positive attitudes and greater confidence and sense of collective responsibility in that they can be part of the solution. Another extreme example is that some other people may simply not have any interest in the problem, since it may barely register on their agenda or list of priorities. In this case, they may consider other social problems such as unemployment as having greater urgency in comparison to environmental issues. With this in mind, it is therefore crucial to identify the conditions for (public) discourse that can be referred to in order to justify priorities or preferences (Söderholm and Sundqvist, 2003). However it should accepted that these are likely to change over time as people become more educated and culturally open (Norton et al., 1998).

Although the foregoing examples have highlighted individual differences in discourse, they do not, however, exclude the fact that to a certain extent there can be an intersection area or an interface where particular groups of people have shared perceptions. This can happen when individuals that belong to such groups have similar experiences and/or are associated with certain personal attributes in a given temporal and circumstantial context. It is in fact the common characteristics of perception of a given issue at an aggregate level that is becoming a central theme of discourse analysis (Barry and Proops, 1999).

There have been a growing number of studies dealing with discourse analysis in the area of environmental issues, (Barry and Proops, 1999; Addams and Proops, 2000; and Dryzek, 2005) including in the relatively new interdisciplinary field of Ecological Economics (e.g. O'Hara, 1996; Sweeden, 2006). As supported by these authors,

discourse analysis is believed to have the capacity to offer more insights about a particular problem, in comparison to the sole reliance on conventional techniques such as standard economic analysis. The contexts of the studies vary greatly from sustainability in general to specific niches of environmental disciplines such as ecosystem valuation and environmental policy.

Despite the main objective of discourse analysis as a tool to explore how a group of people 'see and view things', a wide range of methodologies have been employed. Such variation in methodologies is mostly related with techniques or approaches adopted in sourcing and analysing the data. As for the former, some studies need to conduct interviews and/or organise meetings with targeted group of people to generate data (e.g. McGregor, 2004). In other cases this is not imperative as data is readily available on printed documents such as in the news (e.g. Bengston et al., 2005). In terms of data analysis, distinction can be simply made between computer-based analysis and human-centred techniques. Particular software (e.g. Barry and Proops, 1999 employing Q methodology; Bengston et al., 2005 using InfoTrend software) can be useful in selecting relevant materials for analysis, by screening out the irrelevant ones and in assigning scores for the purpose of filtering. While one may argue that analysing data using computer software warrants a high level of objectivity to the outcome of the study, it could be argued that the richness of insights gained from such an approach may be limited. Through an iterative process with a human-based approach, the desired consistency of the outcome can be achieved with a richer understanding of the problem, as computer software may not capture certain valuable aspects and nuances. After all, as with most if not all software of the kind, the outcome of the analysis will be heavily dependent upon ability by the researcher/s to define and classify emerging themes and to establish nodes that link them. As such, subjectivity is unavoidable and at the same time balanced by the level of richness of the picture obtained through the respective approach.

However, regardless of the different approaches that can be used to generate and analyse data as briefly discussed above, apparently there is a set of procedures typically followed by studies in discourse analysis. In many parts, this is similar to the step-by-step conceptual modelling approach proposed by Sinclair and Walker (1998) and Walker and Sinclair (1998). The whole process begins with identification of the main topic or issue of which 'discourse' is worth exploring. After this, data collection through primary or secondary sources will follow. Materials obtained through data collection are then sorted and filtered to extract only relevant material for further analysis. The outcome at this stage will be sets of statements deemed crucial to reconstruct the discourse under examination. Finally, storylines will be developed from the statement extracts that have been previously classified into several key themes. Having said that, further follow up on the outcome can be undertaken by, in the case where data is collected through interviews/meetings/focus groups, verifying the sets of statements via the respondents. As part of the Q methodology, Barry and Proops (1999) assigned scores on each different statement in an attempt to elicit the extent to which each respondent agreed with the corresponding statement. Following this, results can be statistically analysed to examine emerging patterns or versions of discourse on the subject under enquiry. Nonetheless,

verbal interpretation of the discourse is inseparable and essential to conclude the overall procedure.

Setting the geographical and socio-ecological context of study

The Peak District National Park (PDNP) (Figure 1) was established as the first national park in the UK in April 1951. Situated at the southern end of the Pennine Hills, the Park extends over a total area of 1,438 km^2 (555 sq. miles). It encompasses the following Government regions: East Midlands, West Midlands, North West, Yorkshire and Humber. With its unique landscape features and close proximity to the surrounding densely populated conurbations, it is not surprising that the park proudly bears the label as one of the world's most visited national parks (Peak District National Park, 2004; Dougill et al., 2006). As such, anthropogenic pressures have become inseparable from the evolving and dynamic state of the park. These come not only from its 35,000-plus human residents, but also from around 22 million people from within and outside the UK who visit the park every year. In addition to tourism, it should be noted, however, that manufacturing, farming, and quarrying also serve as major economic activities in the area (Peak District National Park, 2004; Dougill et al., 2006).

