Adaptive Governance for Carbon Management

The case of the Dark Peak in the Peak District National Park

A thesis submitted to the University of Manchester for the degree of Doctor of Philosophy in the Faculty of Humanities

2014

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The following poem captures rather accurately what this journey, called a PhD, means to me:

'Ithaca'

Σά βρείτε στὸν πηγαίνο γιὰ τὴν 'Ιθάκη, νὰ εὔχεσατ νὰ 'ναι μακρὺς ὁ δρόμος,
νεκτὸς περιπέτειες, νεκτὸς γνώσεις.
Τοὺς Λαυστρυγόνα καὶ τοὺς Κύκλωπας,
τὸν θυμωμένο Ποσείδώνα μὴ φοβάσαι,
tέτοια στὸν δρόμο σου ποτὲ σου δὲν ἔχαι,
ἄν μὲν ἡ σκέψις σου ύψηλη, ἀν ἐκλεκτὴ
συγκίνησις τὸ πνεῦμα καὶ τὸ σῶμα σου ἀγγίζει.
Τοὺς Λαυστρυγόνα καὶ τοὺς Κύκλωπας,
τὸν ἄργον Ποσείδώνα δὲν θα συναντήσεις,
ἄν δὲν τοὺς κουβανεῖς μὲ στὴν ψυχὴ σου,
ἄν ἡ ψυχή σου δὲν τοὺς στίγκει ἐμπρός σου.
Νὰ εὔχεσατ νὰ 'ναι μακρὺς ὁ δρόμος.

Πολλὰ τὰ καλοκαιρίνα πρωίνα νὰ εἶναι
ποὺ μὲ τὶ εὐχάριστη, μὲ τὶ χαρά
θὰ μπαίνεις σὲ λιμένας πρωτειδώμενος.
Νὰ σταματήσεις στὴ Αμάθης καὶ
cαὶ τὰς καλὲς προγέματες νὰ ἀποκοτῆσεις,
σεντέφια καὶ κοράλλια, κεχιμάραια κ’ ἕξενους,
καὶ ἵδονικα μυρωδικὰ κάθε λουῆς,
ὅσο μπορεῖς πίο ἄφθονα ἱδιόνικα μυρωδικά.
Σὲ πόλεις Αἰγυπτιακὲς πολλὲς νὰ πάς,
νὰ μάθεις καὶ νὰ μάθεις ἀπ’ τοὺς
σπουδασμένους.

Πάντα στὸ νοῦ σου νὰ 'χεις τὴν 'Ιθάκη,
Τὸ φθάσαμεν ἐκεῖ εἶν’ ὁ προορισμός σου.
Ἀλλὰ μὴ βιάζεις τὸ ταξίδι διὰκου.
Καλλίτερα χρόνια πολλὰ νὰ διαρκέσει.
Καὶ γέρος πία ν’ ἀράδεις στὸ νησὶ,
πλοῦσις μὲ ὅσα κέρδισες στὸν δρόμο,
μὴ προσδοκώντας πλοῦτι νὰ σὲ δώσει ἡ 'Ιθάκη.

Ἡ 'Ιθάκη σ’ ἔδωσε τ’ ώραξα ταξίδι.
Χωρὶς αὐτὴν δὲν θὰ 'βγαίνες στὸν δρόμο.
Ἀλλὰ δὲν ἔχει νὰ σὲ δώσει πία.
Κὶ ἐὰν πτωχὴ τὴν βρείς, ἢ 'Ιθάκη δὲν σὲ γέλασε.
’Ετοι σοφὸς ποὺ έγνες, μὲ τόση πείρα,
ἤδη θὰ τὸ κατάλαβες οἱ Ιθάκες τὶ σημαίνουν.’

Κωσταντίνος Π. Καβάφης,

(Aπαντά, σ. 48-49)

'Ithaca'

When you set out on your way to Ithaca
you should hope that your journey is a long one:
a journey full of adventure, full of knowing.
Have no fear of the Laestrygones, the Cyclopes,
the frothing Poseidon. No such impediments
will confound the progress of your journey
if your thoughts take wing, if your spirit and your
flesh are touched by singular sentiments.
You will not encounter Laestrygones,
nor any Cyclopes, nor a furious Poseidon,
as long as you don’t carry them within you,
as long as your soul refuses to set them in your path.

Hope that your journey is a long one.
Many will be the summer mornings
upon which, with boundless pleasure and joy,
you will find yourself entering new ports of call.
You will linger in Phoenician markets
so that you may acquire the finest goods:
mother of pearl, coral and amber, and ebony,
and every manner of arousing perfume —
great quantities of arousing perfumes.
You will visit many an Egyptian city
to learn, and learn more, from those who know.

Bear Ithaca always in your thoughts.
Arriving there is the goal of your journey;
but take care not to travel too hastily.
Better to linger for years on your way;
better to reach the island’s shores in old age,
enriched by all you’ve obtained along the way.
Do not expect that Ithaca will reward you with wealth.

Ithaca bestowed upon you the marvellous journey:
if not for her you would never have set out.
But she has nothing left to impart to you.
If you find Ithaca wanting, it’s not that she’s deceived
you.
That you have gained so much wisdom and experience
will have told you everything of what such Ithacas
mean.’

Translated by Stratis Haviaras

(C.P. Cavafy, 2004. The Canon. Translated from the
Greek by Stratis Haviaras, Hermes Publishing)
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<th>Description</th>
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<tbody>
<tr>
<td>AES</td>
<td>Agri-Environment Schemes</td>
</tr>
<tr>
<td>AG</td>
<td>Adaptive Governance</td>
</tr>
<tr>
<td>AM</td>
<td>Adaptive Management</td>
</tr>
<tr>
<td>AONB</td>
<td>Areas of Outstanding Natural Beauty</td>
</tr>
<tr>
<td>CAP</td>
<td>Common Agricultural Policy</td>
</tr>
<tr>
<td>CH4</td>
<td>Methane</td>
</tr>
<tr>
<td>CO2</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CPRE</td>
<td>Campaign to Protect Rural England</td>
</tr>
<tr>
<td>DEFRA</td>
<td>Department for Environment, Food and Rural Affairs</td>
</tr>
<tr>
<td>DOC</td>
<td>Dissolved Organic Carbon</td>
</tr>
<tr>
<td>DP</td>
<td>Dark Peak</td>
</tr>
<tr>
<td>DWT</td>
<td>Derbyshire Wildlife Trust</td>
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<tr>
<td>EA</td>
<td>Environment Agency</td>
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<tr>
<td>ECD</td>
<td>European Commission Directive</td>
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<tr>
<td>ES</td>
<td>Ecosystem Services</td>
</tr>
<tr>
<td>ESAs</td>
<td>Environmentally Sensitive Areas</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FoPD</td>
<td>Friends of the Peak District</td>
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<tr>
<td>GHG</td>
<td>Greenhouse Gases</td>
</tr>
<tr>
<td>Gt</td>
<td>Gigaton</td>
</tr>
<tr>
<td>HLS</td>
<td>High Level Stewardship</td>
</tr>
<tr>
<td>HMIP</td>
<td>Her Majesty’s Inspectorate of Pollution</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for the Conservation of Nature</td>
</tr>
<tr>
<td>LAF</td>
<td>Local Access Forum</td>
</tr>
<tr>
<td>LFA</td>
<td>Less Favoured Areas</td>
</tr>
<tr>
<td>MA</td>
<td>Moorland Association</td>
</tr>
<tr>
<td>MEA</td>
<td>Millenium Ecosystem Assessment</td>
</tr>
<tr>
<td>MFFP</td>
<td>Moors for the Future Partnership</td>
</tr>
<tr>
<td>NRRCE</td>
<td>National Risk Register of Civil Emergencies</td>
</tr>
<tr>
<td>NE</td>
<td>Natural England</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
</tr>
<tr>
<td>NRA</td>
<td>National Rivers Authority</td>
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<tr>
<td>NT</td>
<td>National Trust</td>
</tr>
<tr>
<td>PAA</td>
<td>Penny Anderson Associates</td>
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<td>PDNPA</td>
<td>Peak District National Park Authorities</td>
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<td>POC</td>
<td>Particulate Organic Carbon</td>
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<tr>
<td>RELU</td>
<td>Rural Economy and Land Use programme</td>
</tr>
<tr>
<td>RSPB</td>
<td>Royal Society for the Protection of Birds</td>
</tr>
<tr>
<td>SAC</td>
<td>Special Areas of Conservation</td>
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<tr>
<td>SCaMP</td>
<td>Sustainable Catchment Management Programme</td>
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<td>SES</td>
<td>Socio-Ecological System</td>
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<td>SFP</td>
<td>Single Farm Payments</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>SNA</td>
<td>Social Network Analysis</td>
</tr>
<tr>
<td>SPA</td>
<td>Special Protection Areas</td>
</tr>
<tr>
<td>SSSI</td>
<td>Sites of Special Scientific Interest</td>
</tr>
<tr>
<td>STW</td>
<td>Severn Trent Water</td>
</tr>
<tr>
<td>SU</td>
<td>Sustainable Uplands</td>
</tr>
<tr>
<td>UU</td>
<td>United Utilities</td>
</tr>
<tr>
<td>WFD</td>
<td>Water Framework Directive</td>
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<tr>
<td>YW</td>
<td>Yorkshire Waters</td>
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ABSTRACT

The world is facing a 'perfect storm' of socio-ecological crises: adverse climate change, natural resource depletion, water conflict, to name but a few. With many of these future pressures looming, it is essential to learn how to shift from traditional command-and-control strategies to more adaptive ones. Adaptive governance is an approach from institutional theory that combines ecological systems theory, natural resource management and the study of self-governing institutions to manage common pool resources. The Dark Peak of the Peak District National Park is one of the UK’s largest carbon stores, fraught with a history of frequent change in policies and land management activities, conflicting knowledges and interests, convoluted property rights regimes, and carbon emissions. The recent development of a carbon agenda made it an excellent example to explore how this restructures the Dark Peak social network, how its key stakeholders adopt and respond to it, and finally how an adaptive framework can facilitate in mitigating carbon emissions. This thesis offers the first analysis of the Dark Peak’s social network managing for a carbon agenda, and also provides a critical reflection on the possibilities and limitations of using an adaptive framework in this particular context. This has been achieved by combining social network analysis, with stakeholder mapping, observation, and semi-structured interviews to identify the key stakeholders steering the Dark Peak’s carbon agenda.
DECLARATION

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or institute of learning.

Ioanna Tantanasi
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ACKNOWLEDGEMENTS

There are countless people who have contributed with their help and support to the completion of this thesis. I would like to start with a massive thank you to my supervisors Dr. James Evans and Prof. Clive Agnew for their endless support, advice, constructive feedback, inspiration, and understanding that got me through the high’s and low’s of this life-changing quest for knowledge. Thank you for showing me how to use my wings.

I would also like to thank Prof. Chris Davies for being an invaluable line-manager in my first academic research post; studying whilst being a part-time research assistant has been an informative learning experience, thank you for the advice and support on how to achieve this.

I would also like to thank other members of staff within the School of Environment, Education, and Development such as Julia McMorrow, Martin Evans, and Tim Allott for lending me their guidance and insights from their experience in working in the Peak District. I am also immensely grateful to Erik Swyngedouw, Maria Kaika, Andy Merrifield for discussions on the more radical fields of human geography throughout these past few years. A big thank you goes also to the administrative staff Monique Brown, Elaine Jones, and Emma Carter-Brown that offered great support and encouragement. Special thanks also to Moors for the Future Partnership for providing not only with the funding for a part of this project but also with valuable contacts to make this exploration possible.

There are also a great number of friends that I would like to thank for their unyielding support during this time, being there for me either by my side or through the phone and skype has made all the difference. Special mentions go to Jenny Watts, nee Ferreira, for a limitless supply of laughs, sweets, and paper-clips; thank you for also introducing me to the Villiers Park ‘family’ and for teaching together their Geography course for the past two years, it has been a superb experience. Also, thanks to Sarah Kneen for the endless supply of positivity, coffees, and chats; to Sarah Hall, Ralitsa Hiteva, Matt Gray, and Phil Johnstone for their support and thought-provoking discussions; to the ‘Crete family’ Claire Goulsbra, Martin Evans,
Chris Perkins, and John Moore, for welcoming me in the team for the past 4 years; to Andy Speak, Jana Wendler, Mark Usher, Craig Thomas, and Danielle Alderson for making work in the Geography quad pleasant and fun; and finally, special thanks to Japhy Wilson, Emma Shuttleworth, Jenny Watts, and Jane Wilson for their much appreciated support in the final stage of writing up. A massive thank you also to all my fellow Open Spacers Lazos Karaliotas, Brian Rosa, and Samson Wong for the ever stimulating discussions. Also thanks to my Mancunian-Greeks Valentina Spiropoulou, Chrysa Kantere, and George Chalikiotis for adding the ‘Opal!’ factor in the last few months of writing up. And special thanks, to my best friends back home Haroula (Xips) Georgiadou, nee Chondrokostopoulou (could your husband’s surname be any longer??) and Elpida (Pepi) Euthimiou, for being by my side for as long as I can remember myself; thank you for being the sisters I never had.

I am indebted to my parents Korina Exarchou and Theocharis Tantanasis for their unyielding love, motivation, inspiration, and support throughout these past few years, and my whole life. Words cannot describe how blessed I feel to have you as my parents; to begin with I literally wouldn’t be here without you! This is a Cretan mandinada dedicated to you: ‘Όσο ψηλά κι αν ανεβείς, σε τούτη τη ζωή σου, να μην ξεχνάς πως τα φτερά, στα ‘δώσαν οι γονείς σου.’ (Ανώνυμος)

And most of all, I would like to thank Japhy, for providing the happiness and love that makes life this exciting and marvellous journey.
CHAPTER 1 INTRODUCTION

Increasingly, environmental problems of conservation, economic development, social welfare, and adaptation to climate change cannot effectively be managed by traditional command-and-control processes, whereby state actors accumulate relevant knowledge, incorporate it into existing or new policies before putting it into action. Systems where the biophysical and social world interact frequently (Redman et al, 2001), or in other words socio-ecological systems (SES), are characterised by complex regimes of uncertainty, functioning scales of space, constantly changing and with a vast array of probable effects from any management/policy practice. They therefore require new modes of governance that acknowledge the importance and complex interplay within them (Armitage, 2008; Berkes, 2010; Ostrom, 2010; Evans, 2012).

This suggests that strengthening the relationships between social and ecological networks by enhancing communication, learning, collaborative knowledge production may lead to more successful ecosystem services management (Schneider et al, 2003; Tomkins and Adger, 2004; Newman and Dale, 2005; Bodin et al, 2006; Prell et al, 2007; Evans, 2011). An increasingly important approach to governing highly complex and uncertain systems is adaptive management. Initially adopted from ecosystem management, adaptive management encompasses ‘a systematic process for continually improving management policies and practices by learning from the outcomes of implemented management strategies’ (Pahl-Wostl, 2007, p. 51). Adaptive management is a way to increase the capacity of a system to adapt to change under conditions of uncertainty (Holling, 1978; Walters, 1986; Pahl-Wostl, 1995; Lee, 1999). Furthermore, this approach emphasises the importance of institutions in facilitating collaborative knowledge production that uses the knowledge of all stakeholders to reach more effective, more legitimate management decisions (Evans, 2011). Adaptive management combines insight from institutional theory, such as the evolution of formal and informal institutions for the management and use of common pool natural resources and environmental assets that provide ecosystem services (Bowles, 2003; Ostrom, 2005) with those of
ecological systems to focus on the role of self-governing institutions within a network managing common pool resources (Hatfield-Dodds et al, 2007).

The peat ecosystem of the Peak District National Park (PDNP) is characterised by the dynamic intersection of ecological and social processes, suggesting it may be suited to an adaptive approach. Peatlands have increasing ecological importance for climate change mitigation because they sequester and store carbon. The peatlands of the PDNP and of the UK more widely, hold a critical position among the Northern hemisphere peatlands as they are located in the most southern position and therefore will act as an early alarm system for the effects of climate change on these ecosystems. Moreover, current policy frameworks address peatlands as forests (Parish & Silvius, 2008) and thus fail to recognise their special socio-ecological characteristics, which are critical in determining whether they behave as carbon sinks or sources (Worrall and Evans, 2009). Research and natural resource management policies in the past two decades have focused primarily on the promotion of ecosystem services such as clean water (Agnew and Woodhouse, 2010), the reduction of soil erosion (Worrall and Evans, 2009) and the conservation of biodiversity (Dougill et al, 2006; Quinn et al, 2008). However, as carbon budgets become critical due to climatic change, new forms of management are required to ensure socio-ecological systems adapt and therefore continue delivering the most important ecosystem services.

This project builds upon attempts to examine the socio-ecological system of the peatlands in the Dark Peak of the PDNP in terms of its ability to absorb disturbance, self-organise and learn (Folke, 2006). In adaptive governance terms, is the Dark Peak system able to enhance its capacity to adapt to social as well as natural induced pressures? In other words is it resilient? And what does resilience for the Dark Peak socio-ecological system actually mean? This research has explored how knowledge on carbon budgets and the development of a carbon agenda, as a new objective in environmental and land management policies, is being absorbed as an organising principle in the social network of the Dark Peak and how its key stakeholders engage with each other, learn from each other, exchange this knowledge, and even co-produce it. This research therefore represents an
innovative first attempt to explore whether adaptive management may be beneficial in improving the conditions of this peatland ecosystem as well as provide opportunities for the actors, organisations, and institutions that work and live there to become more adaptable and resilient to climate change.

1.1 Aim and Objectives

This research aims to explore how the carbon agenda is employed as an organising principle to manage and govern the Dark Peak, and whether this can be conducted in an adaptive manner. To meet its aim the following three interlinking research questions were designed:

I. How does the introduction of a carbon agenda since 20XXX restructure the Dark Peak’s social network?
   - What are the new and emerging key stakeholders in the network?
   - How has the carbon agenda affected the relationship and ties between old and new key stakeholders?

II. How do the Dark Peak stakeholders adopt and respond to the carbon agenda?
   - What are the key conflicts arising?
   - How do they impact on the stakeholders’ activities?

III. How can an adaptive framework help the Dark Peak manage its carbon agenda?
   - Through what mechanisms can this be achieved?
   - Can it help enhance the Dark Peak’s resilience?

By addressing these research questions I wanted to investigate whether the adaptive management approach may promote more resilient and robust governance within a multifaceted socio-ecological system with a carbon agenda. As stated in the literature (Walker et al, 2004; Adger et al, 2005; Evans, 2009), managing in an adaptive way increases the likelihood of maintaining desirable routes under conditions of uncertainty.
Chapter 2 outlines the scientific and practical context which underpins this research. The chapter starts with the science of peatlands, explaining the processes behind peatland formation as well as the natural environments that support this across the world. Furthermore, it considers the significance of peatlands as a large carbon store due to their capacity in storing the carbon of our terrestrial biosphere long-term. This chapter lays out the reason further research on carbon in peatlands is important mainly due to the contribution of damaged peatlands in at least 7% of the global CO₂ emissions budget. In particular, the peatlands of the UK are considered due to being the 17th largest peatland area worldwide and also in the top 20 most degraded which makes them a conservable contributor to Green House Gasses (GHGs). This chapter then discusses the causes that have led to the degradation of peatlands in the UK, both human and natural induced, before concluding to the reason the Peak District National Park was selected and in particular the Dark Peak. In short the Dark Peak peatlands have been eroding for the past 200 years due to a succession of contradicting land-management practices brought about by differing societal demands in food provision and cultural practices. Topped with the natural effect of climatic change the fate of the peatlands depends on reversing the degradation and also reduce the amount of carbon emitted in the atmosphere by enhancing their storing capacity. It is for these reasons that a carbon agenda has come to exist and affect the Dark Peak stakeholders.

Chapter 3 presents the theoretical underpinnings that set the framework of this project. It explores the key concepts and literature on resilience and the notion of adaptive governance. Ecosystem resilience is the ability of an ecosystem to endure external disturbance without breaking down into a different condition that is governed by different processes. Resilient ecosystems are able to tolerate stresses and reconstruct themselves. In social contexts resilience can allow humans to accept and plan for future changes. Humans live and interact with the natural world and therefore need to be considered as an item, a socio-ecological system (SES), when managing and governing natural resources. They therefore require new modes of governance that acknowledge the importance and complex interplay within SESs. Strengthening the relationships between social and ecological
networks by enhancing communication, learning and collaborative knowledge production may lead to more successful natural resource, or ecosystem services management. The selected case study of the Dark Peak and its socio-ecological system are characterised by all of the above elements of complexity, this therefore makes adaptive governance and the theory of resilience an excellent theoretical approach to explore what these complexities are and suggest how they can be resolved by an adaptive approach.