The socio-environmental condition of the park, like most other ecosystems with intense human interest and intervention, is far from static. Dougill et al., (2006) reports how the traditional socio-demographic composition of the park has begun to change. They contend that new wealthy residents have increasingly been buying significant areas of property in the park, often holiday homes at prices which many locals can't afford. Prohibitively high property prices coupled with a dearth of job opportunities means young people look to move away from the area. As a consequence, fewer labourers are available for farm and grouse management work, which are two prominent economic land uses in the area. The fact that these traditional land use practices offer far from promising economic returns has intensified the problem even further. This unquestionably poses challenges to any future scenario development scenarios developed for park management at PDNP as a large percentage of the land (see Figure 2 below) is owned by individual landholders, of whom the majority are farmers. On average, each of these landholders has 62 hectares of farming land[1] (PDNP, 2000). In fact, to continue their management practices on the landscape, these segments of the landholders have to depend upon the injection of financial resource through the governmental agri-environmental scheme. Due to its status as a Less Favoured Area, over 90% of the park is eligible for financial support from the European Commission Directive (Dougill et al., 2006).

[1] Landholding-related data is only available for up to and including 2000. The most recent report (2004) does not indicate data on landownership.

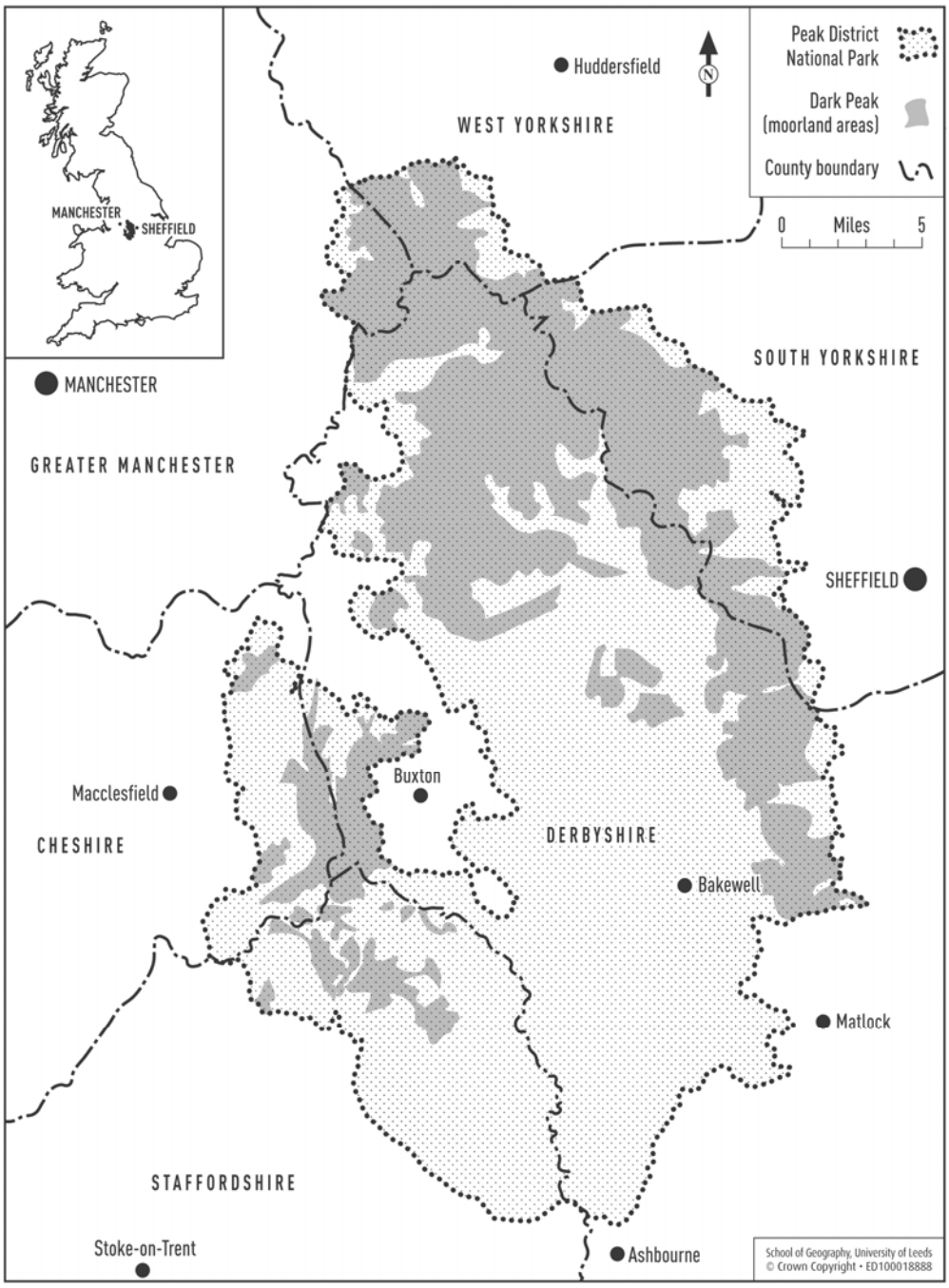


Figure 1. Map of study area

(Source: After Prell et al., 2006)