Chapter 4 begins by explaining that this thesis aims to understand how the carbon agenda is used as an organising principle to manage and govern the Dark Peak, and whether this can be conducted in an adaptive manner. It then introduces the three interlinking research questions that led to achieving this thesis’s objectives. The chapter then considers the research design and methodology developed in this research. Furthermore, this chapter discusses the reason a case study approach was selected for this particular PhD project and also considers previous research approaches in the Dark Peak area. This chapter then discusses in detail the research design, which is comprised by four interrelated methodological tools: a key stakeholder mapping exercise, a set of semi-structured interviews with key stakeholders in the Dark Peak as identified by the mapping exercise, participatory observation, and finally Social Network Analysis (SNA). Chapter 4 concludes by a brief summary of the methodological approach and how this facilitated me to address the research questions. The findings of this research are considered in chapters 5, 6, and 7 where each chapter addresses each research question.

Chapter 5 examines the first research question ‘How does the carbon agenda structure Dark Peak’s social network?’ At first the role of each actor in each of the five key stakeholder categories is briefly considered (Government Agencies and Environmental Regulators, Academic Institutions and Consultants, Utility Companies, Environmental Guardians, and Landowners and Land managers). Drawing from social network analysis theory, this chapter then carries on by exploring the role of each of the five key stakeholder groups and examining their position within the social network. Furthermore, this chapter delves into the patterns the relationships of stakeholders are organised into the network. Social
networks are significant in providing insight in environmental governance, and by gaining an understanding of how the actors in the Dark Peak social network connect with each other we can trace how knowledge travels through the social relations of the network. The quantitative outcome of social networks analysis is presented in a graphic illustration which aids the analysis and allows the reader to trace the social ties, where red ties represent one way communication, whereas green ties mutual communication. Moreover, chapter 5 concludes with laying out the strong and weak elements of the Dark Peak social network. The Dark Peak social network is characterised by a plethora of one directional communication ties which suggests top-down knowledge transfer and therefore a lack in mutual learning among stakeholders. Secondly, there is an abundance of relationship ties that are lacking in trust, a necessity for in-depth dialogue when managing complex environmental issues. Good communication can lead to conflict resolution. Finally, there are highly central stakeholders either individuals or organisations/institutions, that have access and control of the majority of knowledge produced in the network with regards to carbon storage and sequestration. This position allows actors to manipulate information to their advantage and due to spending a lot of energy in being connected in various pools of knowledge and people they may also feel forced to ‘take sides’ and therefore marginalising other stakeholders. Revealing the weaknesses of the social network ties also brings to light the underlying structure of the issues with managing for carbon, as problematised in chapter 6.

Chapter 6 explores research question two ‘How do the Dark Peak stakeholders contest the carbon agenda?’ This is achieved by delving into and considering the key challenges for managing the Dark Peak’s moorlands for carbon. Three key themes have been found through data analysis to contribute to these difficulties. To begin with, there is the contentious issue of heather burning which is further complicating land management and policy decisions due to existing scientific uncertainties but also the polarised interests between pro-burning Land Managers and against-burning Environmental Guardians, or conservation groups. Secondly, the recent increase in demand for new avenues of funding for further scientific research, for biodiversity conservation, and agricultural activities seems to have
found a new potential panacea. Stakeholders’ responses are explored on the recent ‘carbon push’ and how the potential of new funding affect their views and practices. Finally, this chapter discusses how different types of stakeholder knowledges with seemingly different objectives in moorland management are negotiated or not in the Dark Peak adding to the complexity of managing the moorlands for carbon as well as other ecosystem services. The chapter concludes by arguing that adaptive management in this complex context would prove useful in managing the moorland ecosystem in the face of constant uncertainty, and the success for this relies heavily on successful brokering of the disparate types of knowledge and flexible institutions willing to experiment with incorporating these knowledges into current and new rural policies.

Chapter 7 as the final empirical chapter addresses research question 3 ‘How can an adaptive framework aid the Dark Peak deal with its complexities and conflicts?’ It first considers the role of adaptive management in aiding climate change adaptation in the Dark Peak SES, and then moves on to discuss the necessary mechanisms for adaptive governance to achieve collective action, as well as the challenges to maintaining resilience in this complex and uncertain SES. Chapter 7 reflects on the extent to which adaptive governance can affectively contribute to the management of the carbon agenda of the Dark Peak social network. I explore the mechanisms behind adaptive management in practice in the Dark Peak socio-ecological system, and emphasise the importance of social learning, of knowledge brokers, and of knowledge co-production by providing relevant examples from the Dark Peak stakeholders. The chapter also discusses the opportunities for and limitation of adaptive governance in the Dark Peak in relation to case studies from around the world, and considers the possible futures of environmental management in the region.

Finally, Chapter 8 draws upon all three discussion chapters to provide a comparative overview of the significance of the Dark Peak as the selected case study, presenting the key three contributions (theoretical, empirical, and methodological) from studying and analysing the stakeholders’ social network of the Dark Peak and the role of adaptive governance in facilitating the delivery of the
carbon agenda and aiding the co-production of knowledge on carbon management. The disparate stakeholder groups are very well connected and there is abundant knowledge transfer and exchange among them. However, not all types of knowledges are included in the decision-making processes in the same level, and neither are all knowledges produced collaboratively. I argue that the sense of ownership over the avenues and results that stem from stakeholder collaboration can build long-lasting support and dynamic execution of resolutions, a focal element under conditions of intrinsic uncertainty. These processes have already been observed to take place in the following years of this research and therefore there has been an initial shift away from traditional command-and-control modes of knowledges production to more adaptive ones by increasing opportunities of learning-by-doing. The challenge now remains to actively incorporate all these different knowledges in adaptive policies that innovate through experimentation with different agricultural strategies. An important role in this is played by stakeholders who act as intermediaries, or knowledge brokers, that provide forums for active deliberation and knowledge exchange. These activities contribute to building up the adaptive capacity of the Dark Peak social and ecological system to deal with uncertainty and disturbance. The chapter also highlights the need in developing support mechanisms to render current institutions in the Dark Peak flexible to adapt to change and therefore contribute in making the socio-ecological system more resilient against climate change. Finally, the chapter considers potential limitations and drawbacks in the theory and implementation of adaptive management and governance in the case of the Dark Peak as well as in a broader geographical context and offers suggestions for potential future research avenues.
CHAPTER 2 THE NOTION OF ADAPTIVE GOVERNANCE

2 Introduction

‘...ecological science has...provided knowledge about nature that has served to classify and objectify it, to predict environmental change and to provide a technocratic recipe book for directing and controlling that change.’

- W.M. Adams (1997, p.278)

Humanity has a critical role in influencing global biosphere change and constructing ecosystem dynamics from a microscopic to a macroscopic level (Redman, 1999; Steffen et al, 2004; Kirch, 2005). At the same time human societies rely profoundly on ecosystems services and support (Millennium Ecosystem Assessment (MA), 2005). Over recent years, policy-makers and researchers have focused increasing attention on the capacity of human systems to continue functioning in the face of severe and rapid natural and human induced ecological disturbances. An array of examples can be drawn from Hurricane Katrina (2005), the extensive summer flooding in the UK (2007), till the most recent catastrophic earthquakes in Haiti and Chile (2010). On the other hand, ‘the global financial meltdown and post-peak oil production decline’ were the imperative ‘that began to focus political minds on the question of how human society can accommodate future shocks, crises and disasters’ (Evans, 2009, p.1). It has now become fundamental that models of production, consumption and wellbeing develop not only from economic and social relations within and between regions but also build upon the ability of other countries ecosystems to sustain them (Arrow et al, 1995; Folke et al, 1998). Therefore, resilience theory has become something of a new panacea for environmental governance and research agendas towards a more sustainable global future (Costanza et al, 2000; Lambin, 2005; Evans, 2012).
The resilience approach has been used increasingly as a compendium for decoding the dynamics of ecosystems and especially ecosystems affected by human actions and activities: socio-ecological-systems (Folke et al, 2002; Walker et al, 2002; Folke, 2006; Evans, in press). The reason for this lies in its dualistic nature which has roots both in ecology and multiple basins of attraction in ecosystems and its connection to social drivers and dynamics, a key point highlighted in the Millennium Ecosystem Assessment (MA) (2005) (Folke, 2006). The concept of resilience has arisen from a body of work by the ecologist C.S. Holling (1973), which promotes the ability of an ecosystem to renew, re-organise and develop. In other words in a resilient ecosystem disturbance has the potential to create prospect for novel structures, innovation, adaptation and evolution (Folke, 2006). According to Holling and his colleagues (1973:14), resilience is the estimation ‘for persistence of systems and of their capacity to absorb change and disturbance and still maintain the same relationships between populations or state variables’. Their philosophy stresses the need for experts (policy-makers, institutions, scientists) and non-experts (individuals) to learn to manage and live in an ecosystem by change (Carpenter and Gunderson, 2001; Berkes et al, 2003; Peterson et al, 2003a; Kinzig et al, 2003) (e.g. insect outbreaks, fluctuating fish populations, algal blooms, cattle grazing, carbon emissions, storage and sequestration) instead of struggling to control and force the ecosystem into a constructed equilibrium. One must not forget that nature has its own ways of coping with change.

This progressive idea managed to challenge the old dominant command-and-control perspectives, which have implicitly considered the ecosystem of being stable and of infinitely resilient structure, where resource flows could be controlled and nature would regain equilibrium as soon as human action and activity was ceased. Unfortunately, these strategies that have become ensconced with contemporary natural resource and environmental governance tend to offer temporary single, generalised solutions founded on simple system models (e.g. food web dynamics, nutrient cycling), which do not acknowledge diversity or context specificities (see, e.g., Booth, 1994). Furthermore, they often neglect to look more broadly across sectors and can lead to the adoption of so-called blue-
print or ‘panacea’ policy instruments (Brock and Carpenter, 2007; Roe, 1991; Ostrom et al, 2007; Ostrom, 2007).

Such management practices produce environments that become spatially unyielding and susceptible to changes that previously could be diffused and assimilated by the system (Holling and Meffe, 1996; Gunderson et al, 1995; Holling et al, 1998). This phenomenon is called by resilience ecologists the ‘pathology of natural resource management’ (Gunderson et al, 1995) and has been employed to describe various resource systems including forestry and lake fisheries (Regier and Baskerville, 1986), coastal fisheries (Huitric, 2005), agricultural regions (Allison and Hobbs, 2004) and trade, globalisation and growth in organisational structure in urban areas where decisions makers become distant and alienated from environmental feedback in both contemporary and ancient societies (Redman, 1999; Lebel et al, 2002). For example, in the Peak District National Park the changes on land due to changing land-policies have led to the current eroded peat-state and carbon emissions respectively. A common land management strategy implemented in UK peatlands is peat draining (Worrall and Evans, 2009). It has been estimated that 1.5 million ha of the country’s 2.9 million ha of peat has been drained (Milne and Brown, 1997; Stewart and Lance, 1991). The primary purpose for this is lowering the water tables to improve hunting, grazing and forestry (Ratcliffe and Oswald, 1988). As previously mentioned, the subtraction of a variable, in this case of the water table level, has led to a less resilient peat ecosystem, which has affected other variables within the system, like peat, causing peat degradation, erosion and gully ing (Worrall et al, 2009); in that respect, the removal of the variable water table level has led to decrease of the carbon storing and sequestrative capacity of the peat ecosystem. The definition of Holling (1973), which has been the foundation from which the resilience perspective has developed, fits with the dynamics of complex adaptive cycles.
2.1 The Adaptive Cycle

‘Tell me and I will forget. Show me and I may remember. Involve me and I will understand.’

- Confucius (c.450 BC)

To delve more into the notion of the adaptive cycle we must initially identify and describe its core stages. The notion of cyclicality within the adaptive approach derives from Holling’s (1986) initial description of ecosystem’s adaptive cycles. The model of the adaptive cycle is meant to be a mechanism for reflection. It focuses attention upon processes of destruction and reorganisation, which are often neglected in favour of growth and conservation. An adaptive cycle alternates between long periods of aggregation and transformation of resources and shorter periods that create opportunities for innovation. This paradigm can be used to interpret from complex ecosystems, socio-ecosystems to socio-ecological-systems (SES) which will be analysed in the following section.

According to Gunderson and Holling (2002), ecosystems can be represented by an adaptive cycle and are governed by four stages (Figure 3.2):

1. growth or exploitation ($r$)
2. conservation ($K$)
3. collapse or release ($\Omega$)
4. reorganisation ($\alpha$)
Figure 2.2-1 A conceptual illustration of the four distinct phases within an adaptive cycle (Source: Gunderson and Holling, 2002).

Two key stages can be identified. The first phase is called the **foreloop** (from \( r \) to \( K \)) or else **exploitation and conservation** phases of the adaptive cycle, where stability increases. The black dashed lines connecting \( r \) with \( K \) indicate a steady and slow flow. This S-shaped curve is considered to describe a succession process, from the primary few pioneers in the exploitation phase to the mature and complex community, such as climax forest, in the conservation phase. In the traditional succession theory, the climax was often considered among terrestrial ecologists to be a condition the system would reach if not provoked, rather than simply a transitional stage in an iterative cycle.

The growth and conservation stages are the sections of the adaptive cycle around which conventional natural resource management has evolved. For example, from an ecosystem’s point of view, during the growth and conservation phase capital of nutrients and biomass is slowly accumulated and sequestered. In the case under study one could also add that during this phase the peat ecosystem stores and sequesters carbon. From a socio-ecologic point of view, accumulation could take place in the form of produced scientific knowledge, policies, and networks of human/stakeholder relationships (i.e. institutions, policy-makers, scientists) that are increasingly developed and tested during the progression from \( r \) to \( K \). During
that time resilience is high within the growth stage and decreases as the cycle moves towards the conservation phase, where the system becomes more delicate (Dorren and Imeson, 2005).

The second phase (from Ω to α) that follows, which is evoked by disturbance, is called backloop or else release and reorganisation phase and illustrates the rapid process of transformation leading to regeneration. The white continuous line between Ω and α indicates the high velocity in which the process develops. This phase highlights that disturbance is an inherent process within ecosystems where gradual change and rapid transformations coexist and complement one another (Berkes and Folke, 2002). A representative example of the adaptive cycle within an ecosystem could be drawn from forest fires. Fires occur in cycles that are described by gradual changes and rapid transitions. Those transitions are evoked by disturbances taking place within the system and in this example fire is the disturbance. A forest ecosystem evolves gradually following a course of successive events. It commences usually with the colonisation of bare ground rapidly growing grasses and shrubs. Over a temporal scale of decades to centuries, the ecosystem develops as forest structure and biomass grows. Nevertheless, that configuration doesn’t develop infinitely, by reason of the way in which energy is used in the system. Whilst the forest ecosystem develops and grows as a configuration, the energy stored within it and by it goes into maintaining the accumulated structure which results in the reduction of the system's resilience to disturbances and change. The forest ecosystem by nature tends to reach spatial and temporal limits so many trees can grow in a given space and trees can only get so big or a condition where the system is gradually changing.

The biomass that has accumulated in late-succession forests becomes vulnerable to disturbances, such as fire. The amount of biomass or fuel in a section of land, and connections among sections of land within the forest, are fundamental elements for fires, in addition to some ignition source and appropriate weather conditions (wind and drought). As soon as there is sufficient fuel combined with dry conditions and a spark, fires can destroy all or part of the existing forest ecosystem. In terms of the adaptive cycle this is the ‘release’ phase, also called ‘creative destruction’
(Gunderson and Holling, 2002). After a fire, the ecosystem reorganises as it is being recolonised by different species of flora and fauna. However, within forest soil there is a particular type of natural capital, called 'the seed bank', which allows the regeneration of certain plant species (Wills and Read, 2006). Furthermore, in a system as broad and complex as the terrestrial ecosystem there are various forms of capital (e.g. natural capital, financial capital, infrastructure, social capital such as education, and social capacity such as trust and networks) apart from ecological capital that are developed during the growth and conservation process and are fundamental in influencing the system’s resilience and adaptability.

2.2 Social-Ecological-Systems (SES)

‘People are part and not apart from ecosystems’

- Elmqvist (2007, p.69)

The impact of human activity on the earth’s ecosystem is well acknowledged and therefore its effects interest the research community greatly (Redman, 1999; Gunderson and Holling, 2002; Steffen et al, 2004; Kirch, 2005; Elmqvist, 2007). Therefore, it is almost an imperative to study those systems as one configuration (Berkes and Folke, 1998; Redman, 1999; Gunderson and Holling, 2002). This section of the continuation report will highlight the profound interdependence of social and ecological systems through a brief overview, which is also advocated further below by the choice of the particular case study for this PhD research.

The concept of social-ecological systems (SES) has been defined by Redman et al. (2004, 163) as:

‘a coherent system of biophysical and social factors that regularly interact in a resilient, sustained manner; a system that is defined at several spatial, temporal, and organizational scales, which may be hierarchically linked; a set of critical resources (natural, socioeconomic, and cultural) whose flow and use is regulated by a combination of ecological and social systems; and finally, a perpetually dynamic, complex system with continuous adaptation.’
In the definition by Berkes et al. (2000) a SES is the interdependence of a social and an ecological system, stating that earlier studies either externalise or black-box one or the other (as seen in Evans, in press). A clear example is when one fisherman’s enterprises alter the outcomes of another fisherman’s activities via the interplay of biophysical and non-human biological units that compose the dynamic, living fish stock.

While there are various interpretations of SES, a common notion underpins all of them which is also the strength of this theory: SES are complex, adaptive systems involving multiple subsystems, as well as being embedded in multiple larger systems, that share common properties including resilience (Evans, in press; Levin, 1998; Gunderson and Holling, 2002; Anderies et al, 2004; Redman et al, 2004). Therefore, Berkes et al.(2000) distinguish four subsystems that compose and influence a SES: ecosystem, local knowledge, people and technology, and property rights institutions; all of which are closely intertwined and a disturbance in one has immediate impact on the rest and in that respect in the SES itself.

However, addressing only one aspect/subsystem of SES, i.e. the social dimension of resource management without an understanding of resource and ecosystem dynamics will not be sufficient to guide society toward sustainable outcomes. For example, the organising of Belizian coastal fishermen into unions, which was socially desirable and economically successful, led eventually to the over-harvesting of stocks of lobster and conch (Huitric, 2005). Furthermore, concentrating only on the ecological dimension as a basis for decision making for sustainability may also lead to quite limited conclusions. For example, an observed shift in a lake from a desired to a less desired state may indicate that the lake has lost resilience, but if there is capacity in the social system to respond to change and restore the lake the social-ecological system is still resilient (Bodin and Norberg, 2005; Carpenter and Brock, 2004).

The capacity to adapt to and shape change is an important component of resilience in a social-ecological system (Berkes et al, 2003). In a social-ecological system with high adaptability, the actors have the capacity to reorganise the system within
desired states in response to changing conditions and disturbance events (Walker et al., 2004). Adaptive management (Holling, 1978) is often put forward as a more realistic and promising approach to deal with ecosystem complexity (Gunderson, 1999) than management for optimal use and control of resources (Holling and Meffe, 1996; Ludwig et al., 2001).

2.3 Adaptive governance and management

The concept of adaptive governance was used by Dietz et al. (2001) to expand the focus from adaptive management of ecosystems to address the broader social contexts that enable ecosystem-based management. By governance, it is meant creating the conditions for ordered rule and collective action (Stoker, 1998) or institutions of social coordination (Lee, 2003). Governance is the network, of structures and processes, by which people in societies make decisions and share power (Lebel et al., 2005). The term 'governance' has recently become a fashion for various reasons to traditional down-scaling government control, including cooperation, partnerships and networks (Eckerberg and Joas, 2004). Advocating an adaptive ecosystem approach, Boyle et al. (2001) suggest a triad of activities, wherein governance is the process of resolving trade-offs and of providing a vision and direction for sustainability, management is the operationalisation of this vision, and monitoring provides feedback and synthesises the observations to a narrative of how the situation has emerged and might unfold in the future.

Adaptive governance systems often self-organise as social networks with teams and actor groups that draw on various knowledge systems and experiences for the development of a common understanding and policies. Therefore since adaptive governance is fostered through learning within a social context it connects individuals, organisations, agencies, and institutions at multiple scales. Its concept refers to sometimes as ‘learning while doing’ (Dougill et al., 2006) and considers natural resource policies as experiments to be studied, such that the results from one generation of study inform subsequent decisions (Holling, 1978; Walters, 1986; Berkes and Folke, 1998). Moreover, it takes the view that towards more efficient
governance, new relationships must be created within socio-ecological systems to enhance multi-directional information flows, learning and flexibility (Carpenter and Gunderson, 2001). In addition, not only does it convey multi-objective reality when handling conflicts among disparate stakeholders, but also adapts this social issue to resolve problems concerning dynamic ecosystems (Dietz et al, 2003).