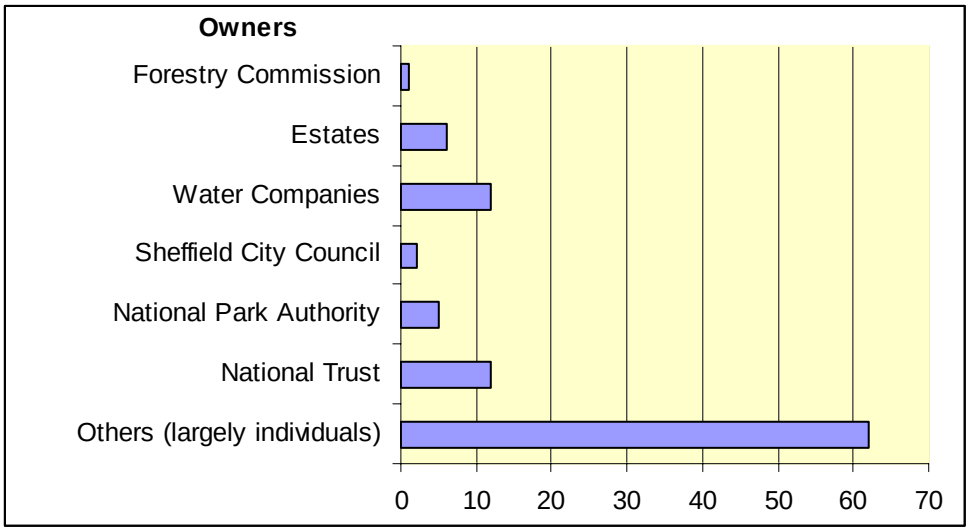


Figure 2. Distribution of landholding in PDNP (%)

(Own analysis, data sourced from www.peakdistrict.org)

Undoubtedly, it is the design of the governmental subsidy scheme that plays a critical role as one of the overriding determinants in directing current land management practices to achieve preferable landscape conditions for the future. More and more pressures on land managers to sustainably manage the land are very likely with the review of existing schemes and the emergence of new initiatives. As for the latter, land managers will be expected to do more to ensure that their land is in good conditions, if they are to be eligible for embracing the Water Framework Directive for example. Minimisation of erosion and pollution through runoff should be the main objective of their land management options. As for the former, rewarding or incentive mechanisms, especially on agriculture activity, are no longer based on land productivity (as gauged through farming output) and have been replaced by a 'Single Farm Payment' method. This mechanism, as an outcome of the Common Agricultural Policy, is expected to encourage land managers to adopt more sustainable land management practices and to place greater interest on the protection of wildlife and their habitats (Lowe et al., 2002, Dougill et al., 2006). However, it is important to bear in mind that the answer to the question of to what extent these better mechanisms will be embraced by land managers as well as how these will bring about positive impacts on the landscape is far from simple. The nature of the complex interrelationship of this issue in light of the cross-section of a stakeholders, serves as the premise of this research project.

Methods

Developing a Visual Discourse Analysis

This particular research draws upon a unique methodology (i.e. visual discourse analysis), which is arguably the first of its kind, especially in the sphere of environmental management. Having that said, it is fair to say that the proposed approach has some degree of resemblance to the methodology developed by Sinclair

and Walker (1998) and Walker and Sinclair (1998). Nevertheless, in addition to the fact that the approach introduced through this study is the first to be named visual discourse analysis, it has several important distinct features which will be described later in the section.

While most of the steps in a typical discourse analysis described earlier in this section are applicable for this research project, it is still worth mentioning that there are several distinct features that characterise the visual discourse analysis approach employed in this study. In principle, this approach combines a selection of elements taken from three different methodological approaches, namely mediated modelling (e.g. van den Belt, 2004), grounded theory (e.g. Strauss and Corbin, 1998), and system dynamics (Hannon and Ruth, 2001). Although the analysis was carried out in isolation, an element of mediated modelling was still present in that it sought to explore commonalities among different interest groups, while at the same time recognising the emerging polarisation of perceptions. Furthermore, the approach makes use of data from semi-structured interviews, a technique recommended by van den Belt (2004) as an important tool in establishing a starting point or basis for the development of mediated models. By attaining an initial grasp of the issues raised by the interest groups, the model(s) to be developed will have greater relevance and acceptability.

To facilitate the process of building up such an initial comprehension, a qualitative approach that is useful in dealing with multiple texts or interview transcripts (i.e. grounded theory) was employed. Babbie (2005) summarised the procedure in four steps, which he claims ideally come in sequence as follows:

1. Striking elements or concepts that represent a selected category are compared.
2. Different categories are integrated with relevant properties (indicators and dimensions).
3. Interrelationships between various categories or between themes are established to delimit the theory.
4. The theory is put in writing or produced where essential relationships between different elements are clearly established.