Drawing from its core notion of adaptive cycles, adaptive governance champions an approach where the various levels communicate and learn effectively from each other. Consequently, adaptive governance follows a specific cyclical pattern beginning with the identification of problems and goals and requiring the development of appropriate policy. Following comes the implementation of policy and finally the monitoring of results; subsequently problem and goals are revised and the cycle begins again (Stringer et al, 2006) (Figure 3.2).

Figure 2.2-2 This figure illustrates the iterative process that adaptive systems follow. Each stage offers the potential to involve different groups and the opportunity for them to learn from one another (Walters, 1986).

Since the self-organising properties of complex ecosystems and associated management systems seem to cause uncertainty to grow over time, understanding should be continuously updated and adjusted, and each management action viewed as an opportunity to further learn how to adapt to changing circumstances (Carpenter and Gunderson, 2001; Folke et al, 2005). This is the foundation for adaptive management wherein policies become hypotheses, and management actions become the experiments to test those hypotheses (Gunderson et al, 1995; Folke et al, 2005). Walters (1997) in his review of adaptive management of riparian
ecosystems argues that a reason for failure lies in management stakeholders showing undesirable self-interest, seeing adaptive-policy development as a threat to existing research programs and management regimes, rather than as an opportunity for improvement. Similar results were also presented by Dougill et al (2006) while doing participatory rural research in the Dark Peak of the Peak District National Park. They state that landowners and farmers, who are the primary managers of the area, in the beginning viewed adaptive management practices with great scepticism as they already consider the area to be sustainable and the current management status quo the best way forward.

However, Dougill et al. (2006), where successful in applying experimentally the adaptive learning model where according to a number of participants’ observations it was the first occasion all these different stakeholders had physically sat in the same space together not even join a discussion. As such, their project has laid the foundation for future work with adaptive management in the Dark Peak of the PDNP, upon which this current PhD project will build upon. Furthermore, it has indicated that with careful inclusion of the social dimension and social-network-analysis, respectively, further collective learning may be enabled among stakeholders. This is why it is important to address the social dimension and contexts for adaptive governance in relation to ecosystem management, including processes of participation, collective learning, and knowledge integration. Also, this is where one gap in current literature lies and where one of the research questions ("how knowledge and decision-making are governed?") of this project will aim at filling.

To assess the adaptive capacity of a system that wishes to transition from a command-and-control to a more flexible, adaptive management system, it must meet certain criteria. This study has tried to assess the capacity of the Dark Peak socio-ecological system to be adaptive based on the following characteristics as also summarised by Pahl-Wostl et al, 2007:

1. Knowledge must be transferred and exchanged among all relevant stakeholders, i.e. performance criteria and guidelines of change that can induce beneficial or non-
beneficial outcomes, and monitored within suitable time frames that are by and large broader than those required by short-term policy targets.

2. The stakeholders in the system to be managed should have the ability to interpret and comprehend this knowledge. This is attained by an iterative process of learning and negotiating where the actors are engaged in all stages of appraisal, policy implementation, and monitoring. Disparate actors have disparate, and often changing, political interests and thus the need for transparency and leadership to facilitate such complex process.

3. For change to be effective it needs to be accessible and comprehensible to all the stakeholders. They must have the ability to adapt to change building on new knowledge, processed in a clear way, that makes it unambiguous how, by whom, and when decisions are taken to change management strategies and what facts were used to guide this decision. This is achieved by striking a balance between continuity and flexibility as management practices may require more than one decade to be implemented and assessed.

The above requirements are returned to in detail in chapter 7 where the notion of adaptive management and governance are considered with regards to assisting the Dark Peak stakeholders deal with complexities and conflicts arising from the carbon agenda.

2.4 Knowledge diversity and integration as key towards social learning for adaptive governance

To govern and manage knowledge productively one has to understand what it means and also how the various stakeholders perceive it. Knowledge may be comprised by different types of information a person holds, from raw numbers, to ‘useful’ data that has been processed and interpreted, to ‘known’ information held by individuals or a group (Reed et al, 2011). Furthermore, knowledge is influenced significantly by the individual epistemological convictions a person can have and the paths through which one shares and redefines them (Raymond et al, 2010).
There are many types of knowledge and methods of knowing (Fazey et al, 2006a) in example, ‘tacit’ which is the ability to recognise a face without consciously knowing why (Polanyi, 1997), ‘implicit’ which is the knowledge a land manager has gained over years of experience living and working in a rural area (Olsson et al, 2004; Fazey et al, 2006b), and ‘explicit’ which is the written and spoken knowledge such as the scientific (Polanyi, 1962). This is also referred as the ‘know-why’ due to science’s inherent objective to ascribe a meaning in the principles underpinning observable phenomena (Ludvall and Johnson, 1994), and is contrasted with Ingram’s (2008) ‘know-how’ of local lay knowledge which is rooted in experience from practice.

Disparate types of knowledge work at different scales (Wilbanks, 2006) from lay/local knowledge that is created and practiced at a local level to scientific which is frequently scaled out to a larger global level (Raymond et al, 2010). Nevertheless, knowledge may be created and incorporated at various scales and levels (Holling, 1992). The challenge then for adaptive management and governance is to foster mutual interaction and integration of these diverse knowledges, in example, between scientists, conservationists, policy-makers, and land managers. This is what adaptive governance calls cross-scalar and cross-level knowledge nested and networked (Ostrom, 1990).

2.5 Social learning-by-doing

Existing research in social learning, and in particular that relating to natural resource management from Reed et al (2010) has faced three key criticisms. First, that social learning is commonly confused with enabling processes, and this is illustrated by stakeholder participation which for Reed et al (2010) is not social learning, but a mechanism achieve social learning. Second, that social learning can be confused with its resultant outcomes. For example, improved governance of social-ecological systems and sustainable management is a potential outcome of social learning and not social learning itself. Third, Reed et al (2010) argue that learning commonly includes social aspects and therefore it is difficult to identify a distinction between the two.
For many researchers, there are concerns about the disparate ways social learning is conceptualised within different disciplines (Ison et al. 2013). This is made clear by Beers et al (2010) who highlights that both learning sciences and sustainability sciences utilise the concept of social learning but that there is little interaction between the two. Furthermore, Garmendia and Stagl (2010, p. 1713) make the observation that ‘theory development around social learning takes a different direction within each field’.

Despite these broad criticisms there is recognition that there are common themes which can be drawn from the literature, notably that is commonly acknowledged that social learning requires more than individual actions and the accumulation of explicit knowledge. In addition, it is noted that there commonalities in the consistent use of organisational learning theories (Argyris, 1993; Argyris and Schön, 1978) as well as learning through collaboration amongst communities (Muro and Jeffrey, 2008; Pahl-Wostl et al, 2007; Wenger, 1998).

The collaboration of people who privilege different forms of knowledge or ways of knowing, however, remains a fundamental and consistent aspect of social learning. Nevertheless, this aspect is also subject to critical discussion (Beers et al, 2010). Indeed, for Beers et al (2010) heterogeneity amongst collaborators, which is widely considered a strength of social learning, presents a potential weakness, particularly where stalemates, disagreements and elements of secrecy take place. In addition, Muro and Jeffrey (2008) argue that a focus, and sometimes, overemphasis on the positive aspects of learning through collaboration and consensus fails to account for those occasions where learning takes places as a result of dispute and opposition. However, the extent of these limitations as stated by these authors can be questioned. This thesis argues in chapter 7 that adaptive governance should not focus solely on consensus as this risks overshadowing issues by displacing the focus on a different problem, or rather put them ‘on hold’. This thesis argues that compromise could a more suitable alternative and defined the term as the settlement of a dispute that is reached by each stakeholder group through a process of deliberation and negotiation (Stoll-Kleemann and Welp, 2006).
Examining the particular communication metaphors used by Beers et al. (2010) reveals the importance of dialogue and negotiation for the success of social learning but in fact conceals that stalemates and disagreements do occur, which also conceals where moments when social learning takes place due to solutions (or at least compromises) to intractable stalemates and disagreements.

The time-consuming nature of collaboration is also concealed, as the process itself required extensive and often lengthy dialogue between stakeholders. For some stakeholders, particularly those who worked under severe time constraints there are potentially negative consequences because of the time this can take (Rist et al., 2007). There is also the possibility that where a false consensus is obtained, without consequent effective action, even more time is consumed, and this too may be concealed. Social learning then, in most cases requires flexible, spontaneous and sustained participation. Universities, NGOs and other organisations cannot usually provide this if there are quantified parameters or pre-determined time periods allocated (Rist et al., 2007). Some may consider this turn to be seen a failure of universities to have suitable institutional arrangements which make it fit for purpose. For many authors, social learning equates with consensus (often implicitly) which is not necessarily the case. Others, such as Ison and Russell (2007) illustrate how consensus constitutes the lowest common denominator position which frequently negates consequent action because the emotional enthusiasm for action only remains with those who had the consensus position at the outset.

In fact, as van den Hove (2006) argue, where there the primary focus on consensus fails to account for the legitimacy of negotiation and the use of conflict as an innovative tool to intimate change, the effectiveness of participatory learning approaches is limited. Therefore, it can be argued there is a need to alter the focus from seeking consensus to providing an environment which accommodates differences, which is in turn, based on the explication and valuing of difference (Ison et al., 2007). This has the potential be a more effective way to manage conflict.

There are two further limitations outlined by Schusler et al. (2003): first, ‘participants learning incorrect information and developing negative perceptions of
others’, and second subversion of an open dialogue by more participants in more powerful positions. Similarly, Friedman (1987) and Paquet (1999) argue that those social learning approaches which make assumptions that access to knowledge is equal and comparable levels of ability between participants is naive (cited in Plummer and FitzGibbon, 2007). For Muro and Jeffrey (2008) the idea that through social learning differences between participants will be overcome, and a shared understanding will be acquired, is unrealistic. This itself makes the assumption that differences are superficial and easily surmountable.

The particular interests, drivers, intents and epistemological positions (implicit or explicit) of users will affect their understanding of social learning. However, many discussions evidence in the literature outlined here fail to adequately address whether the limitations perceived relate to the concept, the situated praxis (theory informed practical action) or both. Furthermore while these discussions are important, the reality of enacting effective and context sensitive activities is often very different from the hypothetical discussions that take place. In many cases critiques of social learning conflate its enactment in ways that are not helpful; there is a clear need to recognise both the praxis domain and the conceptual domain in relation to social learning. Moreover, there is a need for more nuanced reporting which teases out both theoretical as well as praxis issues, including the political context of enactment.

This review has provided an overview of the different ways social learning has been defined and interpreted. This however, constitutes a fragment of the social learning literature. The key finding of this review is that the complexity and diversity of stakeholders in decision-making processes has on one hand been interpreted as a major weakness of social learning (Garmendia and Stagl, 2010); on the other, it also highlights the crucial need for responsibility and reflexivity in the ways the concept of social learning is deployed. In this thesis social learning is often used to also describe
2.6 Institutional Context

The adaptive governance of social-ecological-systems entails polycentric institutional structures, which are embedded semi-independent decision-making configurations operating at multiple scales (Ostrom, 1996; McGinnis, 2000; Folke et al, 2005). They incorporate local, regional, and national scales and aim at achieving equilibrium between centralised and decentralised management (Imperial, 1999). The upscaling links of such structures may enhance adaptive governance, and ecosystemic resilience in that respect, for example when local and national institutions are empowered through regional and global institutions. However, such links can also cause adaptive governance to collapse; i.e. in paradigms where national land-use regulations contradict or condemn informal local regimes of land tenure (Young, 2002) and constrain stakeholders' capabilities from utilising an inter-organisational network's collective ability (Imperial, 2001). Effective institutional interaction across a governance network can increase diversity of response spectrum and can cope more efficiently with uncertainty and change (Ostrom, 2005). Moreover, such multifaceted structures may be critical in resolving ecosystem dynamics at various scales (Folke et al, 2005).

The development and implementation of local management practices is framed by institutions, i.e. the formal and informal rules at different levels of organisation that guide human behaviour. This includes local customs, property rights regimes, social norms and conventions, national legislation and procedures for decision-making and conflict resolution. The institutional framework sets the conditions for human interaction with the ecosystem, including which management practices are permitted, and by whom. Local institutions for managing complex ecosystems are often overlooked, although they have the potential both to reveal important understanding of social-ecological interactions, and to improve the capacity to manage ecosystems for human wellbeing.
2.7 Conclusion

The resilience perspective emerged from a stream of ecology that addressed system dynamics, in particular ecosystem dynamics, and where human inflicted change and actions early became a central part of understanding the capacity of ecosystems to generate natural resources and ecosystem services. The early inclusion of humans as agents of ecosystem change distinguished this ecosystem oriented branch of ecology from the main stream ecology profession. The main stream excluded humans or treated human actions as external to the system and consequently the interdependencies and feedbacks between ecosystem development and social dynamics, and their cross scale interactions, were not on the table. The resilience perspective evolved out of observation, using models as a tool for understanding and for incorporating actors and interest groups in adaptive management and learning of ecosystem processes.

More recently, social scientists have started to play an active role with diverse contributions and perspectives in understanding the dynamics of social–ecological systems. Research on social–ecological resilience is still in the explorative phase. Recent advances include understanding of social processes like, social learning and social memory, mental models and knowledge–system integration, visioning and scenario building, leadership, agents and actor groups, social networks, institutional and organizational inertia and change, adaptive capacity, transformability and systems of adaptive governance that allow for management of essential ecosystem services.

Research challenges are numerous and include efforts clarifying the feedbacks of interlinked social–ecological systems, the ones that cause vulnerability and those that build resilience, how they interplay, match and mismatch across scales and the role of adaptive capacity in this context. The implication for policy is profound and requires a shift in mental models toward human-in-the-environment perspectives, acceptance of the limitation of policies based on steady-state thinking and design of incentives that stimulate the emergence of adaptive governance for social–ecological resilience. Not only adaptations to current conditions and in the short
term, but how to achieve transformations toward more sustainable development pathways is one of the great challenges for humanity in the decades to come.
CHAPTER 3 KEY INFLUENCES ON THE PEATLANDS OF THE DARK PEAK

3 Introduction

Over the last few decades research into the impacts of anthropogenic induced climate change has dominated many fields of earth systems and environmental science research. Of the more widely and persistently researched and publicised natural processes, are the various biochemical cycles of the greenhouse gases (GHGs), such as carbon dioxide (CO$_2$) and methane (CH$_4$). An understanding of how human activities have increased the emissions of greenhouse gases, such as CO$_2$, in the atmosphere since the industrial revolution has led to the theory of the Enhanced Greenhouse Effect. The theory suggests that global climate change is caused by an increase in the natural process of the greenhouse effect, brought about by human activities, whereby greenhouse gases such as carbon dioxide, methane, chlorofluorocarbons and nitrous oxide are being released into the atmosphere at a far greater rate than would occur through natural processes and thus their concentrations are increasing.

The alarming global climatic effects of carbon emissions have led to international conferences, where scientific expertise meets political, social and economic issues. The most important summit, that placed the carbon cycle and in that respect carbon dioxide in the top list of the global political and environmental agenda, was the Summit meeting which led to the Kyoto Protocol in 1997. One of the terms of the Kyoto agreement was for the participating countries to reduce the collective greenhouse emissions by an average of 5.2% below 1990 levels during the period of 2008-2012 (Kyoto Protocol, 1997). It was later proposed that nations could offset their emissions by sequestration; hence the increased need for research and development of sequestering environments and technologies (United Nations, 1998).

Within the terrestrial biosphere the wetlands are the most important carbon store (Pawson, 2008). Temperate peatlands contain about as much carbon as all living
organisms on earth, and contribute 25% of global soil carbon (Moore, 2002), while in the UK (a signatory country to the Kyoto Protocol) the northern peatlands represent the largest terrestrial carbon store (Worrall and Evans, 2009). However, according to Worrall and Evans (2009), with the current rate of global warming, increases in droughts and changes in precipitation rates there is great risk that this important natural carbon store could be transformed from a net sink into a net source of atmospheric carbon. Climatically driven causes of enhanced carbon loss could become more acute by other factors, including land management and water table fluctuations (Worrall and Evans, 2009).

This chapter provides an overview of the existing research in this area before analysing the specific research aims of this project. The review of literature begins with a broad examination of peatlands in general, followed by a more detailed description of the carbon budget of upland peat soils.

3.1 The history of the British peatland moorlands

Before venturing on to explore the natural process that govern peatland moorland’s processes and render them significant to climate change regulation and mitigation this section will focus on a historical overview of how they were shaped by human activity throughout the years to become the rich socio-cultural landscape we know today. Britain’s peatland moorlands have a significant role in the nation’s upland landscape history. They are regarded as semi-natural habitats shaped by human activity over a thousand years in addition to areas of agricultural extensification (Ratcliffe, 1977; Evans and Warburton, 2011). More precisely they can be defined as rich socio-cultural products of society (Bevan, 2009).

These upland landscapes have been providing an abundance of natural resources, or ecosystem services as is the modern definition (MEA, 2005), such as water, wood and stone used as construction material, peat used as fuel, and pastures used for keeping livestock ever since the end of the last Ice Age (Simmons, 2003).

From the twelfth till the sixteenth century most of the Dark Peak moorlands were owned by monasteries belonging to an array of new orders such as Cistercians,
Carthusians monks, Knights Templars, and the Augustines to name but a few (Mengue, 2000). From the sixteenth century onwards the dissolution of the monasteries along with the deforestation of many peatland moorlands allowed a more secular, non-royal part of society to own parts of the landscape. The dissolution of the monasteries, often called ‘the Suppression of the Monasteries’, was the outcome of legal and administrative processes in the 16th century (1536-1541) by which Henry 8th separated Catholic monasteries, priories, and convents in England, Wales and Ireland, appropriated their revenue, dispossessed them of their assets, and provided for their earlier members and functions. While the plan was originally aiming to increase the regular income of the King, much previous monastic property was sold off to support Henry’s military crusades in the 1540s. The legal routes that allowed Henry 8th to carry this out were the Act of Supremacy, passed by Parliament in 1534, which made him Supreme Head of the Church in England, thus separating England from Papal authority, and the First Suppression Act (1536) and the Second Suppression Act (1539) (Bernanrd, 2011). They were local élites that acquired status and wealth by exploiting property which also came to outline their class (Daniels, 1990). A new social hierarchy was created consisting of landowners, small freeholders, tenant farmers, and poor agricultural labourers (Bunce, 1994). The acquisition of property became the measure to define the sovereign elite whereas landownership became the symbol of economic affluence, social prestige, and political power; this in return increased the influence of local landowning elites in how the peatland moorlands would be managed (Daniels, 1990). Pastoral production was spread out through enclosing and clearing more land. This led farmers to develop stone fences and walls throughout the landscape, a custom still maintained to this present day (Figure 3.1).
During the eighteenth and nineteenth centuries fundamental social and economic changes following industrialisation, and urbanisation shaped the landscape dramatically. The market economy and production dominated social affairs transforming Britain to a trading country (Bunce, 1994). It is during the eighteenth century that the local elites perceived the peatland moorland as a commodity and developed the belief that privately owned land would be more efficient and productive compared to common land (Johnson, 1996). Efficiency was translated into using fertilisers, drainage, and the application of lime throughout the landscape to maximise its productivity. According to Williamson (2002), often landowners had limited agricultural knowledge and therefore experimented with, what would seem today, inappropriate areas and methods. It is during that time that landowners increasingly influenced their tenants’ lives by common land enclosures, and land improvements in their attempt to maximise land productivity. Enclosure was frequently unsuccessful and met with farmer tenants’ resistance due
to having their rights of access to natural resources dispossessed (Johnson, 1996; Bevan, 2009).

In some instances enclosure took place to boost the landowner’s recreational activities such as grouse shooting rather than agricultural extensification. It is during the eighteenth and nineteenth centuries that grouse shooting became a fashion as the local elites became fascinated with the wilderness landscapes of peatland moorlands (Williamson, 2002). During the nineteenth century shooting had become a considerably more profitable industry for landowners comparing to livestock production which led to many parliamentary enclosure Acts (Wards, 1931).

Furthermore, industrialisation resulted in increased demand for water in the urban conurbations surrounding the Dark Peak which led to Parliamentary Acts being passed that allowed peatland moorland valleys be flooded to create reservoirs (Bevan, 2009). Creating reservoirs through flooding resulted in the displacement of a large amount of the local farming population. These reservoirs were followed by an increased development of tree-planting activity to support the ground surrounding the reservoir with its roots and also the development of the Forestry Commission in 1919 as its regulating authority (Condliffe, 2009). However, a few years later, mainly after WW2, the majority of trees were removed to supply timber to the country which led to the creation of new tree-cutting machinery to maximise the provision of wood.

Aside from the provision of sustenance goods and recreational grouse shooting, the end of the nineteenth century saw the return of descendants of some of the displaced poor farming communities who had found work in the industrial cities in the vicinity. Their motivation was to develop physically and mentally though enjoying the natural beauty of the countryside by rambling in its open spaces. The first working class ramble took place in the Dark Peak’s Kinder scout plateau in 1900 causing the first conflicts with local landowners. Further into the 1930’s improved transportation and road networks brought larger numbers of people visiting the area for recreation against the wishes of local landowning elites. This drew people from a vast array of political backgrounds from anarchists, socialists, to
conservatives to campaign for public access and the freedom to roam which culminated in 1932 in The Kinder Mass Trespass (Figure 3.2).

Figure 3-2 The Mass Trespass marching towards Kinder Scout in 1932 (Source: Peak District National Park Authorities).

A few years later the Peak District National Park was created under Parliament law in 1951 and became the UK’s first national park.

3.2 The science of peatlands

Upland peatlands are globally a crucial supplier of ecosystem services, such as foods, water, sustain biodiversity and climate regulation, as well as other cultural services, i.e. recreation, education, cultural heritage etc. However, upland systems face threats and sometimes different challenges from exogenous factors like anthropogenic activities, climate change, policy and land management disfunctions (Bonn et al, 2009). Followed by increase of peat erosion and water colour, degradation of habitats, loss of biodiversity and decrease of carbon storage rates these changes have created great incentives for current and future research in the area. According to the IPCC (2007), upland ecosystems have been described as
exceptionally vulnerable environments with respect to climate change, with expected impacts ranging from local to international environments and societies (Bonn et al, 2009).

In order to determine and comprehend the vulnerability and importance of the peatland ecosystem, and develop or improve land governance and policies, one must become, initially, familiar with the scientific knowledge that underpins the peat environment. Peat is constituted by organic rich, waterlogged deposits of sediment (Bragg and Tallis, 2001). Peat accumulates when the rate of surface production exceeds decomposition, resulting in a vertical deposit of organic matter (Turetsky et al, 2004). In other words, peat, or turf as it is often called in Ireland, is a type of soil that contains a high proportion of dead organic matter, mainly plants, that has accumulated over thousands of years. Close inspection can reveal the types of plants that grew, died and accumulated to form a piece of peat. Unlike most other ecosystems, the dead plants in peatlands do not decompose. This is because of waterlogged conditions, where the lack of oxygen prevents microorganisms such as bacteria and fungi from rapidly decomposing the dead plants. The formation of peat is a very slow process, and it takes approximately 10 years for 1cm of peat to form. Although there is a wide geographic distribution of peatlands, northern latitudes dominate, with large areas covering Canada, Russia and Fennoscandia (Figure 3.1) (Lappalainen, 1996).

3.2.1 The peatland system

The simplest way to approach an overview of peatland systems is to break down the main components of these complex environments. The table below provides a summary of the definitions on the terms peatland, moorland, and upland as they are perceived and used in this thesis (Table 3.1). The term ‘peatland moorland’ is the one that will be used to describe the natural ecosystem of the Dark Peak due to the complex and diverse natural and social processes that govern it. Peatland moorland systems are extremely diverse, and as such there is a huge amount of variability between individual catchments and examples of peat on a wide range of scales. Coupled with natural variability, peat (the substance) and peatlands (the
ecosystem supported by peat surfaces) can mean many different things depending on the particular interest of the researcher (Charman, 2002).

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Adapted from</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upland</strong></td>
<td>‘Upland’ is a broadly used term and therefore requires a clear explanation in the context of this PhD. Uplands as semi-natural habitats shaped by human activity over a thousand years in addition to areas of agricultural extensification. Hence, my understanding of uplands has a UK-specific focus mirroring that of Ratcliffe (1977) and, Evans and Warburton (2011), as lands past the boundary of enclosed cultivation.</td>
<td>Evans, M. and Warburton, J. (2011)</td>
</tr>
<tr>
<td><strong>Peatland</strong></td>
<td>Habitat ‘with a peat deposit that may currently support vegetation that is peat-forming, may not, or may lack vegetation entirely.’ (modified from Ramsar Convention 1971)</td>
<td>JNCC (2011)</td>
</tr>
<tr>
<td></td>
<td>The term peatland is used here to describe all habitats where the main surface deposits are accumulations of organic matter (peat) in surplus of 0.4 metres depth.</td>
<td>Evans, M. and Warburton, J. (2007)</td>
</tr>
<tr>
<td><strong>Moorland</strong></td>
<td>The term, in this thesis, encompasses unenclosed upland landscapes dominated by a variety of semi-natural vegetation. Not synonymous with peatlands but used interchangeably with ‘uplands’ in this thesis.</td>
<td>JNCC (2011)</td>
</tr>
</tbody>
</table>


Table 3.3.1 Definitions of the terms upland, peatland, and moorland as they are perceived and used in this thesis.
The above image depicts the distribution of peatlands at an international scale. The white areas indicate a prevalence of mire that is below 5%, whereas the light green areas illustrate a 5-10% ranging prevalence. Finally, the dark green parts (>10%) are those that occupy the greatest land cover. (Source: Lappalainen E., 1996)

For some, a peat surface represents the product of ongoing microbial processes in microscopic populations of organisms (e.g. Brown, 1998), while for others massive expanses of wetlands represent an essential habitat for global communities of wildlife (e.g. Thompson et al, 1995). To some, the blanket bogs of UK provide a wealth of potential proxy climate indicators to outline climatic fluctuations of the past (e.g. Blackford and Chambers, 1995; Baker et al, 1999; Mauquoy et al, 2002), while others investigate paleo-pollution record and its contemporary effect on water quality, (e.g. Rothwell, 2006). As such, the complexity of the various physical and chemical cycles and processes within these systems, and their interactions with internal and external ecological and environmental change give rise to a wide range of interested parties (Thompson et al, 1995). These ‘interested groups’ commonly have conflicting research interests, often resulting in the confusing terminology and classifications schemes used for this area of environmental science (Charman, 2002).

This means that a comprehensive summary of these systems is impossible in such limited space, and as such here I concentrate on the broad classification, formation process, distribution and major physical and chemical processes of the peatland type relevant to the interests of this research topic: the blanket peatland or blanket
bog. This peat type also provides a good general analogue as it is the most widespread type in the British Isles (Lindsay and Immirzi, 1996).

The Peak District in the South Pennines is characterised by considerable ombrotrophic peat moorlands. This region is located in the heartland of the 19th century English Industrial Revolution between the urban-industrial conurbations of Greater Manchester, Blackburn, Burnley, Derby, Sheffield, Bradford, Halifax, Huddersfield and Leeds (Rothwell, 2006). Many peatland areas within the southern Pennines have been subjected to degradation or are severely eroded. This is especially true in the Peak District (Anderson et al, 1997). Tallis (1997) describes the Peak District as one of the badlands in Europe due to the extensive and persistent nature of peat erosion in this territory.

3.2.2 Peatlands, carbon cycles, and management

While containing only 3% of the globe’s land area, peatlands contain 450 Gigatons (Gt) of carbon in their peat (Table 3.2) (Gorham, 1991). This is equivalent to 30% of all soil carbon, 75% of all atmospheric carbon, as much as all terrestrial biomass, and twice the carbon stock of all forest biomass of the world (Joosten and Couwenberg, 2008).

<table>
<thead>
<tr>
<th>Storage/area characteristic</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area covered by peatlands</td>
<td>400 million ha (Joosten and Clarke, 2002)</td>
</tr>
<tr>
<td>Carbon stored by peatlands</td>
<td>550-560 billion ton (IPCC, 2001)</td>
</tr>
<tr>
<td>Carbon stored by all global plant biomass</td>
<td>694 billion ton</td>
</tr>
<tr>
<td>Carbon stored in the world’s soils (including peat)</td>
<td>1.600 billion ton</td>
</tr>
<tr>
<td>Carbon in the atmosphere</td>
<td>700 billion ton (Gorham, 1995)</td>
</tr>
</tbody>
</table>

Table 3.3-2 The above table provides figures of how peatlands compare with other carbon stores (Source: Parish et al, 2008)

Therefore, this makes peatlands the top long-term carbon stock in the terrestrial biosphere. Furthermore, according to IUCN (2009), damaged peatlands are
responsible for at least 7% of the world’s carbon dioxide emissions. The same report mentions that the UK has the 17th largest peatland area, out of 175 nations with peat deposits and is in the top 20 countries with the most damaged peatlands.

It has been estimated that more carbon is stored in Britain’s soils than in the forests of Germany and France combined (Reed et al, 2009). Peatlands hold a significant proportion of around 3 billion tonnes of UK soil carbon (Holden et al, 2007; Worrall and Evans, 2009). Moreover, peat bogs can actively sequester carbon. Studies estimate that all of the peatlands in England and Wales could absorb around 400,000 tonnes of carbon per year if in pristine condition. The large stocks of peatland carbon are an indication of the long term nature of carbon sequestration in peatlands rendering the ecosystem not only a substantial store but also a large potential sink of atmospheric carbon (Worrall and Evans, 2009). However, with the current rate of climate change (Worrall and Evans, 2009) and pressures from upland land policies there is great risk that this important natural carbon depository could be transformed from a net sink into a net source.

In addition to external environmental drivers, many peatlands are subject to land management systems that have not always been conducive to carbon storage (Holden et al, 2007). In the UK these management systems typically include: drainage, afforestation, burning, and grazing. Peat drainage has been common in many European countries. In the UK it has been estimated that 1.5 million ha of the country’s 2.9 million ha of peat has been drained (Stewart and Lance, 1991). Increased soil CO₂ respiration has been observed upon drainage of peatlands (Silvola et al, 1985).

Afforestation has been a significant cause of the net moorland habitat loss over the past century in the UK. Nine percent of upland UK peatland has been afforested (Cannell et al, 1994) and while carbon is taken up by tree biomass as the forest grows, there may be severe depletion of the soil carbon store through enhanced decomposition of the organic soil through lowering of the water table (Cannell et al, 1994).
In England, calculations have shown that a 40% of moorland has been subjected into some form of burn management (Thomas et al, 2004; quoted in DEFRA, 2005). Rotational burning is practiced to maintain a mosaic of heather age classes and maximise heather productivity in the building phases. Plant community species composition and vigour of primary productivity depend upon conditions and burn frequencies. Beyond changing primary productivity managed burning has also been shown to influence water table, Dissolved Organic Carbon (DOC) concentrations (Worrall et al, 2007), Particulate Organic Carbon (POC) losses through soil erosion (Tallis, 1987); and overall peat accumulation (Garnett et al, 2001). The objective of controlled burning should be to produce a rapid moving fire that leaves behind an amount of ‘stick’ (Defra, 2007) without destroying the litter and underlying soil. There has been much debate about the founding elements of ‘cool’ burning and the magnitude at which it is exercised (Davies et al, 2010; Reed et al, 2009), a successfully controlled burn would possibly be anticipated to leave behind a larger amount of biomass without destroying significant layers such as peat forming Sphagnum mosses. Research has monitored a variety of fuel consumptions ranging from <30 to 100% for prescribed managed burning (Farage et al, 2009; Kayll, 1966; Legg et al, 2010).

Grazing on uplands in the UK can be by cattle or deer but is predominantly by sheep. Depending upon its intensity, grazing can reduce competitive vigour, or even kill plants through defoliation and direct damage: overgrazing is thought to be a major cause of: heather moorland loss (Shaw et al, 1996); changes in hydrology (Langlands and Bennett, 1973) and increased erosion of peats (Sansom, 1990).

While land management practices can result in damage to long-term carbon stores in peat soils land management practices can more readily be reversed than external drivers such as atmospheric CO₂ (Worrall et al, 2009). For example, Tuititila et al. (2000) illustrated that upon restoring a cut-away peatland there was a statistically significant increase in CH₄ flux. The carbon benefit of peat restoration or changed management can be considered to be threefold. Initially, the peatland could presently be a net source of carbon and a change in management or restoration could result in this source being diminished in magnitude. Such a decrease
represents a carbon saving that can be considered as an avoided loss. Subsequently, between the state of a damaged peatland which is a net source of carbon, and a pristine peatland there is a transitionary stage. This transitionary stage can be of carbon benefit due to both avoided losses and net gains of carbon. For example, this transitionary sink could be the period during which an eroded gully refills with peat. Finally, several studies have indicated that properly managed or pristine peatlands store carbon and provide long-term sinks. This ability for continuous accumulation of carbon makes the peat environment invaluable in carbon-worth terms compared to other ecosystems. Other ecosystems, such as forests, can accumulate biomass and store carbon, but the system will reach a steady-state equilibrium within which there is no continuous carbon sequestration.

The disturbance in UK peatlands caused by implementation of land policies and management such as over-grazing, excessive burning, clearance, drainage, resulting in erosion and drainage, scientists estimate result to 381,000 tonnes of carbon emissions per year. The Peak District peatlands, in particular, store between 16 and 20 million tonnes of carbon and have the potential to sequester up to 13,000 tonnes of carbon per year (Moors for the Future, 2007). Furthermore, in the Peak District, up to 100 tonnes of carbon are lost annually per km² in some eroding catchments where wildfires have caused large areas of bare peat devoid of vegetation (Evans et al, 2006), whereas the Dark Peak area has been a constant carbon emitter for the past 200 years due to excessive erosion.

3.3 Property rights and moorland management

The combination of complex property rights’ regimes that govern natural resource management in the UK and the conflicting interests between landowners and land-managers has often contributed to developing upland policies that have been deemed ‘ineffective’ by both land-managers and some academics alike (Quinn et al, 2008). In the case of the Dark Peak the main issue as is investigated further in Chapter 6 is the contentious controlled moorland vegetation burning. Peatland moorland management policies in the British uplands have been heavily influenced
by Natural England, conservation groups (such as the National Trust and the RSPB), and water companies’ (such as United Utilities and Yorkshire Water) agendas with regards to limiting vegetation burning to certain areas which where against this method for different reasons each; conservation groups such as the National Trust and the RSPB for example. This will be further explored in Chapters 6 and 7. There are two potential origins of conflict over natural resource management in the uplands. The first originates from the conceived legitimacy of certain rights holders to own those rights and exercise them. It is a fact that many landowners and tenant farmers-managers who have an extensive family history in peatland moorland areas consider their rights unfairly removed or reduced by transformations in government policies. This conflict seems to stem from disparate understandings of property. Most landowners tend to conceive ownership as having exclusive rights over the land and also the capability to implement their decisions without any legal interference. On the other hand, other landowners may regard property rights as a movable object that can be allocated to various stakeholders and illustrate that there are various values connected with the land. Furthermore, landowners still refuse to be reduced or removed of their rights (Quinn et al, 2008).

In addition, the second source of disagreement lies within the different aims concerning management among land holders. Whilst rights holders manage uplands to capitalise on water, quality, carbon or conservation this can lead to conflict with other property holders such as grouse moor owners and farmers who manage uplands to maximise production. It is argued that management for production may cause water discoulouration, water acidification, carbon loss and reduced biodiversity despite that there is no obvious evidence (Holden et al, 2007; Quinn et al, 2008). This in turn implies that it may be impossible to manage uplands in order to capitalise on all ecosystem services in tandem. The dispute then is set on which of the rights holders has the capability to precede over the others in exercising their rights over land management.

Moreover, the current management status quo is unable to affect land management decisions for the whole array of ecosystem services provided. This is partially because of the uncertainty that governs different land management
practices of some ecosystem services (Quinn et al., 2008), such the effect of heather burning on the moorland and its peatland and its subsequent impact processes such as carbon storage and sequestration. Another reason that land management is unable to influence decisions is the manner in which different types of moorland knowledges are being integrated into decision-making processes. Some knowledges are more favoured than others, and as is common in natural resource management decisions and policies are generally heavily science-based in an attempt to ‘speak truth to power’ (Jasanoff and Wynne, 1998; Chilvers and Evans, 2009). However, until these effects become more unambiguous it is difficult to assign accurate property rights to each stakeholder.

3.4 Description and justification of the study area

Established in 1951, the Peak District National Park, subsequently termed Peak District, is the UK’s first National Park. It is situated at the southern end of the Pennine Hills (Figure 3.2 p. 64), straddling four Government regions (East Midlands, West Midlands, North West, Yorkshire, and Humber) that together contain around 48% of England’s population, making it one of the world’s most visited national parks with over 22 million visitors a year (Peak District National Park, 2004).

In addition to the demands that these visitors put on the landscape, the area has a resident human population of 38,000 (Office of National Statistics, 2003). As with many other UK uplands, the Peak District has undergone significant socio-economic (e.g. demographic) and subsequently environmental (e.g. climate) changes (Arblaster et al., 2009). Many new residents have moved to the Park to retire or to purchase holiday homes whereas younger, unskilled workers have been priced out of local housing markets (Dougill et al., 2009). This has created labour shortages for traditional land management practices. Both farming and grouse-shooting activities operate at the margins of financial viability, and are reliant on agricultural subsidies. Some 93% of the Park qualifies for funding under the European Commission Directive for special assistance to Less Favoured Areas 75/268/EEC (ADAS, 2003).

The Park also contains two Environmentally Sensitive Areas (ESAs) that provide payments to land managers to maintain certain landscapes, wildlife or historical
features. Of particular ecological interest is the Dark Peak area, characterised by extensive heather moorland and blanket bog habitats, surrounded by enclosed pastures in deep, narrow valleys. Blanket bogs are ecological communities characterised by cotton grasses, sphagnum mosses and dwarf shrubs. They form uniquely on top of hill land that is subjected to heavy and infrequent rainfall over acid peat that is over half a metre deep. This habitat is internationally important, being recognised as key biodiversity habitat (UK Biodiversity Steering Group, 1995), containing a number of ‘Sites of Special Scientific Interest’ (SSSI) (English Nature, 2003), and listed in the EU’s Habitats Directive (92/43/EEC) as requiring special conservation measures as ‘Special Areas of Conservation’ (SAC) and ‘Special Protection Areas’ (SPA).

Changes to the farming subsidy system are currently progressing with reform of the EU’s Common Agricultural Policy (CAP). The CAP reform has replaced output-based subsidies with Single Farm Payments for ‘environmentally sensitive agriculture’ that rewards farmers for using more sustainable management practices and promoting wildlife habitat (Lowe et al, 2002). Rural land managers are also trying to adapt to the EU’s Water Framework Directive that requires all inland waters to be in ‘good status’ by 2015 (WFD, 2000).

Furthermore, as with most UK upland environments, the Peak District is subject to a complicated system of property rights (Figure 3.3 p. 65) regimes. While land might be in private ownership, rights of withdrawal, access and management of different resources on that land may be afforded to different stakeholders. This can result in private property regimes, common property regimes and state control overlapping as they seek to manage resources in the same landscape for different objectives, sometimes leading to conflict between the different rights holders. At the same time climate change, as previously mentioned, economic development and changes to agricultural and other policy drivers is an indication that the relative significance of different ecosystem services is changing along with the balance of power between disparate stakeholders.
3.5 Previous research approaches to the area

This PhD partially builds upon and is inspired by the research conducted by RELU-Sustainable Uplands project, but it also takes this research forward (see below, Table 4.2 pages 81,82) in terms of focus (carbon agenda) and methods (social network analysis combined with adaptive governance framework). Funded by the Rural Economy and Land Use programme (UK Research Councils with DEFRA and SEERAD) as part of the Sustainable Uplands project (RES-227-25-0001) a team of researchers led by Mark Reed, Klaus Hubacek, Cristina Prell, Claire Quinn, Lindsay Stringer, Anil Graves, Norman Dandy, Helena Posthumus and Joe Morris have contributed greatly to the literature of stakeholder participation and analysis as well as social network analysis in natural resource management through research they undertook study sites in the Peak District National Park, Yorkshire Dales and Galloway, and Scotland. Their project aimed to enhance stakeholder analysis for participatory natural resource management. Through the use of Social Network Analysis they identified the role and influence of different stakeholders and stakeholder groups in relation to their location within the network.

The RELU -Sustainable Uplands team suggested a more iterative approach in line with the context of adaptive management literature, where scoping interviews and focus groups guided the primary collection of issues and these progressed. In the beginning they used data from a MFFP focus group, which through semi-structured interviews with eight stakeholder representatives identified during the focus group to represent different land-management perspectives. The purpose was to evaluate and adapt the proposed aims of their project in order to establish the focus on relevant issues and identify and categorise stakeholders. They came up with 200 organised and non-organised stake-holder groups in upland issues in the PDNP. Further on, they asked the stakeholders to create the categories under which they classed the groups. Eight final actor groups emerged: i) water companies, ii) recreational groups, iii) agriculture, iv) conservationists, iv) grouse moor interests (consisting of owners/managers and game keepers), v) tourism-related enterprises, vi) foresters, and vii) statutory bodies. Finally, they used these categories to
develop a stratified snowball sample attempting to identify within each stakeholder group the actors that had not yet been considered. A total of 22 interviews were conducted representing all categories. Their research revealed heather burning as the most pressing land-management issue in the area (Evans et al, 2011).