The final distinct feature of the visual discourse analysis is its premise of capturing the complex and dynamic nature of a system. In reality, the nature of environmental problems is far from simple. They are not simply characterised by one single factor causing a linear effect on another individual component of the system. Rather, various components interact with each other and affect and direct how a given socio-ecological system works. In addition, the interactions and effects have the potential to exert spatial and inter-temporal variations in which change is an inherent part of the system. This is not to mention that the resultant effects of various factors imposed on the system can be positive on one component and negative on the others. As such the importance of a system dynamics approach, which takes into account different aspects of a problem of concern, has become increasingly recognised as an alternative tool to deal with current environmental issues (van den Belt, 2004). Only then can the multidimensionality of the problem so far as its social, economic and physical aspects are concerned be meaningfully captured and better understood.

Sourcing the Data

The sustainable upland management project (see Hubacek et al., 2005) conducted one-on-one semi-structured interviews targeting various stakeholders with either similar or distinct interests in the current and future management of PDNP. Interviewees were selected following a stakeholder analysis[2] meeting organised by the project team and further developed through a snowballing technique (Bryman, 2001; Reed et al., 2005; Prell et al. 2006). The interviewees represented a diverse array of interests relating to the management of PDNP as a landscape, including those with concerns relating to farming, grouse management, grouse moor owners, general landholders and tenants, water companies, PDNP authority, and conservation and recreational users. In principle, transcripts produced from interviews described above were treated as data for this study.

However, for the purpose of this study the above stakeholders were further grouped into four major interests. The grouping was deemed necessary to facilitate the conceptual modelling building process (described further in the following section) and to some extent reflects general sharing of views about upland management complexity among individuals within each of these four interest groups:

1. Direct Land Use Group;
   This covers those stakeholders who have an interest in managing the landscape for farming (mainly sheep) and grouse keepering. In other words, the main emphasis of this particular group is on the economic activity of land use.
2. Water Interest Group;
   This encapsulates water companies operating in the area.
3. Recreational Landscape Users;
   Groups whose interest is primarily social and recreational in nature, e.g. ramblers and bird watchers.
4. Management Users Group;
   Groups with wider scale (spatial and temporal) management interests such as the PDNP Authority, National Trust, DEFRA and the English Nature.

Technical Procedure of Visual Discourse Analysis

As the chosen methodological approach suggests, this study draws its premise (content) entirely from the concerns and comments of different stakeholders in relation to the management intervention of the UK uplands landscape and its desired socio-environmental characteristics. Ideally, the whole process begins with the identification of a discourse topic worth researching and subsequently the formulation of research questions. Data collection follows by the means of conducting semi-structured

[2] Initially key stakeholders were identified following examinations of focus groups with members of the *Moors for the Future* management team. The outcomes from this early stage were then cross-checked with key members of other stakeholders that had not been present at the focus group. As a result, a pool of potential interviewees was identified from these two initial stages and subsequently invited to take part in a series of interviews. During these interviews, they would be asked if they would like to recommend others within their stakeholder group who would be willing to participate in the research. For detailed accounts of this technique, see Reed et al., in press.

interviews that target a wide range of interest groups that are hypothesised to hold some degree of difference in perceptions and opinions about the discourse subject matter. A careful sampling design with regard to the justification for selecting representative samples is crucial. When the targeted samples involve institutional bodies it is important to remind the representatives to as far as possible ensure that their responses are closely commensurate with the values and aims of their corresponding institutions. This needs to be critically addressed as it affects the validity of the visualisation of the discourse under research. By ensuring that this is the case, it minimises the likelihood of counter-claims from the representative institution that the outcomes would have been different if other individuals from the same institution take part in the data collection.

The overall data analysis process of this study consisted of two main parts: deconstruction and reconstruction. The first part of the analysis deals with extracting key themes from the data for each of the four major interest groups previously described. These key themes more or less reflect answers to the research questions put forward in the previous section. All individual interview transcripts covered by each of the four interest groupings were subjected to this part of the process. As such interview transcripts that contained the identified, relevant themes were then pulled out and grouped into more systematic categories, as to whether the themes that emerged represented 'drivers', 'processes', or 'effects' or 'outcomes of a process'. During this stage, perceptions held by individuals were aggregated to form a general picture for each different interest group. It should be noted that the aggregation process was not intended to highlight areas of intersection or conflict as far as perceptions are concerned within a particular group. Rather, all elements of discourse expressed by individuals that were deemed relevant to meet the study objective were included in the corresponding group' discourse. In other words, it is the richness of the ultimate picture or discourse on which this study places emphasis.

The reconstruction part of the analysis entails the examination of connectivity or links between variables that emerge as relevant themes and hence resemble the complexity and dynamics of landscape management at PDNP. Even up to this stage, it is of importance to note that the research questions were always borne in mind to guide and serve as the boundary as to what extent an emerging theme could be considered relevant for inclusion. In fact, discarding irrelevant material is an ongoing part of the overall procedure. In the reconstruction process, conceptual modelling that aggregately visualises the interrelationships of various driving factors identified during the previous stage was computerised using VENSIM (http://www.vensim.com/), one of the computer software packages for modelling system dynamics. A variety of features embedded in this particular software system makes it a powerful tool to facilitate the discourse visualisation process. These include, among others, a wide selection of shapes, lines, and colours. Nonetheless, the software modelling features are in general very useful in allocating space for differing variables and links between them on the conceptual models being developed in the visualisation stage. To illustrate, combination of different shapes and colours are useful in highlighting particular themes. What is more, creative use of these features can make the conceptual models more communicative and hence accessible by different prospective users. As such, it is critical

for the model developer to maintain consistency in associating certain features across particular categories of themes.