In order to complement and enhance the stakeholder analysis they also considered the role of social networks in influencing stakeholders’ views and behaviour. They examined how the social ties that link stakeholders together may affect the context in which resource management occurs. They argue that ‘such consideration to social context can help one make better informed decisions on how to approach particular stakeholders and how to involve these stakeholders in meaningful dialogue’ (Prell et al., 2007, p.7). To start identifying this social network they asked the questions ‘do you communicate with anyone from (stakeholder group name her) on upland management issues in the PDNP? Please list up to five names’ and in order to elicit tie strength information among these actors’ and ‘how often do you communicate with this person?’. Following the data analysis it was revealed for example, that a conservation group stakeholder (names are not mentioned in their report as part of anonymity agreement) had a high betweenness centrality, in other words resting between two other actors who themselves are not connected. The immediate neighbours to whom the organisation is strongly tied consist of two stakeholder categories, with most of the ties being with similar organisations (for example, grouse moor managers). Thus, whilst this particular conservation group stakeholder connects many different parts of the network together, its strong connections tend to be with similar organisations. In contrast, a stakeholder from the water group, does not have as high a betweenness score as the conservation stakeholder, yet is strongly linked to a more diverse mix of organisations.

According to Burt (2001), actors with high centrality scores are important for the bridging roles that they play. Additionally, the RELU team considered the i) strength of ties and ii) homophily, in order to take into account the stakeholder
categories from which actors and their immediate neighbours come from and how strongly tied central stakeholders are to those in other categories. This additional information can aid in distinguishing whether a stakeholder is linking similar or dissimilar organisations, a significant issue for resource management purposes (Prell et al., 2007). Their analysis also revealed that no foresters, or statutory body representatives appear as ‘highly central’, suggesting that the communication ties between these categories of stakeholders could and should be enhanced in order to achieve more successful resource management.

To gain more insight into the relationships/ties of a socio-ecological system they underlined the necessity of three focal points: to look beyond attributes of individuals to also examine the relations among actors, to look how an actor is positioned within the network and finally, how relations are structured into overall network patterns. In conclusion, they argue that stakeholder participation can enhance the quality of environmental decisions by allowing for more comprehensive information inputs (Reed, 2008) from multiple levels and facilitating the development and empowering of relationships among stakeholders for mutual learning (Grimble and Wellard, 1997; Dougill et al., 2006; Stringer et al., 2006; Prell et al., 2007). However, one difficulty and limitation to their work can be argued to be that they address the management of natural resources in general and identified a broad stakeholder network. As has been argued by others as well (Dougill et al. 2006) without knowing the problems, it is problematic to identify which actors are appropriate and significant to be involved in detecting appropriate issues. Therefore, as has been the case here too, problems are characteristically identified in a top-down fashion by the social network and stakeholder network investigators and could consequently reveal their interests and biases (Clarkson 1995; Varvasovszky and Brugha 2000).

This PhD research builds upon and is inspired by the methodology and findings of the RELU-Sustainable Uplands project in terms of SNA and stakeholder identification in the Dark Peak area. But it takes this methodology and research further by using a specific lens for its analysis: the existence of carbon as an
organising principle within the socio-ecological network of the Dark Peak. A clear
distinction between the two methodologies can be found in Table 4.2 page 82 in
the following chapter.

This complex and changing background makes the Peak District typical of a range of
rural settings within and outside the UK where traditional upland management is
under pressure. All of the above reasons made the Peak District a relevant locale in
which to apply the adaptive governance approach. In addition, considerable
logistical support is available in this region from partnership projects (e.g. Moors for
The Future) and research conducted the last decade by leading academics, from the
Department of Geography of the University of Manchester, in the field of peatland
degradation, restoration and recently carbon fluxes.

The focus of this PhD project is the area of the Dark Peak, which is the higher
northern part of the Peak District National Park. The Dark Peak was named after the
underlying limestone covered by a cap of Milestone Grit, which means that in
winter the soil is almost always saturated with water. The land is of particular
hydrological and ecological interest, characterised by extensive heather moorland
and blanket bog habitats, surrounded by enclosed pastures in deep, narrow valleys.
Blanket bogs are ecological communities characterised by cotton grasses,
sphagnum mosses and dwarf shrubs. They form unusually on top of hills and not in
valleys and are subjected to heavy and infrequent rainfall over acid peat that is over
half metre deep. This habitat, being part of the Peak District National Park, is
internationally important recognised as key biodiversity habitat (UK Biodiversity
Steering Group, 1995), a "Site of Specific Scientific Importance" (SSSI) and is also
listed in the EU's Habitats Directive as requiring special conservation measures as
"Special Areas of Conservation" (SAC) and "Special Protection Areas" (SPA). Furthermore, it contains heavily degraded peatlands which due to the history of
policies implemented in the area dictating particular land management practices
and the current rates of climate change are in great risk to be transformed from
natural carbon depository to carbon source.
Figure 3-4 Map of the Peak District National Park. The red boundary indicates the area under study (Dark Peak) (Source: Dougill et al, 2006).
It is for all these reasons that this project focused specifically on the Dark Peak, despite its small geographical range. It is precisely because of its geographical expanse that allows for a more in-depth investigation that a larger area would probably make more difficult. The issues revealed and considered in this case study can however be relevant only in this local context yet the investigation of applying an adaptive approach which will be discussed in the following chapter; one can...
draw some general recommendations for other similar environments where society interacts with the ecosystem. This project was materialised through a set of research questions that created the structure for investigating carbon budgets’ management in the Dark Peak.

3.6 Conclusion

The question now remains: What of the future? Rising carbon budgets will have a direct but as yet uncertain effect not only on the Dark Peak peatlands and moorlands, but on the whole world. The significance of this case study is to raise awareness of the contribution of the Dark Peak, as part of the UK’s largest peatlands, in acting as an early alarm system of the effects of climatic and human change on this significant ecosystem and its carbon budgets. Although not all answers will be applicable to an international context there are still some generalised lessons that can be drawn from this research and potentially impact local policy. It is apparent that environmental change will lead to uneven changes in both human and ecological ecosystems as all species respond differently to disturbance, altering the geography and structure of ecological communities (Caporn and Emmett, 2009). Taking into account the fast pace of change anticipated and the undeniable complexities governing the relationship between human and the environment our society is faced with significant questions regarding the ability to adapt within moorland ecosystems and become more resilient by management. The following chapter will now introduce the key concepts of resilience, adaptive capacity, adaptive management, adaptive governance, socio-ecological systems, social learning, knowledge brokering that are the theoretical pillars of this research. A critique on the effectiveness of these notions in the context of the Dark Peak can be found in chapter 7.
CHAPTER 4 METHODOLOGY

4 Introduction

This chapter will discuss the methodological underpinnings of this research and weave them into the theory described in the previous chapter, in order to shed light upon and begin to answer the three main research questions. The main consideration that influenced and defined the methodology of this research was the researcher’s interest in the increasing involvement and impact of the carbon agenda as an organising principle across disparate networks, scales and disciplines, including local farmers, academic institutions with international span, regional government authorities, local environmental stewardship organisations, to international conservation organisations. The order of actors mentioned does not reflect the order in which carbon became popular, but is merely used to illustrate the magnitude of scale and discipline that have found interest in it.

To further investigate this aspect the theory of adaptive governance was employed, and management, for managing ecosystem services or natural common pool resources in Ostrom’s terms (Ostrom, 2000), as an initial theoretical tool as it entails all relevant notions of networks, scale, co-production of knowledge and mutual learning, resilience and socio-ecological systems. Furthermore, the case study approach was chosen as a favourable tool to delve into the issue of carbon within the particular socio-ecological system of the Dark Peak in the PDNP as has been justified previously on Chapter 3. An exploratory stage, however, preceded the final decision of particular methodology techniques involving emails, telephone communication, informal interviewing, use of non-academic and academic contacts and participants’ lists from relevant events (seminars, workshops, conferences). All of the aforementioned means allowed for flexibility in identifying stakeholders as well as emerging themes (Glaser and Strauss, 1967).

4.1 Research Design

The research design comprised four interlinking elements: two key stakeholder mapping exercises (a pilot one seen on Figure 4.1 on page 75 and a final one seen
on Figure 4.5 on page 103, a set of semi-structured interviews with 36 key stakeholders; 4 periods of direct observation in the field (on 20/06/2010, 13/07/2010, 06/08/2010, 30/03/2012), and two stages of Social Network Analysis (SNA): one pilot which helped identify the initial stakeholder groups for the Moors for the Future-funded report, and the final one which build upon the pilot and was developed further to capture the most recent and comprehensive stakeholders list for the purpose of this PhD. For this purpose the qualitative analysis software UCINET 6 was employed. This aimed at enhancing the learning configurations within the socio-ecological network through fostering knowledge production, which is ‘...the critical link between social and ecological systems. Such knowledge can only be developed through a process of learning. New forms of knowledge hold the key to being able to adapt and become more resilient to change.’ (Evans, 2011: p. 226).

The first stage of the key stakeholder mapping exercise was used to identify key actors of the socio-ecological network of the Dark Peak in the PDNP. On this basis, 36 semi-structured interviews were undertaken in total. The resulting information was further enriched by more inquiries as well as a session at a Moors for the Future Partnership (MFFP) workshop in November 2010. Moors for the Future Partnership is a public-private partnership of organisations in the Peak District working together to ensure the sustainable management of the ecosystem services provided by the peatlands of the National Park. MFFP is consisted of the Peak District National Park Authority (PDNPA), National Trust (NT), Natural England (NE), United Utilities (UU), Yorkshire Water (YW), Severn Trent Water (STW), Environment Agency (EA), Derbyshire County Council (DCC), and the Royal Society for the Protection of Birds (RSPB). This research was partially funded by MFFP. Building upon the initial research findings gained from the MFFP report other complimentary methods where used (Robson, 1993) such as direct observation which took place unplanned whilst having planned for semi-structured interviews, before concluding with Social Network Analysis (SNA). SNA was deployed only as a method for access rather than a theory in itself (Latour, 1998), placing documents and policies within networks constituted by people, institutions and objects (adopted from Evans, 2002; Callon, 1986). SNA was used as an empirical analytical
tool to reveal the relationships and knowledge paths connecting the stakeholders of the network under study. Finally, this project was designed to address all three research questions. Table 4.1 provides a list the research methods used for the collection of data.

4.2 Case Study method

‘Everything is unique, but that really does not tell us very much.’

(N. Smith, 1987:67)

The literature described in chapters 2 and 3 shaped to a large degree the methodological approach of this project, especially the selection of the case under study. According to Yin (2003, p.2), the case study method is appropriate in the analysis of complex social phenomena. One of the main appeals of this method is its explanatory strength in dealing with research questions asking “why” and “how” in real-life scenarios. But why use a single case study? Explanatory case studies do not look for statistical generalisations or representative samples, but rather seek in-depth understanding of cases and phenomena (Hammersley, 2004). This understanding can, in turn, be subject to analytical generalisation – “in which a previously developed theory is used to compare the empirical results of the case study” (Yin, 2003: p.32-33). In single case study projects, the investigator looks for a study object whose assumed properties are considered to embody a critical, unique, typical or even disconfirming case in relation to the theoretical assumptions (Yin, 2003: p.41; Bradshaw, 2005). Bryman (2002) argues, that this certain style of research highlights the dialectical links connecting empirical data with theory as well as the iterative manner of data analysis and interpretation while the researcher alternates between field and theory (adopted from Ernstson, 2008: p. 25).

With regard to the case considered here, the complex socio-ecological system of the Dark Peak and its carbon agenda (loaded with local politics) made the Peak District typical of a range of rural settings within and outside the UK scale in which
traditional upland management is under pressure. All of the above reasons, as have been examined in detail in chapters 2 and 3, made the Dark Peak of the PDNP a relevant locale in which to apply and investigate the adaptive governance approach. Furthermore, given the time constraints and financial limits I had as a non-British PhD student I chose to focus on a single fieldwork period and destination, which had the added benefit of being close to my university. In addition, as with all research projects, there is also a range of practical and pragmatic questions that influenced the choice of methods. For example, considerable logistical support is available in this region from partnership projects (e.g. MFFP) and important research has been conducted in the last decade by leading academics at the University of Manchester both in the fields of social and natural research, i.e. peatland degradation, restoration; and more recently concerning carbon fluxes, adaptive governance and socio-ecological resilience.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstructured interview</td>
<td>Variable length, wide-ranging discussion</td>
<td>Gather several opinions, less formal layout</td>
</tr>
<tr>
<td>Semi-structured interview</td>
<td>50-70 minutes, open ended questions</td>
<td>Combination of structured and unstructured interview</td>
</tr>
<tr>
<td>Group interview</td>
<td>50-70 minutes, more than one interviewee</td>
<td>Allows dialogue between interviewees and development of opinions</td>
</tr>
<tr>
<td>Observation</td>
<td>passive, direct, unannounced</td>
<td>Allows researcher for perceptible actions in real-world situations whilst interacting with interviewees</td>
</tr>
<tr>
<td>Archival</td>
<td>Library research</td>
<td>Access books or unpublished material</td>
</tr>
<tr>
<td>Electronic</td>
<td>Email communication and internet search</td>
<td>Easy and direct way to gather information and other literature material</td>
</tr>
<tr>
<td>Phone / Skype</td>
<td>Scoping interviews or semi-structured interviews</td>
<td>Easy access to people for either preliminary interview or alternative method of interview if one-on-one in-person option unavailable / additional information</td>
</tr>
</tbody>
</table>

Table 4-1: Illustrates the tools used through the course of this research project. (Source: Friedrichs and Lüdtke, 1975; Brenner et al, 1985; Cassel and Symon, 1994; Robson, 1993; Frey and Mertens-Oishi, 1995; Flick, 1998; Gillham, 2000. As adopted from Evans, 2002).
The fieldwork period for this research was carried out over the course of about twelve months in two interlinking sections, due to the nature of funding input in the project. The first section was sponsored by a bursary from Moors for the Future Partnership (MFFP) for projects conducted in the Peak District in the year 2009-2010. The research team (constituted by primary supervisor Dr. James Evans, secondary supervisor Prof. Clive Agnew and the author herself) was contracted to deliver a report by March 2011. It was made explicit ever since the funding application process that the work and report delivered formed a part of an ongoing PhD study. Whilst recognising current omissions in the number of interviewees due to time limitations it was also acknowledged that this did not compromise the quality and findings of the investigation as even with the current amount of stakeholders a point of saturation was reached in the interviewees’ answers whereby similar concerns were aired.

4.3 Selection of Methods

Participation needs to foster empowerment, equity, trust and collaborative knowledge production/learning among the diversity of stakeholders (Phillipson and Liddon, 2007; Reed et al, 2008). Consequently, if lay knowledge and scientific knowledge can be combined they can provide a more comprehensive insight into diverse socio-ecological systems and processes. Despite claims of the many advantages of stakeholder participation, practitioners and stakeholders alike remain sceptical about its effectiveness. Although many of the claims remain untested there is strong evidence from research studies that stakeholder participation in natural resource management can be successful (Prell et al, 2008; Dougill et al, 2006; Reed et al, 2008).

There is a set of techniques that have been developed to complement stakeholder analysis, which examine the relationship ties and patterns among the actors, both as individuals and as groups, in the frame of a certain event. The three principal approaches that are commonly employed in stakeholder analysis are nicely summarised by Reed (2009). They start by drawing stakeholder-connection matrices, developed manually on paper demonstrate the interconnections among
actors in simple key-words. Secondly, they follow on with a Social Network Analysis, which enables the investigator to improve their knowledge of the social relationships such as influence, communication ties, and trust that characterise the actors connected in the network. Finally, by producing a map of the knowledges, the researchers can explore the type of knowledge transferred and exchanged between these stakeholders. To shed light on the social structures and processes that produce distinguishable subgroups and patterns of information exchange, this research has used SNA, as discussed below.

I. Identification of key stakeholders

Stakeholder in this thesis is defined as an individual, or organisation (or institutions in the terms of adaptive governance) with an interest to manage under a carbon agenda and also who will have their livelihood and job directly affected by such an agenda. Stakeholder identification literature has assumed to a large extent of that actors are self-evident, and has also principally focused on grouping pre-identified actors in order to establish their their motivations and relationship ties (Prell et al, 2007; Reed et al, 2008). Nevertheless, prior to any other process, it is crucial to establish the actors with the stakes within the system under study. This in itself calls for an explicit understanding of the limits of the socio-ecological system under investigation.

Identifying the stakeholders of a socio-ecological system is ordinarily an iterative procedure, whilst further actors are being included in the list the more the analysis advances by using, for instance, semi-structured interviews, snow-ball sampling, focus groups, expert opinions, or an amalgamation of the previous. Should the boundaries of the system remain unclear and undefined, then stakeholder identification becomes quite complex. On the other hand, there is the danger that some actors could be accidentally omitted and therefore not every stakeholder will be identified and included (Clarkson, 1995). Nonetheless, given the practical difficulties of identifying and involving every possible stakeholder, some boundaries must be set that builds upon well justified standards decided by the research team (Clarke and Clegg, 1998). The criteria could potentially include geographical
standards such as the boundaries of a National Park or demographic standards such as the age or nationality of an actor depending on the focal point of the analysis or the time limitations of a particular research project (Prell et al, 2007).

It is a fact that every single actor in the area under investigation allegedly has an interest and an involvement. Nonetheless, a fundamental issue that arises is whether the stakeholders involved should define the system under study or whether it should be the other way around (Reed et al, 2009). This issue is not often taken into account in stakeholder analyses, due to the challenging interplay between identifying stakeholders and identifying which aspect of an organisation’s activities, which intervention, or which issue to focus on. Nevertheless, being unaware of the problem makes it is hard to decide which stakeholders should be involved in identifying the focus (Dougill et al, 2006; Prell et al, 2008). Consequently, researchers conducting the analysis commonly rely on top-down approaches to identify the relevant stakeholders which may as a result echo their personal biases and views, which may in turn completely contradict the biases and views of the stakeholders themselves (Clarkson, 1995; Varvasovszky and Brugha, 2000).

According to Chevalier and Buckles (2008), there is a vast array of other methods of identifying stakeholders, such as: through specialists or other actors (i.e. in conferences, workshops or other academic activities); through put oneself forward (i.e. in response to announcements or advertisements); through written documents or census data which may give insight about ones gender, age, religion and residence; through written or oral testimonies of important events (i.e. identifying the individuals involved); or by using a checklist of potential stakeholder groups (Prell et al, 2008). The decision of who is integrated and who is misplaced may depend on the technique used for identifying actors as well as the objective of the research project (Mitchell et al, 1997).

Generally, if the main objective of the research is the equal distribution of the costs and benefits of a project (e.g. in project planning and implementation), all stakeholders may need to be included (Grimble et al, 1995). When the main interest is the effectiveness of a project or organisation (e.g. in a management
context), only those stakeholders who are most likely to affect the functioning of the project or organisation given their interests, resources, and influence are usually included (Grimble et al, 1995). This project investigated the key stakeholders and their communication ties in relation to carbon management interest and carbon knowledge production. This close focus on the subject area aided the key stakeholder identification within the network quite easily. Using a combination of other methods, as described further below, the key stakeholders groups were enhanced in an iterative manner before using SNA to begin analysing the structural patterns that emerge among these actors.

An iterative stakeholder analysis was deployed to identify the key stakeholders by involving data from: i) previous stakeholder analysis projects conducted in the area through the literature (see Dougill et al, 2006; Prell et al, 2008 and Reed et al, 2009), ii) by consulting stakeholder lists from Moors for the Future Partnership (MFFP), iii) by snowballing through a workshop organised by MFFP for PDNP stakeholders and finally, iv) by semi-structured interviews (Tantanasi et al, 2011). Data from the first three stages contributed towards the final stakeholder selection, which was then grouped into categories (as adopted by Reed et al, 2008) and developed into a stakeholder map to allow for further categorisation.

II. Stakeholder mapping exercise

The research projects within the Dark Peak area identified through the literature mainly focus on property rights issues (see Dougill et al, 2006), stakeholder identification methods and processes to improve natural resources management (RELU- Sustainable Uplands project in the Dark Peak, see Prell et al, 2007; Reed et al, 2008, Reed, 2009). In an initial phase of my own investigation, the stakeholders identified by the combination of methods described above were grouped together in an excel spreadsheet under these distinct categories: scientific institutions, conservation groups, statutory bodies/policy makers, land-owners, water companies, recreation groups, tourism, and forestry. However, in order to ensure that the process remained as inclusive as possible and no key stakeholders were excluded, I consulted members from MFFP as well as their conference and
workshop stakeholder lists from the past 5 years. Through this process another important category of stakeholders was identified - that of 'land-managers'. In addition, stakeholder data were also collected through snowballing at a workshop, organised during a MFFP Conference in November 2011. This led to the creation of an initial stakeholder map (Figure 4.1), in which I grouped the key stakeholders in three broad categories for the purposes of the analysis (see Tantanasi et al, 2011), as will be discussed in the following chapter.

Figure 4-1 Pilot map of the key stakeholders as emerged from the stakeholder mapping exercise.

Initially almost 12 categories of all possible stakeholder groups had been identified building upon data found in the literature (Prell et al, 2008; Reed et al, 2009). However, as aforementioned, while the focus of this study was particularly on carbon this has simplified the stakeholder groupings as compared to the RELU-Sustainable Uplands project. Furthermore, building upon the analysis of transcribed interviews the following three general categories have emerged: i) scientific communities, ii) statutory bodies/policy makers, iii) landowners/managers to aid the analysis and discussion part with regards to managing for carbon. Nevertheless, there seemed to be five stakeholders that had dual or multiple roles therefore
belonging to more than one category. This led to the creation of a fourth category of ‘hybrid’ actors. This fact, however, does not compromise the quality and findings of this project as even with the current amount of stakeholders a point of saturation was successfully reached within the interviewees’ answers. These five additional stakeholder groups where focal elements of the representative sample of this research and therefore were included at the second part of this project. It was not expected that the findings and Social Network Analysis to change dramatically (Tantanasi et al, 2011). More in depth discussion on the final major stakeholders can be found under the Social Network Analysis section.

Figure 4-2 This figure illustrates the final stakeholder map in a one dimension scale as this was developed after the completion of the interviews and the stakeholder identification exercise. It reflects the current key actors who have a direct stake in managing the Dark Peak for a carbon agenda (‘Who is in the carbon network of the Dark Peak?’).
The final map of the key stakeholders in the Dark Peak (Figure 4.2) provides a static one-dimensional perspective of the five key stakeholder groups and the specific actors that constitute these groups. Throughout this thesis the terms ‘stakeholder’ and ‘actor’ are used in a complementary manner for the purpose of variation in the text. The author acknowledges that these terms taken precisely may represent different meanings and therefore provides this clarification. The research began by identifying all possible categories of stakeholders as part of the Moors for the Future Partnership (MFFP) project (refer to Chapter 1). Later on in the MFFP project they were narrowed down to three broad categories i) scientific communities, ii) statutory bodies/policy makers, iii) managers/owners to aid the analysis and discussion parts with regards to managing for carbon.

Nevertheless, there seemed to be five actors that had dual or multiple roles therefore belonging to more than one category, which were called ‘hybrid actors. These broad categories facilitated a smaller scale and a more revealing version of the dynamics in actions in the social network. After the completion of the fieldwork period and analysis of all the data for the final PhD thesis the names of the key stakeholder groups were revised to encompass an even more comprehensive description of the nature of the stakeholders. Also, the grouping of some stakeholders such as the National Trust and the Utility Companies in the ‘Landowners and Land-managers’ group, or Penny Anderson Associates (a local consultancy office which has years of experience in the area) in the ‘Hybrid Actors’ group, added more complexity to the final argument than clarity as will be explained further on (Tantanasi et al, 2011).

The initial complication was created by the ‘Hybrid Actors’ group which originally included stakeholders with dual or multiple roles within the social network such as conservation, consultation, landownership, and land-management. Since the focus of the argument, and therefore the purpose of this stakeholder map, was not on the ‘hybridity’ of those stakeholders per se it was decided that the name of ‘Environmental Guardians’ was more suitable. This name reflects the main objective these stakeholders share in common, which is essentially to safeguard the environment, through each, of course, aims to do this in their own unique way and
in accordance with their own interests. This, therefore, called for some stakeholders to be moved around in other groups with the National Trust being placed under ‘Environmental Guardians’ as its primary function is environmental conservation, and Penny Anderson Associates was moved under ‘Scientific Community’ which now constitutes the ‘Academic Institutions and Consultants’. Penny Anderson Associates’ chief role, apart from being concerned with environmental conservation, is environmental consultation. As part of this role they produce scientific knowledge and provide further scientific consultation to other stakeholders such as Academic Institutions, Conservation Groups, and the local Regulatory Authorities. Therefore, their significant role in scientific knowledge production would only be undermined in the ‘Environmental Guardians’. This led to the creation of the ‘Academic Institutions and Consultants’ group.

In the case of the ‘Landowners and Land-managers’ group it was realised that the main function of its stakeholders was on the ground land-management of some sort whereas the Utility Companies’ key function was water provision and management, as well as being a key landowner within the Dark Peak. This called for a differentiation which led to the formation of the ‘Utility Companies’ group where all its stakeholders now feature separately, namely United Utilities, Yorkshire Water, and Severn Trent Water.

Finally, the ‘Statutory Bodies’ group was renamed as ‘Government Agencies and Environmental Regulators’, which reflects the stakeholders’ functions in a more adequate manner than mere statutory status. One would assume that due to the Dark Peak’s geographical location it would include stakeholders such as Sheffield Council and Derbyshire County Council. Yet Sheffield was not mentioned by any of the key stakeholders interviewed, and Derbyshire was only mentioned by two. The researcher herself contacted both County Councils to establish whether they had a direct stake with managing for carbon through land management activities in the Dark Peak and both Councils stated that they were not involved into land management policies or activities in the area. Hence, the final key stakeholder groups are: i) Government Agencies and Environmental Regulators, ii) Academic Institutions and Consultants, iii) Utility Companies, iv) Environmental Guardians,
and v) Landowners and Land-managers. A synopsis and analysis of the five stakeholder groups, their members, and their relationship patterns and nature of ties will be provided in the following chapter.

**Mapping the Social Network of the Dark Peak: the Sustainable Uplands work of RELU.**

Social Networks are focused on actors/stakeholders and the relations that characterise them. It is thus that Social Network Analysis builds upon a relational ontology that examines the relations between actors rather than the status of actors in the network, or the nature of the relation between them (Janssen et al, 2006: as adapted by Evans, 2012). The aim to map the social network of the Dark Peak originated from the interest to investigate a gap in the literature concerning the identity of the key stakeholders with a carbon agenda, and how knowledge on carbon, and in particular carbon sequestration and storage, infiltrates the network and how this has an effect on the management and governance of the network respectively. This work builds upon previous work in the area by the Sustainable Uplands team funded by the RELU programme (RES-224-25-0088).

The RELU project identified every actor in the Peak District National Park who has a stake in natural resource management. Through engaging them in meaningful dialogue, it aimed to produce policy recommendations and inform future policy on UK upland environments. The policy recommendations and feedback were conducted in the iterative manner of ‘learning while doing’ as proposed by adaptive management. The results of their work has influenced UK uplands policy in terms of ecosystem services and stakeholder participation in the decision-making process, with only recently informing DEFRA and launching a pilot UK Peatland Carbon Code for the year 2013-2014 (DEFRA, 2013). This pilot code apparently is claimed to operate in an analogous way to the Woodland Carbon Code. The latter Carbon Code was launched in 2011 and has already led to the creation of woodlands that promise to ‘reduce by over one million tonnes of carbon dioxide from the atmosphere’ (Reed, 2013). A UK Peatland Carbon Code is expected to provide the scientific and regulatory basis for peatland restoration, guiding projects in the
quantification of carbon and other benefits of restoration. The Code also promises to give potential corporate investors the confidence that their financial contribution is making a measurable and verifiable difference to UK peatlands, and to enable them to report this to their stakeholders.

The RELU Sustainable Uplands team research supported an ecosystem services approach, which complements the notion of Adaptive Governance, (Reed, Prell, Hubacek, Ostrom) as the best practice for natural resource management in the 21st century. The E.S approach interprets environmental impacts in financial language and by economic valuation. It allows direct comparison between the costs and benefits of diverse kinds of decisions (Evans, 2011). Although the research in this thesis has been inspired by RELU’s research and methodology it bares significant differences (see Table 4.2 below) as it uses a combination of stakeholder analysis and Social Network Analysis on a list of key stakeholders to explore and investigate how their ties and relationship patterns are organised around producing and co-producing knowledge about managing for a carbon agenda. The table below (Table 4.2) demonstrates the similarities and differentiations between RELU’s methodology and findings and of this thesis.

<table>
<thead>
<tr>
<th>Similarities and Differences between this PhD’s and Sustainable Uplands’s methodological approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sustainable Uplands project</strong></td>
</tr>
<tr>
<td>Project aim: Identify which individuals and categories of stakeholder play more central roles and which ones are more peripheral, and gain a sense for how the overall network is shaped to enhance uplands’ sustainable management.</td>
</tr>
<tr>
<td>Focus: all stakeholders within the Peak District National Park (PDNP).</td>
</tr>
<tr>
<td>Used Social Network Analysis to inform Stakeholder Analysis and then both to help identify stakeholder groups, ascertain that key categories are not marginalized, and identify representatives that are well connected with and respected by the groups they need to</td>
</tr>
</tbody>
</table>
represent (Prell et al, 2009) management in relation to their location within the Dark Peak’s network of stakeholders managing for a carbon agenda.

**Initial stakeholder data from MFFP’s stakeholder lists and Sustainable Uplands focus group.** Initial stakeholder data from MFFP’s stakeholder lists, snowballing thereafter for identifying further stakeholders.

**8 predefined stakeholder groups as derived from Sustainable Uplands focus group to conduct snowballing.** 5 stakeholder groups were identified using a combination of interview data, mapping exercise and Social Network Analysis.

Heather burning revealed as the most pressing land-management issue in the whole PDNP. Heather burning was also identified as the most controversial land-management practice in the Dark Peak causing conflict among stakeholders. However, the ‘carbon push’, the promise for future funding, and its impact on stakeholders’ approach to adopting a carbon agenda was identified as an issue of equal importance. Two years onwards from the sustainable Uplands study, the carbon agenda is emerging as a key conflict issue in the area. The ongoing conflict between different types of knowledges, ie. Science-policy-conservation nexus vs land-management community was identified as being at the heart of this conflict.

**Stakeholder analysis used in combination with Social Network Analysis (SNA) to examine how social ties between previously identified stakeholders can affect resource management** Stakeholder analysis used in combination with SNA to identify new and additional key stakeholders. SNA and stakeholders analysis were subsequently used to identify the paths knowledge travels through the network, the role of knowledge brokers in facilitating the carbon agenda, and any emerging patterns of communication among the new set of stakeholders.

**Given the large geographical scale of the Sustainable Uplands project, the methodology allowed for a focus on understanding and discussing the strength of ties and collaboration among stakeholder groups when managing for natural resources.** The considerably more focused scale of my research, allowed for more in-depth and inter-personal interaction with key stakeholders. This provided a more nuanced insight into how stakeholders adopt and respond to the carbon agenda, and enabled me to identify issues of conflict as well as issues of collaboration amongst key stakeholders.
The project Addressed the management of natural resources in general and identified a broad stakeholder network. Problems were identified in a top-down fashion by the social network and stakeholder network investigators and could consequently reveal their interests and biases.

The project Addresses specifically the management of a carbon agenda in the Dark Peak and identified the key stakeholders for this agenda in the area. Problems were identified in a bottom-up manner. In this approach it is acknowledged that the close interaction of the researcher with the interviewees can involve a bias in the researcher’s part with certain groups.

Source: Author’s own.

Table 4-2 Similarities and Differences between this thesis and RELU’s methodology and findings.

III. Semi-structured interviews

The predominant use of the interview in social research is due to the great refinement of this method which was reached during the last decades. The reason why researchers have focused on the increasing development of this method, causing the neglect of other tools, seems to be that the collection of information by using extensively cognitive medium, language, was easier to standardise (Friedrichs and Lüdtke, 1975). This research has employed semi-structured interviews in order to determine how the stakeholders of the Dark Peak adopt and respond to the carbon agenda.

Building upon the conceptual stakeholder map created in the first stage of my research (Figure 4.1 p.75), 17 key stakeholders were initially selected and approached. The initial stakeholder map was created as part of a consultancy project funded by Moors for the Future on identifying the key stakeholders in for carbon management in the Dark Peak (Tantanasi et al, 2011)The interview sampling strategy was selective in order to be representative of the main stakeholder groups. Snowball sampling, whereby contacts recommended key potential interviewees, was used to identify the most appropriate people to talk to in each stakeholder group (Bernard 1994: 165).

The initial contact was made via email where a Participant’s Information Sheet (PIS) was attached outlining the aims and objectives of this project and also guarantying
semi-anonymity and data safe guarding to all future interviewees. Once the Moors for the Future project came to a completion the second round of identifying stakeholders took place in the same methods as described previously which revealed another 19 key stakeholders with a carbon agenda in the Dark Peak. The total number of interviewees was 36 individuals from 26 stakeholders (Table 4.3 p.85)

The table below lists the key stakeholders that were interviewed for this research project alongside their role/function. A more comprehensive description of their role can be found in the beginning of chapter 5 where the stakeholder groups are introduced before delving into their roles in the social network. They comprise government bodies (2), water companies (1), academic institutions (4), local land-managers (2), non-governmental organisations (4), land owners (2), and conservation groups (2). Subsequently, to avoid bias arising from initial data composition, data were triangulated through the semi-structured interviews process, which a few additional stakeholders were identified.

The key stakeholders were approached through email or telephone communication. A consent form and a participant information sheet was provided and signed by all participants to secure ethical research approval and legitimacy of data. Each interview lasted on average 60 minutes and was recorded using an Olympus digital voice recorder. The majority of interviews (29 out of 36) were conducted at the participant’s professional surroundings, either their office or farm in the case of the Landmanagers. One was conducted at the local pub in Edale ‘The Rambler’s Inn’ which spontaneously turned into a group interview when other farmers’ friends of my farmer interviewee joined. This also gave me the opportunity to conduct some direct observation as will be discussed further in section 4.5.4. On four occasions when a face to face meeting was not possible due to time and space limitations the communication software Skype was used instead to conduct a virtual interview online. Finally, on two occasions arranging an interview proved impossible due to participants’ unavailability and difficulty to use Skype; therefore, the interview questions where send to both via email and they responded in the same manner.
The setting of the interview is important as Elwood and Martin (2000: 649) conclude: 'the interview site itself embodies and constitutes multiple scales of spatial relations and meaning, which construct the power and positionality of participants in relation to the people, places, and interactions discussed in the interview'. In all cases, the interviews were transcribed by myself immediately after they occurred using an Olympus transcription kit along with any additional notes taken during the interviews. They then were also coded in order to identify the key themes that emerged from the sample. This was to ensure that details and data was transcribed and recorded accurately while remaining in recent memory (Wengraf, 2004). Furthermore, it also enabled the advancing of my research whilst doing fieldwork, and the incorporation of ideas and issues that came up in interviews as new perspectives and details came to light. This way interview questions could be adapted accordingly.

Transcribing, on one hand, can be a frustrating, monotonous, time-consuming procedure but on the other it allows the investigator a direct contact with the data, and the opportunity to spot nuances, non-verbal cues (sighs, laughter) and revisit the dynamics of interaction in group settings. Direct transcription enables the researcher get into the heart of the interview and to get a sense of the dynamics of social situations. I think this contributes to a stronger focus on member's views and meanings, and an appreciation of the flow between personal and 'public' statements: the 'front and back' of personality and opinion (Goffman, 1959).
<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Manchester (x2)</td>
<td>Academic Institution</td>
</tr>
<tr>
<td>University of Leeds (x1)</td>
<td>Academic Institution</td>
</tr>
<tr>
<td>University of Sheffield (x2)</td>
<td>Academic Institution</td>
</tr>
<tr>
<td>University of Durham (x2)</td>
<td>Academic Institution</td>
</tr>
<tr>
<td>Penny Anderson Associates (x1)</td>
<td>Consultant</td>
</tr>
<tr>
<td>DEFRA (x1)</td>
<td>Government Agency</td>
</tr>
<tr>
<td>PDNPA (x1)</td>
<td>Local Authority</td>
</tr>
<tr>
<td>Natural England (x1)</td>
<td>Environmental Regulator</td>
</tr>
<tr>
<td>Environment Agency (x1)</td>
<td>Environmental Regulator</td>
</tr>
<tr>
<td>United Utilities (x1)</td>
<td>Water Company</td>
</tr>
<tr>
<td>Yorkshire Waters (x1)</td>
<td>Water Company</td>
</tr>
<tr>
<td>Severn Trent Water (x1)</td>
<td>Water Company</td>
</tr>
<tr>
<td>Land-managers (x4)</td>
<td>Farmers</td>
</tr>
<tr>
<td>Gamekeepers (x3)</td>
<td>Gamekeepers</td>
</tr>
<tr>
<td>Moorland Association (x2)</td>
<td>Landowners/Gamekeepers/Farmers</td>
</tr>
<tr>
<td>Ramblers (x1)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>Derbyshire Wildlife Trust (x1)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>Friends of the Peak District (x1)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>MFFP (x1)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>RSPB (x1)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>IUCN (x2)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>National Trust (x2)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>Rangers (x1)</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>The Heather Trust (x1)*</td>
<td>Environmental Guardian</td>
</tr>
<tr>
<td>Local Access Forum (x1)</td>
<td>Environmental Guardian</td>
</tr>
</tbody>
</table>

Table 4-3 The table below illustrates the list of interviewed stakeholder groups and organisations. (*The Heather Trust was dropped from the final list after it was established that their role is not key in the management of carbon in the Dark Peak. This should not be interpreted as being less significant in their role only that current analysis has revealed that they might not be a key player for managing for carbon yet*)

**Coding** is a process in social science research for grouping qualitative data into categories and for defining the connections and features of these categories (Basit, 2003). Codes, according to Coffey and Atkinson (1996), are ties between places in the data and sets of theories or ideas, and in that sense analytical tools, which facilitate the researcher in looking beyond the data (as seen in Basit, 2003). There
are two approaches in coding (Miles and Huberman, 1994). The first one is inspired by grounded theory and therefore called ‘grounded’ method, formerly proposed by Glaser and Strauss (1967), which is used when the researcher does not wish to code any data prior to their collection, or determine how it operates or sits within its context, or establish the data’s diversity. In other words the researcher allows new codes to surface from ones dataset as one reads it. The second one, favoured by Miles and Huberman, is to create an initial and temporary record of codes a priori which will build upon the theoretical framework, research questions, aims and objectives and literature gaps that the researcher will have identified in the beginning of one’s project (Basit, 2003).

This study has deployed the first approach in analysing data. Initially it was decided to use the software NVivo 9 for the qualitative data analysis. Time limitations however acted as a hindrance to learning and familiarising myself with the software. Therefore, given the manageable size of the data it was considered to proceed with coding the data manually. This was done by going through all the transcripts several times and using different highlighters and post-it notes for the various themes that surfaced. Having as a main key code that of ‘carbon management knowledge’ the themes that emerged through this coding process where the following: i) scientific uncertainty underpinning carbon related facts, ii) lack of resources to motivate stakeholders into further involvement in managing for carbon emissions, and iii) communication channels within the network that need enhancing. The aforementioned themes where consequently used to form the basis of the discussion, can be seen further below on the following chapters.

IV. Observations in the field

‘Observation involves looking and listening very carefully. We all watch other people sometimes but don’t usually watch them in order to discover particular information about their behaviour this is what observation in social science involves.’

(P. Langley, 1988 p.).
Observation enables the researcher to examine people in their ‘natural surroundings’ without their behaviour being influenced by the presence of a researcher; it also allows for the study of a group of people interacting together. Within the Dark Peak, observation took place on six occasions: during a workshop I organised to snowball for potential key stakeholders at the Moors for the Future Joint MoorLIFE and Research Conservation Conference in November 15th and 16th 2010, on four farm visits, and at the Rambler’s Inn, the local pub in Edale where land managers socialise.

I conducted three semi-structured interviews with farmers/landmanagers, and one with a local gamekeeper/landmanager. For all my interviews I met my interviewees in their work environments. I agreed to meet my interviewees on their farms and on one occasion in the local pub in Edale ‘The Rambler’s Inn’ where farmers and gamekeepers socialise, to ensure complete convenience for the contributor, but also appropriate surroundings such as a quiet office or meeting space for the interview to take place. The pub was a different experience due to that it was loud and rendered me unable to use my voice recorder so I had to rely on taking notes whilst participating in the interview which turned more into a discussion once my interviewee was joined by a fellow farmer friend. Taking into consideration that working on a farm is a collaborative process I was prepared to meet and talk to more than one person whilst conducting my interviews. The same applies with my interview in the local pub where I expected that talking to one farmer might attract other colleagues or friends to join our conversation and ‘chip in’ as one called it.

This method provided me with access to an assemblage of people which would be otherwise more difficult to come across due to my temporary and infrequent presence on rural settings. These occasions typically comprised of farmers and gamekeepers with their wives or other friends, usually also farmers from neighbouring farms; and on one occasion a member of the National Trust (NT). It further allowed me to feel part of their group on several occasions as throughout conducting the interviews on the farms I was often walking with the farmers along the farm where they were showing me around their fields, equipment, and layout whilst explaining how different land-management and farming procedures work. All
those interviewed shared the same argument that if their landowners and audit officers were more engaging with them on the farm-level like they had been 10-15 years ago (and “like I had briefly been in my fieldwork” then their tense relationships would be far better. This to my understanding suggests that the shift towards more corporatist behaviours from the land-owners’ and audit officers’ part was one of the main reasons that the previously trusting relations had broken down between them and the Landmanging community.