By now, it is evident that the discourse analysis developed and explored in this study heavily involves the researcher's mental processing or reasoning and intuitive creativity. To minimise distortion or bias, the whole process was performed iteratively by referring back to the data at any stage of the process to ensure that the final product (which is the conceptual modelling) has adequately and consistently captured the reality perceived by stakeholders falling under each interest category. As has been addressed in the earlier section, an ideal visual discourse analysis requires a verification stage by means of taking the analysis products to the corresponding interest groups whose views are incorporated into the conceptual models.

Results and Discussion

In this section, the outcome of the study will be presented by means of conceptual models, which will then be subsequently described. The visual models represent the views of stakeholders from four main interest groups (direct land uses, water enterprises, recreation, and wider-scale management interest). In principle, the models capture the perceptions of these interest groups on three broad areas that make up the complexity of UK uplands management:

1) Drivers that have shaped and will direct UK uplands management in the future.
2) Interdependent interaction between landscape management practices and the landscape characteristics
3) Sets of biophysical characteristics that different interest groups associate with a desirable landscape.

In light of the findings of this particular study, two main aspects are worthy of emphasis. Firstly, with the visual discourse analysis approach, areas of shared perceptions arguably become easily recognisable through the visual representation or reconstruction of the investigated discourse. In general, there is a wide and consistent recognition by stakeholders within and among different interest groups that human intervention through management practices plays a significant role in directing the ultimate characteristics of the UK uplands (Figure 3a and b). Both past and current land use activities affect the various functions and biophysical properties of the landscape. Farming and grouse management have been highlighted by most stakeholders as two major management tools that have the most prominent effects on the landscape.

Nevertheless, factors other than land use practices have also been deemed to have effects on the landscape's bio-physical properties. This eventually determines as to whether it complies with the preference of a particular interest group. Such factors include changes in the climate pattern at global and local scales, changes which by definition have implications which are highly unpredictable. Access for visitors who may increase the likelihood of wild fire risk and site disturbance are also considered by all of the interest groups as one of the factors to which future landscape management should pay attention. Finally, all interest groups recognise the fact that spatial heterogeneity throughout the different parts of the landscape imposes variations on the extent of

impacts of interaction between current landscape management activities and other factors on the landscape itself.

A high degree of shared perceptions have also been identified in terms of various other drivers that have shaped and will continue to direct the overall landscape management strategy. These drivers can be broadly classified into political-legal-institutional, environmental and socio-economic categories. Specifically, despite their different interests, all interest groups acknowledged and emphasised the need to embrace all of the different stakeholders in order to formulate common goals to help to steer the future management of the landscape. What is more, as they are aware of the immense financial outlay consequences involved in managing the landscape, all groups share the concern over the need to urgently address the question of the long-term financial security needed to support landscape management at PDNP. So far, this support has been secured through the governmental agro-environmental incentive schemes. Arguably, the burden on such schemes in the future is likely to be much greater if future landscape management scenarios are to further reduce the volume of economic activities through land use (e.g. farming and grouse) and alternatively to place greater emphasis on biodiversity initiatives. In relation to this, the results of this study have visually uncovered sets of mediating factors[3] that should be taken into consideration when designing such schemes in ways that will be effective and efficient and that will also cause the schemes to be effective and efficient. In the case of farming, for example, incentive schemes should recognise various issues related to landholding. These include the land tenure, size of the farm (not only in terms of production volume, but also its spatial and temporal distribution) and the level of flexibility that land users have to rent various patches of land at different parts of the landscape at different points of time in a given year. In other words, it should address the heterogeneity of individual landholding characteristics, while taking into account interconnectivity across the landscape. In addition, it should also clearly define the objectives that the scheme recipients are expected to achieve. In short, it should combine some aspects of control mechanisms (e.g. compliance records) while at the same time allowing some degree of flexibility for the targeted recipients to design and implement appropriate plans to manage their land, provided that these are directed to optimally achieve the agreed objectives.

[3] Regardless of the contexts, these mediating factors have been referred to as various factors that determine the level of impact that a given driver may impose on the other components of the system linked through an influential connection.