This opportunity to conduct group interviews whilst doing some observation had the benefit of allowing the researcher herself to ‘triangulate’ data among disparate respondents (Denzin & Lincoln 2003; Riley and Harvey, 2007). Furthermore, apart from allowing me to confirm statements and information through this spontaneous process of triangulation, these group interviews allowed me to gain insight into narratives about disparate stakeholders interaction and collaboration with one another, and in particular land managers -an experience otherwise foreign to me. From a research methodology point of view this was important in two key ways.

Firstly, simultaneous discussions with several respondents about carbon management in the Dark Peak enabled collaboration and knowledge exchange between diverse stakeholders: in the case of the workshop, for example, these included policy-makers, scientists, conservationists and a farmer. In all occasions, the group interviews enabled knowledge exchange and to bridge gaps within each other’s narratives between the Landmanagers and myself as an interdisciplinary researcher from the University of Manchester, which is itself among the key stakeholders in the Dark Peak too. Moreover, participatory observation occasionally undermines hypotheses about the position of the ‘key operator’, by reaching people who might otherwise be more difficult to reach (Webb, Campbell, Schwartz & Sechrest, 1966). These insights into the communication and interaction among the diverse stakeholders provided a valuable tool, which combined with data from the literature and the social network analysis graph (see chapter 5), enhanced my understanding into the social interactions of the Dark Peak stakeholders.
4.4 The key stakeholders of the network

Having identified and mapped (Figures 4.1 and 4.2) the key stakeholders previously in this chapter this section briefly introduces the actors of each key stakeholder group before carrying on to delve into the elements revealed by the Social Network Analysis in section VI.

i. Government Agencies and Environmental Regulators

The Government Agencies and Environmental Regulators comprise actors operating from a local (PDNPA) to a national (DEFRA, Environment Agency, Natural England) level. The stakeholder with the statutory power to create and implement policies is the Department of Environment, Food, and Rural Affairs (DEFRA). Under DEFRA sit the Environment Agency (EA) and Natural England (NE) which are executive non-departmental public bodies. The Environment Agency is a quasi-government body which became the official implementer and regulator of DEFRA’s sustainable development strategies under the Environment Act (1995) with a focus on the aquatic environment. The Environment Agency was derived from the National Rivers Authority (NRA), Her Majesty’s Inspectorate of Pollution (HMIP) and the waste regulation authorities in England and Wales who after being dismantled they gave up their waste regulatory roles. In the meantime, the Environment Agency also became responsible for declaring flood warnings, a duty held by the police in the past. This reflects the Environment Agency’s principal objective of following an integrated approach to environmental regulation (Environment Agency, 1996). Natural England is the government’s statutory advisor on environmental matters and also has authority for environmental regulation. Despite having a role as conservation non-departmental public body its authority in environmental regulation paired with the governments recent plans to merge it with the Environment Agency render it a better fit in this group rather than the Environmental Guardians. Finally, the Peak District National Park Authority (PDNPA) is a public body, funded by and working with DEFRA, aiming to conserve and enhance the natural beauty, wildlife and cultural heritage, and to support
opportunity for the understanding and enjoyment of the special qualities of national parks by the public (PDNPA, 2013).

ii. Academic Institutions and Consultants

There are four internationally acclaimed Academic Institutions that produce natural and social science knowledge on carbon in the Dark Peak of the PDNP: Durham University, The University of Leeds, The University of Manchester, and The University of Sheffield; and a well-established local environmental consultant Penny Anderson Associates that operates on the science-consultancy fringe. This list of Academic Institutions conducting internationally acclaimed research in the area of the Peak District is not restrictive, they are merely they key ones as has been revealed by the social network analysis in combination with the interview process. Other institutions, equally significant but not key, include The University of Liverpool, Cranfield University, The University of Aberdeen, and the University of Exeter.

iii. Utility Companies

The Utility Companies, or water companies, are commercial companies with a natural monopoly (at present) to deliver water to domestic, business, and urban consumers. This is done under the demanding EU Water Framework Directive (WFD), adopted under UK law in 2003 (EU WFD, 2000). In the Dark Peak there are three: United Utilities, Yorkshire Waters, and Severn Trent. United Utilities is the second major private landowner, after the National Trust, in the area followed by Yorkshire Waters.

iv. Environmental Guardians

This group comprises a variety of different stakeholders whose common denominator is the conservation and protection of the Dark Peak for biodiversity of flora and fauna, and for recreation and tourism. It includes local public-private partnerships such as Moors for the Future Partnership (MFFP) -which is consisted of: Peak District National Park Authority (PDNPA), National Trust (NT), Natural England (NE), United Utilities (UU), Yorkshire Water (YW), Severn Trent Water (STW),
Environment Agency (EA), Derbyshire County Council (DCC), and the Royal Society for the Protection of Birds (RSPB), local independent bodies such as the Local Access Forum (LAF), out-based delivery body of the PDNPA’s Enterprise & Field Services Directorate such as the Rangers (run and funded by DEFRA but working under the remit of the National Park they look after), regional conservation NGO’s such as the Derbyshire Wildlife Trust (DWT), national conservation charities such as the National Trust (National Trust) and the Royal Society for the Protection of Birds (RSPB), national campaigning organisations such as the Ramblers, and Campaign to Protect Rural England (CPRE) locally represented by Friends the Peak District (FoPD), and international conservation organisations such as the International Union for Conservation of Nature (IUCN). This provides for quite an interesting and variable mix of actors operating in the area with a wide reach and scope of activity in comparison to the more limited one of local Landowners and Land managers described in the section below.

v. Landowners and Land-managers

This group includes stakeholders who own and manage land the land either for cattle and sheep, such as Farmers, or for grouse, such as Gamekeepers. There are occasions where a farmer is also a gamekeeper and therefore these two stakeholders are very tightly linked. Another actor in this group is the Moorland Association (MA), a national organisation that coordinates the efforts of moorland managers and owners to cease heather loss and maintaining the grouse shooting industry. It also acts as a legal advisor to managers and owners and provides a forum for moorland management issues and new practices to be discussed. The Moorland Association has also members and funding from the game shooting industry.

4.5 Social Network Analysis

Social Network Analysis employs models and patterns to manage data according to relationship ties among stakeholders within a network (Reed et al, 2009). Numbers are the only form of symbols used by SNA to characterize i) the existence/non-
existence of a tie; ii) the corresponding strength of the tie. Each model symbolizes a distinctive relation, such as communication, divergence, friendship, trust, advice etc. Data sampling is usually achieved through questionnaires, participant observation and/or structured interviews (Wasserman and Faust, 1994). The semi-structured interview data were processed using the software UCINET 6 in order to investigate the relations that may affect how key stakeholders communicate and learn from each other. These insights are of relevance when analysing various actors’ abilities to manage environmental challenges. The advantage of SNA is that it highlights the diversity of relationship ties (both positive and negative), the strength of those relational ties, and finally stores this data in a simple and user-friendly quantitative form for further analysis. Investigation of these matrices reveals the construction of the stakeholder network, therefore distinguishing the exact location of each actor within the network (central, marginal etc) but also the arrangement of the actors in relation to each other (Reed et al, 2009).

Furthermore, Social Network Analysis can be used in ecosystem services management to assist in stakeholder identification, make sure that all relevant actors are considered and included in the stakeholder list, identify disputes between involved representatives, and choose the desired key actors according to the form the network is organised. This knowledge can prove critical when managing for ecosystem services as it can identify key influential members of a network who can leverage the behaviour of the rest of the assemblage (c.f. Rogers, 1995). The degree and manner in which networks affect stakeholders both individually and in groups have been disputed in both the resource management and social networks literature (Prell et al, 2008). For example, studies on the strength of ties linking stakeholders reveal that ‘weak’ ties generate different results to ‘strong’ ones. According to Granovetter (1973), strong ties build upon a mixture of attributes, such as reciprocity, time, emotional intensity and intimacy. Prell et al (2008, p. 1940) concur pointing out, ‘The higher a tie scores on each of these characteristics, the stronger the tie’. For instance, it has been observed for that in actors who are connected by strong ties find it easier to affect each other’s decisions. Consequently, developing strong ties between disparate actors within a
network can enhance mutual learning, and the co-production of knowledge as well as resources exchange (Newman and Dale, 2005; Crona and Bodin, 2006). Nevertheless, the advantages of strong ties may be compromised and obscured by the repetition of knowledge leading to lack of novel information production and transfer.

According to Granovetter (1973), weak ties are observed between disparate stakeholders. By linking together distant and isolated members of a network it has been observed that weak ties act as learning and knowledge transfer paths providing space for diverse ideas, novelty and innovation to travel among the stakeholders of the assemblage. Therefore, from an ecosystem services management approach, weak ties have the ability to enhance through learning the adaptive capacity of a network rendering it eventually more resilient to climate change. Despite their great importance, however, weak ties are fairly easy to disconnect as they are shared by individuals who may lack the trust and understanding required to enhance their communication over ecosystem services management issues (Granovetter, 1973; Burt, 1992, 2000, 2001; Newman and Dale, 2005). Ascribing a quantitative value to trust among the actors enables SNA to diagnose complex relationships which when combined with qualitative data may provide information about the type of dispute among the connected stakeholders. Furthermore, it may also reveal stakeholders that are regarded as untrustworthy by the rest of the assemblage (Prell et al, 2008). This knowledge can be useful in selecting actors as intermediates for collaborations who are more likely to be trusted by the stakeholders that would be difficult otherwise to trust one another and connect therefore minimizing the possibilities of arising conflict within the network.

In order to quantify the conflicts and alliances, as well as the power relations within the Dark Peak social network without neither biasing nor asking leading questions to stakeholders I followed the following method. First, I counted the times that each stakeholder mentioned other stakeholders (Table 4.3). this in turn provided an indication of who is regarded as most influential in making decisions about managing for carbon. This method follows Kwak et al (2010) in their paper ‘What is
Twitter, a Social Network or a News Media? where stakeholders’ mentions are used to measure other Twitter users’ influence or acknowledgement of importance.
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<th>MFFP</th>
<th>WT</th>
<th>MA</th>
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1. Table 4-4Social Network Analysis matrix derived by stakeholders’ indirect mentions of each other (Source: Author’s own).
SNA begins with a matrix, usually developed in an Excel spreadsheet, where each interviewee is plotted against a variable using numeric values. In the case of my research all interviewees were plotted against themselves as I was trying to capture how many times each interviewee mentions one another (Table 4.3). To develop this number I went through all my interview transcripts and counted how many times each interviewee was mentioning all other interviewees, either directly or by referring to them indirectly, and then populated the matrix accordingly. The value of zero was used in the matrix for an interviewee mentioning themselves as this information was not relevant to the research and would likely confuse my results.

This matrix was then uploaded on the social network analysis tool UCINET 6 which automatically translates the data into an SNA graph (Figure 4.3 p.98) The interesting aspect of UCINET software is that it is an intuitive tool that performs only statistical computations as selected by the user whilst leaving all the aesthetic and presentation development to the user themselves. In other words the researcher can manipulate the position of the nodes within the graph as one sees fit in order to aid their argument without this compromising the data.

Deciding how stakeholders’ connections would be presented on the graph was a difficult process due to the abundance of ties and the limited space on the graph available. The optimum way to illustrate this was by using a pentagon shape where each stakeholder group would be clustered on its edge. Each stakeholder node was then carefully moved around several times in order to achieve an as clear view as possible where all stakeholder nodes would have both their identity name and majority of relationship ties visible on the graph. Figure 4.3 was the first graph developed before any other statistical analysis was carried out.
The above graph illustrates the final version of the carbon agenda social network in the Dark Peak. It demonstrates only the strong communication links shared among the stakeholders, the thicker the ties the stronger the communication level which then suggests these stakeholders tend to influence one another more.
It illustrates only the strong and weak communication ties among the various stakeholders where black thick lines stand for strong ties and the fine lines demonstrate weak ties. Calculating the strength of tie is a significant statistical computation as it can reveal which actors are more likely to influence one another, which ones are more likely to share opinions, which ones are marginalized, and which play a brokering role (Prell et al, 2009). Strong ties (thick black lines) signify that stakeholders communicate frequently whereas the thinner, weak ties can suggest new knowledge travelling in the network as will be discussed in more detail in the following chapter.

<table>
<thead>
<tr>
<th>Social Network notion</th>
<th>Impact on the carbon agenda</th>
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<tr>
<td><strong>Strong ties</strong></td>
<td></td>
</tr>
<tr>
<td>+ Beneficial for communicating and disseminating multifaceted knowledge</td>
<td></td>
</tr>
<tr>
<td>+ Preserves trust among stakeholders</td>
<td></td>
</tr>
<tr>
<td>+ Stakeholders more likely to influence each other</td>
<td></td>
</tr>
<tr>
<td>- Stakeholders less likely get hold of new knowledge, thus knowledge may be less groundbreaking</td>
<td></td>
</tr>
<tr>
<td>- Can limit stakeholders</td>
<td></td>
</tr>
<tr>
<td><strong>Weak ties</strong></td>
<td></td>
</tr>
<tr>
<td>+ Beneficial for communicating and disseminating simple knowledge</td>
<td></td>
</tr>
<tr>
<td>+ Bridge disengaged segments of the social network</td>
<td></td>
</tr>
<tr>
<td>+ Tend to bridge dissimilar stakeholders</td>
<td></td>
</tr>
<tr>
<td>+ Tend to disseminate new/innovative knowledge</td>
<td></td>
</tr>
<tr>
<td>- Stakeholders less likely to trust each other</td>
<td></td>
</tr>
<tr>
<td>- Can break more easily</td>
<td></td>
</tr>
<tr>
<td><strong>Centrality</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Betweenness centrality (indicates power in the network):</strong></td>
<td></td>
</tr>
<tr>
<td>+ The higher a stakeholder scores the more comprehensive knowledge of the issue they have</td>
<td></td>
</tr>
<tr>
<td>+ Stakeholders act as brokers diffusing knowledge between disconnected members of the network. The higher one scores the more people depend on them to be connected, therefore the more power that individual/group has</td>
<td></td>
</tr>
<tr>
<td>- Stakeholders feel torn or stuck between two, or more, opinions</td>
<td></td>
</tr>
<tr>
<td>- Stakeholders may feel forced to ‘take sides’</td>
<td></td>
</tr>
<tr>
<td><strong>In-degree centrality (indicates influence in the network):</strong></td>
<td></td>
</tr>
<tr>
<td>+ The higher one scores the more power one (may) have over mobilizing the network and bringing other stakeholders together</td>
<td></td>
</tr>
<tr>
<td>- Spend a lot of energy to maintain ties, therefore ties are weak, and no guarantee that they can considerably influence those tied to them.</td>
<td></td>
</tr>
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</table>

Table 4-5: Related notions of social networks for ecosystem service management (Source: Adapted from Prell et al, 2009).
<table>
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<tr>
<th>Stakeholder group name</th>
<th>Stakeholder ID</th>
<th>Indirect mentions</th>
<th>in-Degree Centrality</th>
<th>Betweenness Centrality</th>
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<td>60</td>
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<td>Univ. of Sheffield</td>
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<td>37</td>
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<td></td>
<td>Univ. of Durham</td>
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Table 4-6 Stakeholders’ perceived influence and centrality scores. Indirect mentions are considered to infer the level of a stakeholder’s perceived influence in the social network. The bold font highlights the stakeholders with the highest centrality in each group, which therefore suggests they are more influential over than other who are did not have as high centrality scores.

Moreover, other computations that were carried out by UCINET 6 upon the data comprise measuring the network’s centrality (refer to Table 4.4 for definitions, and Table 4.5 for centrality scores). This computation allows to determine who the key stakeholders are that are most influential and most powerful in acquiring knowledge about carbon management and also in brokering that knowledge across the network. Table 4.5 comprises three columns: indirect mentions, in-degree centrality, and betweenness centrality. Stakeholders have been listed in a descending order according to their in-degree centrality.
There are two types of centrality calculations that can reveal stakeholders with power, and with influence over the network: betweenness centrality, and in-degree centrality. Betweenness centrality indicates that the higher a stakeholder scores the more comprehensive knowledge of the issue they have. Stakeholders act as brokers diffusing knowledge between disconnected members of the network. The higher one scores the more people depend on them to be connected, therefore the more power that individual/group has. However, stakeholders with high betweenness centrality feel torn or stuck between two, or more, opinions or agendas which then may make them feel forced to ‘take sides’. Additionally, in-degree centrality suggests power over influencing people and decisions in the network. For example, the higher a stakeholder scores the more power they (may) have over mobilizing the network and bringing other stakeholders together (i.e. The University of Manchester, Natural England, Land-managers, Moors for the Future Partnership).

Nevertheless, actors with high in-degree centrality tend to spend a lot of energy to maintain their ties across the network, rendering therefore their ties as weak. Weak ties as has been aforementioned is merely the official sociological definition and does not suggest that those ties are less important than strong ties. Rather that they lack in bonding their actors with trust and therefore weak ties cannot guarantee that they can considerably influence those tied to them (Prell, 2010).

Every social network analysis graph makes for a complex illustration. In order to shed some more light into how this came to being it is worth providing a quantifiable representation of the data that led to the creation of the social network graph presented further below in Figure 4.4. Figure 4.3 provides a quantitative illustration of the stakeholders’ mentions whereas the network figures (4.2 and 4.4) provide qualitative illustrations along with computations of centrality. For example, the bar chart depicts how many times each stakeholder has been mentioned during the interviews by the rest stakeholders in the Dark Peak, whereas the pie chart illustrates how many times each stakeholder group is mentioned by the all other actors and is presented in percentages. In combination with the pie chart which demonstrates the number of mentions of each stakeholder group in percentages, one can immediately notice that the Orange and Green groups stand...
out by holding the majority of mentions among all stakeholder groups, as is also
reflected in the social network Figure 4.4.

The higher the bar the more times the particular stakeholder has been mentioned.
This then suggests the level of perceived influence the particular stakeholder holds
over another in the network. This influence may be either direct, through command
and control mechanisms i.e. followed usually by the Environmental Regulators and
Government Agencies such as Natural England; or it can be indirect, through
relationships ties built on trust among stakeholders sharing strong ties (thick lines
in Figure 4.4).

Figure 4.4 Number of mentions of each stakeholder by the rest of the stakeholders, presented
both at the level of the individual (bar chart) and also of the stakeholder group (pie chart).
Figure 4-5 The carbon agenda social network of the Dark Peak.
The combination of the aforementioned data sampling methods and data analysis computations has contributed to the creation of a Social Network diagram (Figure 4.4), as the final product of this research, and has assisted in identifying the paths through which knowledge about the Dark Peak’s carbon agenda is being diffused, as well as the regimes that govern the area under study. To obtain information on who is the most influential within the network interviewees were asked what institution influences their work in the Dark Peak.

In order to establish who is regarded as the most influential within the network the SNA was based upon the indirect mentions of stakeholders within each interview transcript. While direct questioning often produces the answers that interviewees think they should give, using an indirect approach reveals more about how they perceive the importance of other stakeholders. I took this approach to gain an insight into the communication ties and knowledge exchange patterns among the Dark Peak’s key stakeholders. Thus, by mapping and analysing the networks of social relations among stakeholders in the peatland moorland ecosystem, important information was obtained about defining social structures and processes, such as distinguishable subgroups and information exchange as is discussed in the following chapter. Chapter 5 will consider the relationship ties and patterns through which stakeholders communicate knowledge related to carbon management in the Dark Peak.
CHAPTER 5 THE DARK PEAK SOCIAL NETWORK: CARBON AS THE ORGANISING PRINCIPLE

5 Introduction

Chapter 5 will begin by outlining the elements of the Social Network in the Dark Peak. It will then address the first research question, ‘How does carbon infiltrate the local governance network?’ by considering the role of each of the five key stakeholder groups that lends them power, and investigate the relations among stakeholders, how they are positioned within the social network, and how their relations are organised into network patterns (Scott, 2000; Wasserman and Faust, 1994; Wellman and Gulia, 1999; Prell, Hubacek, and Reed, 2009). The structuring agent used in this research is the carbon agenda which as mentioned in the previous chapter is part of this thesis’ unique contributions to methodology. Chapter 5 will explore how the carbon agenda restructures the social network of the Dark Peak and also describe how the interest to manage for carbon has affected the relationship ties among the key stakeholders of this network.