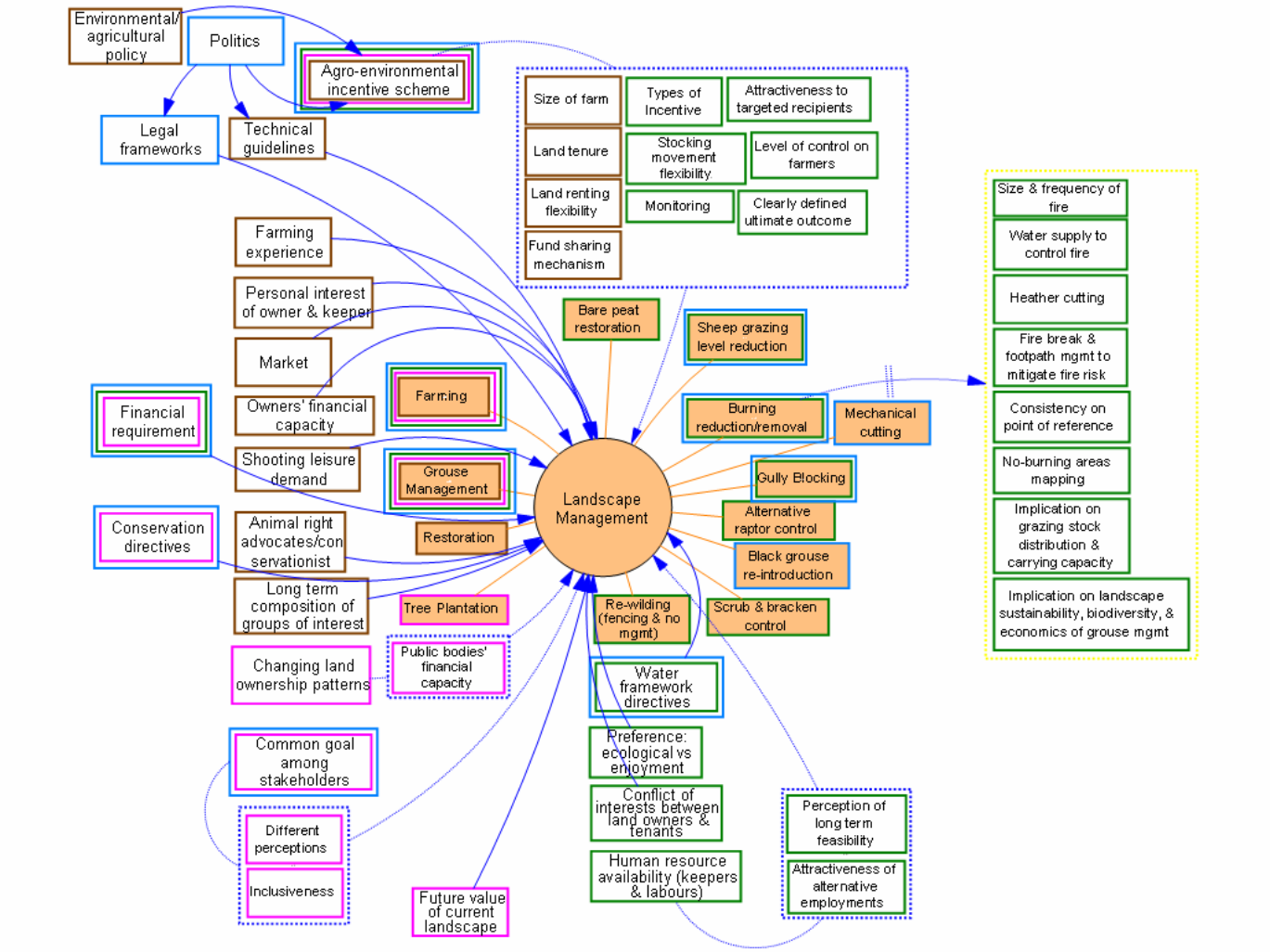
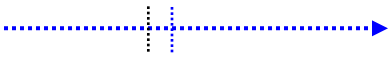


Figure 3a. Visualisation of Discourse on Uplands Landscape Management: Combined Viewpoints

Table 1. Legend for Figure 3a and 3b

Visualisation	***Captured 'discourse'/Groups whose 'discourse' being represented***
	Direct land users (managers)
	Recreational group
	Conservationist (Statutory bodies)
	Water companies
	Mediating factors
	Multiple implications
	Types of landscape management practices
	Desired landscape characteristics
	'Influential relationship'
	'Influential relationship' but intervened by mediating factors
	Removal of a particular landscape management practice results in multiple implications

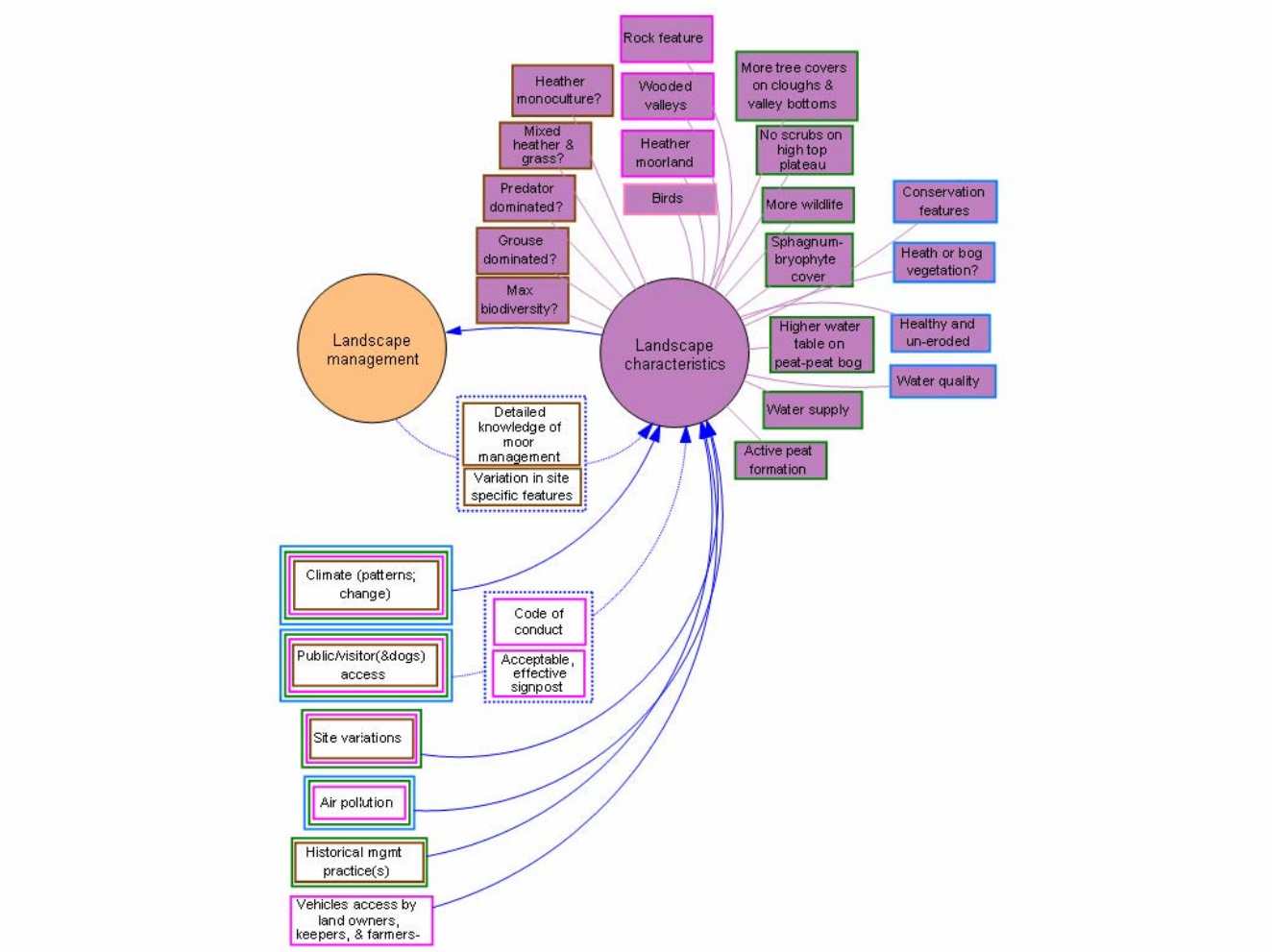


Figure 3b. Visualisation of Discourse on Uplands Landscape Management: Combined Viewpoints

Secondly, the discourse visualisation, evident in the form of conceptual models, voluntarily lends itself as a means for comparing and thus highlighting the degrees of 'difference' in the magnitude of the discourse towards the landscape, which emerges between groups with different interests. In short, there are five main areas that need to be collectively investigated and addressed by these different interest groups:

1. The ultimate objectives of the landscape management in terms of which biophysical properties are expected to be achieved (i.e. what features are desired and in which parts of the landscape) (Figure 3b);
2. A consistent and wide ranging acceptance of site reference points of areas in general and blanket bog in particular which will remain free from burning;
3. A measurable and fair definition of balance between conservation and socio-economic objectives (e.g. the degree of predator control restrictions and its implications on grouse economics, changes in burning regulations and its effect on the distribution of grazing regimes across the landscape);
4. The openness of different interest groups to acknowledge the impacts and implications that different land uses and/or management interventions in

general have on the landscape characteristics and thus on the interests of other groups in the area; and

5. A collective acceptance of the extent of certain management interventions which can be considered 'appropriate' and 'beneficial' in achieving the ultimate objectives in managing the landscape.

In light of the discourse study in general, it has been highlighted that attachment to certain sets of values, beliefs, attitudes, and priorities by different groups of people could result in and be noticeable through a divergence in discourse on a particular subject matter (Hajer, 1995; Barry and Proops, 1999; and Wilkins, 2003). However, it is again beyond the scope of this particular study to examine such linkages. Having said this, such divergence could perhaps be linked to patterns and intensity of communication between members of different interest groups. Although a social network analysis conducted by Prell et al. (2006) revealed that these different interest groups had more or less common views on the general uplands landscape management, distinct patterns of communication networks were still evident. To illustrate, based on their stakeholder classifications, strong linkages in communication were noticeable between agriculture and grouse stakeholders as one 'assemblage' and between water companies and conservationists as another. Nevertheless, the visualisation of the above aspects of landscape management that have not fallen into the sphere of shared perceptions suggests the need for more interaction between the different interest groups. This should be seen by those groups as opportunities to communicate and to share their respective visions as well as their wealth of understanding regarding what a complex and dynamic system is. Such communication will help to positively contribute to a sustainable future uplands landscape management. Scientific knowledge from both the natural and social sciences will be essential to aid and stimulate the process as well as to corroborate and enrich such insights with the latest academic body of knowledge. In the end, from an anthropogenic landscape driver's point of view, it is in fact their open, mutual, and collective collaboration that determines the fate and sustainability of the uplands in the future.

Conclusion and Limitations

Conclusion

Regardless of the emerging variation in 'discourse', the outcome of this particular study has shown overlapping perceptions in two main areas shared by different interest groups. Firstly, all groups who have interests in uplands landscape management admit that there is strong interdependency between human management interventions and the eventual biophysical characteristics functioning and observable in the landscape. However, this would arguably require collective, deliberative participatory discussions to determine management objectives that proportionately contain the substance of landscape system ecological integrity and long term socio-economic sustainability. This process should also work in tandem with willingness from economically driven land users to evaluate their land use practices and to modify these as necessary to achieve the agreed objectives. At the same time, other interest groups who have direct influence and an agenda in landscape management should be prepared to, in a transparent and

consistent manner, explain the rationale - and to address the implications of - alternative management options that they are suggesting. Secondly, all the different interest groups are fully aware that various drivers have shaped and will direct the future management of the uplands landscape. These factors range from political-legal-institutional to environmental to societal preferences. Specifically, they were concerned with the long term funding mechanism to support the uplands landscape management if its ultimate goal is to go beyond economic activities. The agro-environmental scheme has been recognised as the principal and most likely mechanism. Nonetheless, the outcome of this study points to the fact that the design of such schemes should take various factors into account. It should have 'compliance control' built into the package while at the same time allowing some degrees of flexibility for land users who take the scheme on board in developing and implementing designs to manage their lands to achieve the shared objectives. In addition, the scheme should also recognise variation in individual landholding characteristics, spatial and temporal heterogeneity as well interconnectivity between individual sites across the landscape. Only then such schemes will have the greatest likelihood of facilitating the intended objectives towards a sustainable future of the uplands.

Limitations

As a newly developed working methodology, the visual discourse analysis is consequently not immune from limitations. More application of this tool in discourse-related studies in various contexts, especially those which explore people's perceptions on the dynamics and complexities of socio-ecological systems, is necessary to refine the technique. Particular emphasis for future work should be directed towards consistently transforming various categories of system components (e.g. drivers versus outcomes), as well as different types and degrees of 'influential relationships', inherent in any complex socio-ecological systems, into distinct, communicative visual representations. It is recommended that such future work should critically incorporate the various essential elements of syntax discussed by Sinclair and Walker (1998) and Walker and Sinclair (1998) and creatively integrate these with various visual features (e.g. the size and colours of lines and arrows) available in software packages that are widely used for system dynamic research such as VENSIM & DANA.

This particular study, as has been addressed in other sections of this report, has focused on the qualitative aspects of socio-ecological system complexity and dynamics. Two main opportunities for future studies are therefore available. A further elicitation process is recommended, as this would serve as a vehicle to verify the various components and connections captured through the visual discourse analysis with the respective interest groups. During such a process, clarification from the corresponding interest groups could be sought especially in order to redefine certain 'ambiguous' variables captured in the initial visualisation stage. The outcomes from both the initial and verification studies could then provide some basis for quantifying various links in the eventual dynamics models. This does not necessarily imply, however, that all components explored through the visualisation and verification stages are quantifiable by nature. Finally, from the uplands landscape management perspective, more thorough studies are required to examine the implications of alternative management

options such as burning reduction/cessation on the biophysical and socio-economic characteristics of the landscape and to determine to what extent this will eventually drive the whole process into a sustainable state.

The aforementioned limitations shall not, however, override the significance of the visual discourse analysis developed through this study as well as the novelty of its subsequent outcomes. As put forward by Sterman (2000), conceptual models can serve as a mean to compare and examine the diverse interpretations of the dynamics of a given system. In particular, the visual reconstruction of the discourse through this study which takes form in conceptual models can be useful in several ways. These conceptual models lend themselves as a tool for concerned interdisciplinary research teams to clearly identify major areas of studies that are highly relevant for further sustainable management modelling of the landscape (in this case, the UK uplands). At the same time the distinct visual representation patterns of landscape management discourse emerging from different interest groups can be easily used to highlight areas of shared perceptions or otherwise polarisation. From a technical point of view in research involving a participatory approach, this is beneficial to help researchers to be prepared with strategies to mediate the process with the least possible conflicts or tension between different groups. On the other hand, the products of the visual discourse analysis can serve as an easily accessible and communicable means for each of the different interest groups to appreciate the concerns of others outside its group. Finally, visual discourse analysis warrants usefulness for policy makers in recognising various factors that should carefully be taken into account in designing particular policies targeting environmental management. In the context of a socio-ecological system such as the UK uplands, where the costs of striking a balance between environmental safeguarding and socio-economic sustainability are high, comprehensive understanding about such factors will support the development of efficient and effective policies.

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