5.1 Social Network Analysis explained

Social Network Analysis unveils quite a complex network, which was expected after referring to the literature review and interviewing process. Nevertheless, a prominent and positive element is that all stakeholders are well connected with each other and no one is left outside the network. This indicates that the Dark Peak social network already has some well-established communication ties that vary, from strong to weak, among the actors involved; with strong ties being symbolised by the thicker lines and weak ties by the thinner ones (Figure 4.5). There is a considerable amount of knowledge regarding carbon budgets, and their management, produced and transferred across the network. We can also infer by this that in the face of many drivers of change or random failures many stakeholders or communication ties can collapse while allowing the remaining actors to continue reaching one another through alternative network paths.
This suggests that there is some form of social learning and participation in knowledge production and exchange already taking place. However, stakeholders’ engaging in social learning alone does not necessarily imply or guarantee that there is also knowledge co-production (Reed et al, 2010). Furthermore, what the SNA graph cannot reveal is the negotiation for effective social learning among stakeholders, or mutual learning, the deadlocks and dissents that can arise, as well as the occasions where social learning takes place due to resolving, or accommodating uncompromising stalemates and disputes. Also obscured is the lengthy process of collaboration which necessitates extensive dialogue between actors with likely adverse outcomes for those whose time is restrained (Rist et al, 2007; Ison et al, 2013). In addition, using SNA as a method to explore communication ties and relationship patterns may gloss over qualitative dissimilarities in the nature of ties (Prell et al, 2010), for example a relationship tie held between employee-employer such as Land managers-National Trust, or Land-managers-United Utilities is differing from a friendship one such as Land managers-Moorland Association. In this project I didn’t proceed with categorising the stakeholders into friends and non-friends as in doing so this might have insinuated that those who are not ‘friends’ are not friendly or are enemies. My aim was to treat all stakeholders as neutral and let the data from the SNA, the qualitative interviews, and the grey literature guide my analysis and discussion.

Revealing the strength of tie (refer back to Table 4.4 p.99 in Chapter 4) can suggest which actors are more likely to influence one another, which ones are more likely to share opinions, which ones are marginalized, and which play a brokering role (Prell et al, 2009). Strong ties (thick lines) signify that stakeholders communicate frequently. At first glance of Figure 4.4 one can observe considerably prominent strong communication ties on the axis connecting the orange group (Environmental Regulators and Government Agencies) and the green group (Environmental Guardians), in example Natural England and the National Trust, Environment Agency and the National Trust, PDNPA and MFFP, DEFRA and RSPB.

This assertion is also verified by the high in-degree centrality scores (refer back to Table 4.5 p.100 in Chapter 4) with the top 4 stakeholders belonging in these two
groups respectively Natural England, MFFP, the PDNPA, and the National Trust. In other words, high in-degree centrality is the highest sum of direct links a stakeholder has and therefore a higher a stakeholder ranks the more holistic understanding one has of environmental issues, and in the case of the Dark Peak of carbon management. In the Dark Peak network (Table 4.5, Figure 4.3, and Figure 4.4), Natural England has the most direct connections in the network, making them the most active stakeholder in the network. Natural England is a 'connector' or 'hub' in this particular network. Other highly central stakeholders are MFFP (second), the PDNPA (third), and the National Trust (fourth). It might seem that the more connections one has the better but this is not always the case as highly connected stakeholders may feel trapped between two or more varying opinions and may feel pressure to take sides. The significance here lies in where those connections lead to and how they connect the otherwise unconnected.

The top one being Natural England, which can be attributed to its authority to control and regulate Sites of Special Scientific Inquiry (SSSI) areas, Agri-Environment Schemes (AES), and heather burning management plans. This doesn’t come as a surprise however as Natural England has also scored first in the stakeholders’ perceived influence list indicating therefore that actors in the Dark Peak network are aware of the organisation’s regulatory power over management activities in the area. The majority of the Dark Peak falls under all three initiatives which render Natural England the most focal stakeholder everyone interacts with when operating in this area. Being the highest central (in-degree) actor in the network this also reveals Natural England’s power and influence as being in a position of authority and dealing with policy. Natural England’s position of power allows it to strongly influence the government’s (DEFRA) environmental decisions and policies as can be seen by the green thick ties shared between them; and thus, having the power to mobilize the network into certain environmental paths and agendas.

The green thick lines indicate that these two stakeholders share a trusting relationship whilst engaging into mutual knowledge exchange, which also suggests that Natural England and DEFRA are very likely to share considerably similar views and influence each other’s actions. The second strongest communication ties are
shared with the Land-managing group which in previous years would have been unimaginable. However, nowadays they reflect Natural England’s recent conciliatory attitude towards this stakeholder group. This was instigated by land-managers’ recurring demands for more dialogue and consideration of upland management problems who felt previously unsupported and threatened by increasing requirements of them.

Equally, the second actor from the same stakeholder group that is among the top five members with high in-degree centrality is the PDNPA which also corresponds to the results from the stakeholders’ perceived influence list. Furthermore, it scores fourth from top in the betweenness centrality measure which also indicates its control over comprehensive knowledge around carbon management decisions and the potential to act as a broker to diffuse this knowledge. This at first may seem a contradiction as the PDNPA does not share many strong ties with the rest of the stakeholders, apart from the Rangers and Friends of the Peak District. Both ties are directed towards the National Park Authorities indicating in the case of the Rangers strong communication of issues and conflicts arising on the landscape and its ecology, such fire eruptions or public complaints that the Rangers are unable to resolve.

In the case of the FoPD however, the strong red ties can be attributed to their determined lobbying stance in establishing sustainable moorland development on the local political agenda of the Peak District National Park. In example, FoPD claim that the PDNPA are ‘not stepping up in decarbonising the peat in the sense of regeneration and consumption’ (FoPD interviewee, 2011). Their campaigning approach has successfully influenced change in the PDNP’s policy by persuading the PDNP Authorities to take action on the worst affected off-road routes in the landscape. In the same vein, other members of the Environmental Guardians such as the Ramblers, the Local Access Forum (LAF), and the Derbyshire Wildlife Trust (DWT) are frequently dismissed as resource poor and compelled to rely on direct action to accomplish promoting their aims (Lowe and Wilkinson, 2009) in the PDNP. Their inclusion as key stakeholders in the Dark Peak social network stems from their tenacity rather than impact, of accumulative gains over high profile achievements.
However, the PDNPA’s ‘power’ in the social network appears to lie within its delivery partners, who also happen to be key stakeholders, i.e. the National Trust, Natural England, RSPB, WT, Water Companies, and MFFP to name but a few. It is through those communication ties, which span across the whole network, that NPA’s objectives are being met. The majority of the PDNPA’s ties are non-reciprocal (red) suggesting that the ‘power’ over knowledge is directed in a rather top-down manner towards its ties which may also lead to disagreements and conflicts. Yet this can be attributed to its structural position, as being a body of authority that uses other key stakeholders as its delivery partners. On the other hand, relying so heavily on their delivery partners might indicate the PDNPA’s complete lack of actual power and influence in the network at the same time.

Moreover, MFFP from the green group of Environmental Guardians has the second highest in-degree score making it the second most influential stakeholder with regards to carbon management knowledge. MFFP appear to share an almost equal balance of strong and weak communication ties rendering them a valuable actor in the network. Apart from holding a central role in being in the position to diffuse information directly the large majority of stakeholders they also seem to hold relatively strong and trusting relationships with scientific actors such as The University of Manchester and the University of Durham, their research largely informs MFFP conservation actions and advice to the other stakeholders, in example, through their collaboration in knowledge co-production projects such as Making Space for Water I and II. On another note, MFFP also hold strong ties with Environmental Regulators and Government Agencies such as the PDNPA through informing local policy-agendas. The plethora of weak ties, such as with the Land managing stakeholder group, also suggests that MFFP are beneficial for bridging dissimilar and disengaged stakeholders through innovative knowledge-sharing activities such as their annual MFFP conference or other local workshops where they try to create a ‘neutral forum’ (MFFP interviewee, 2010) and bring together disparate stakeholders ranging from policy-makers, scientists, to local farmers and gamekeepers. These forums are not very popular with the Land managers who seem to prefer less formal routes of interaction both with MFFP as well as the rest
of the stakeholder groups. This therefore indicates their focal role in knowledge co-
production and dissemination in the Dark Peak network.

Their power comes from the strong influence they exert on the network through
their knowledge brokering role which comes as no surprise and is also reflected in
the high level of influence the stakeholders perceive them to have. Interview
analysis has shown that stakeholders rely on MFFP’s brokering role very frequently
when it comes to getting a point across regarding land management issues, a point
which will be returned to in Chapter 7. With regards to the contested heather
burning strategy however MFFP have been very careful not to take any bold side
trying to maintain a neutral balance due to their connections to actors who are
both strongly in favour and against it. Furthermore, MFFP’s diplomatic position also
depends on their heavy reliance on funding from a vast majority of stakeholders,
both in support and in opposition of burning, However, being directly connected to
a plethora of weak ties may also indicate a disadvantage in forming many trusting
and long lasting relationships due to the amount of energy spent on maintaining all
these ties in the first place.

The National Trust on the other hand, being the fifth higher in-degree central
stakeholder, appears to have its power and influence attributed to its role as the
major landowner and conservation group in the Dark Peak. Its stronger ties are
shared between Natural England, Environment Agency, and PDNPA which suggests
the sharing of very similar views and actions regarding the importance and effect of
carbon budgets in the moorland. All three come from the same conservation of
flora and fauna angle and according to the interview data they share a ‘burning is
bad’ mentality despite allowing the Land managers and Landowners to use it.
Another prominent feature of the National Trust is its seemingly strong and
reciprocal knowledge communication with their tenants, the Landowners and Land
managers group. This comes as a particular surprise and also reflects one of the
dangers on relying solely on a SNA graph without building upon interview data. The
reason is that through the interview process two thirds of National Trust’s tenants
(five out of seven Land managers interviewed) have expressed their deep
disappointment in the charity’s corporatised behaviour towards them as is discussed in detail in the following chapter.

Another interesting element here is the moderate strong ties shared between the National Trust and RSPB, also a tenant. Both charities share very similar ideas about conservation and biodiversity and 2010 saw ‘the first ever joint RSPB-National Trust nature reserve and the first time the UK’s two biggest conservation charities have come together’ (RSPB interviewee, 2010). Therefore, one would expect their bond to appear in a thicker line indicating stronger communication and knowledge exchange. This might be attributed to the fact the collaboration had only recently commence among the two stakeholders and thus it was too early to be traced within the social network ties.

On the same note, the RSPB which according to the SNA graph and the centrality scores is part of the top three most referenced Environmental Guardians appears to share the strongest tie with DEFRA in a top-down manner. One would expect this relationship to be reversed due to the Charity’s renowned lobbying attitude. However, in the case of the Dark Peak the RSPB appears to influence government decisions indirectly which is demonstrated by the strong ties held with other stakeholders such as the majority of Utility Companies, i.e. mutual strong communication with UU and one directional strong ties YW. In fact the RSPB, manage almost 50% of UU’s land in the PDNP, and therefore their views on land-management can be very influential to UU. This is also reflected in the development of project SCaMP in 2005 where the RSPB advised UU to spend government subsidies in solving the problem of water colouration by targeting the source, catchment level, rather than the usual ‘end pipe solutions’ favoured by policy-makers (RSPB interviewee, 2010). Their advice is claimed to be built on ‘sound science’ as can be also supported by the weak ties shared among the charity and the majority of Academic Institutions and Consultants stakeholders. Weak ties indicate the flow of innovative carbon knowledge and information which is derived by scientific experimentation. This observation also suggests, as will be argued in Chapter 6, that several Environmental Guardians have powerful influence over local and national policy either through informing their making (i.e. the Heather and
Grass Burning Code 2007) or through lobbying for their making (i.e. Countryside and Rights of Way Act 2000). Their power and influence extends to the Land managers and Landowners’ community too which will be covered further in this chapter.

Another interesting observation of the SNA graph is the amount of strong communication ties shared between the Orange-Green group’s axis and the purple group (Academic Institutions and Consultants). Relatively strong ties can be observed between the University of Manchester and the PDNPA and Natural England, as well as with MFFP, the University of Durham and MFFP, and the University of Leeds and IUCN. The University of Manchester in particular is key for this group and the network respectively due to having the highest betweenness centrality score among all stakeholders. The highest betweenness centrality (Table 4.5 p.100) an actor scores the more comprehensive knowledge on a subject they have. Therefore, the more people depend on them to be connected to this knowledge which indicates how powerful the stakeholder is in the regard. The University of Manchester has indeed been at the forefront of carbon budget research contributing to an array of scientific reports and projects in the Dark Peak (Evans et al, 2005; Evans and Warburton, 2007; Daniels et al, 2008; Allott et al, 2009; McMorrow et al, 2009; Albertson et al, 2010; Evans and Lindsay, 2010; Evans et al, 2010). Moreover, Manchester’s moderately strong ties with the PDNPA and Natural England, both of which operate at a local level unlike DEFRA, and the Environment Agency, reflect the influence science has over policy in informing and shaping local environmental decisions. The same can be argued about Durham which shares the strongest tie with Natural England out of all the other stakeholders in the Government Agencies and Environmental Regulators group.

The links between the University of Manchester and the University of Durham are also very noteworthy revealing the strong trusting ties shared between the two institutions, as are the links among the University of Durham and the University of Leeds. These ties also suggest the knowledge co-production taking place and also that these stakeholders are very likely to share very similar views on issues around carbon budgets and management as well as influence each other’s views. The
University of Durham in fact is strongly connected to both Universities mentioned above, who otherwise would share minimal communication. Both institutions’ scientific results seem to strongly influence MFFP’s views as revealed by the strong ties shared between them. However, the communication between Manchester and MFFP appears to be non-reciprocal suggesting therefore a top-down approach to knowledge transfer with the Environmental Guardian. A reason for this may be Manchester’s position as the highest betweenness central actor in the network, which means the actor may feel torn or stuck between two or more opinions regarding managing for carbon which may cause discomfort if felt forced to take sides in a contested issue such as the effects of heather burning on the moorland.

Another reason could also be that the University of Manchester, along with Leeds, Sheffield, and Penny Anderson Associates (PAA) who also share red top-down communication with MFFP, are all frequently contracted consultants to MFFP. Due to their close geographical proximity this allows for frequent formal and informal dialogue, and therefore when MFFP formally receives scientific data from the following stakeholders it is merely to support their decisions regarding moorland research and management advice; in a SNA graph this then would appear as non-reciprocal top-down driven form of knowledge transfer. In contrast, the University of Durham’s communication appears reciprocal due to the nature of the two stakeholders’ relationship. The geographical distance between the two stakeholders allows them to become partners in joint research projects where communication between members takes place in an official formal context. Furthermore, Penny Anderson Associates also influences MFFP in a top-down manner through providing scientific data and consultation on temporary contractual work in the Dark Peak. Finally, on a different note, the universities of Leeds, Sheffield, Durham, and Manchester share moderately strong ties with the International Union for the Conservation of Nature (IUCN), with the majority being of reciprocal nature. This suggests that scientific institutions have the power to reach and influence from local to international conservation agendas with projects such as the Commission of Inquiry of Peatlands (Bain et al, 2011).
Moreover, the Government Agencies and Environmental Regulators-Environmental Guardians axis (Orange-Green groups axis) shares considerably strong communication ties with the Land management and Landowning community with most prominent ties being held among the latter and Natural England, the National Trust, MFFP, and IUCN as has been briefly discussed in the previous sections. With regards to Natural England’s ties, this can be attributed to the influence regulatory and government bodies have over the Land managing and Landowning group through policy enforcement in the Dark Peak moorlands, whereas with the latter three this alludes to the increasing influence and power conservation bodies can have in on-the-ground land management decisions. This is further explored in Chapter 6 where the complaints of local farmers and gamekeepers are discussed on how ‘everyone wants to tell us what to do and how to manage our land’ (Land manager 3, 2011). This also reflects the different environmental agendas at play in the Dark Peak that want to shape the way peatlands are managed for carbon, water, and biodiversity. Another very interesting point in this interplay is the intense red ties directed from the Academic Institutions and Consultants towards the Land-managers group which resonates with the expert-lay knowledge conflict also discussed in Chapter 6.

Finally, it comes as a surprise that the Utility Companies are not perceived by the rest of the stakeholders as more influential on carbon management activities. Being part of the nation’s biggest resource-providing businesses, due to owning and controlling England’s water resources, one would have expected their powerful status to exert a more direct influence on the social network’s activities. However, as every coin has two sides such is the case here. Water companies operate more at a national scale addressing the needs of their stakeholders across England under the guidance of the WFD, in example by providing clean drinkable water, and sewage services, and only get involved at the local scale when an issue arises that compromises their activities on the national scale. In example, water colouration caused by land degradation in the Dark Peak has a direct impact on their customers’ satisfaction and therefore is an issue that UU, for example, is keen on combating by investing in local sustainability water management projects at the catchment scale.
such as SCaMP I and SCaMP II. Water Companies share a strong belief that managed heather burning for instance is potentially detrimental to the quality of the peatland on their land and the main cause of water colouration which also leads to carbon emissions in POC and DOC forms. This can be also supported by the SNA which illustrates that Water Companies share relatively strong links with most members of the Green group such as UU with MFFP, RSPB, National Trust, and YW with National Trust. The interview data reveal that the majority of the Environmental Guardians (Green Group) are in fact not in favour of prescribed, or managed, heather burning due to is proclaimed damaging effects on wildlife population, both flora and fauna.

In the past Water Companies used to blame their tenants, farmers and gamekeepers, which resulted in intense conflicts with only temporary resolutions. Since this past decade, however, they have changed their approach and resorted to more subtle means. They acknowledge that it is difficult to build trusting relationships with the local farmers and gamekeepers as their community is suspicious and fearful of anyone wanting to change their business (YW interviewee, 2010). Therefore, nowadays they seek to influence indirectly by using ‘solid scientific data’ (UU interviewee, 2010) to persuade their tenants that certain management practices are failing and need to be changed despite not being clear on what constituted ‘solid’ for them. This also resonates with the SNA graph where one can observe the abundance of green ties shared among Water Companies and the Academic Institutions and Consultants’ (Purple Group). Through those green weak ties there is reciprocal knowledge exchange between the stakeholders of these two groups with weak ties indicating the flow of innovative knowledge precisely as one would expect; new scientific knowledge produced on Water Company land is provided in order to inform current and future land management changes. However, when this approach does not raise the desired effects, Water Companies do not hesitate to threaten ‘going down the enforcement route’ (YW interviewee, 2010). At the end of the day though it seems that all water companies are willing to maintain some balance with their tenants and allow some undesirable practices, such as either heather burning or the use of pesticides, in an
attempt to build trust with their tenants and maintain the balance in the network. This is also confirmed by the reciprocity of ties shared among the two stakeholder groups. Finally, it comes as no surprise that STW plays a more quiet role in this configuration as the former two water companies also happen to be at the top three major land owners in the Dark Peak (Figure 3, see page 29) having considerably more financial stake in the area.

5.2 Conclusion

Building strong ties between various stakeholders can improve joint learning, co-production of knowledge, and sharing of resources (Crona and Bodin, 2006). However, the knowledge that usually is communicated through such ties indicates that stakeholders who have shared a strong tie for a long period of time tend to have the same information and knowledge regarding ecosystem service management (Prell et al., 2007). This is not the case for a lot of the strong ties in the Dark Peak network as this also depends on the direction of the information flow, or in other words whether a relationship tie is reciprocal or not. Table 6 summarises the strengths and weaknesses suggested by the social network analysis in the Dark Peak.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>All stakeholders are connected with each other</td>
<td>Plethora of one directional communication ties, implies top-down knowledge transfer</td>
</tr>
<tr>
<td>Strong ties and weak ties are shared among stakeholders</td>
<td>Abundance of weak ties suggests a tendency of lacking in trusting relationships, needed for in-depth dialogue in managing complex environmental issues</td>
</tr>
<tr>
<td>Not a highly centralized network, in other words it is resilient if some stakeholders leave</td>
<td>Highly central stakeholders have the power to manipulate information to their advantage</td>
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Table 5-1 The strengths and weaknesses of the Dark Peak social network managing for a carbon agenda.
In contrast, diverse information and novel ideas have been observed to travel best through weak ties. This form of relationship/tie is characterised by less communication and/or less emotional intensity among stakeholders. It usually exists between dissimilar actors and has the advantage of offering to individuals, and the network, access to diverse information and resources. In example, between the Land-managers and all stakeholders of the Utility Companies (Graph 5.4), The University of Manchester and the majority of the Environmental Guardians (Graph 5.5), MFFP with Moorland Association (Graph 5.6). Weak ties have been observed to act as ‘brokers’ and perform bridging roles between otherwise disconnected elements of the network (Prell, 2011) as well as connect stakeholders in both horizontal and vertical levels (Folke, 2005). Their importance lies within this very unique feature, within the context of adaptive management and governance, they can make the network more resilient and adaptive to climate change (Reed et al, 2008). Yet, they are easy to break as stakeholders that share weak ties may lack the trust and understanding that is required for significant dialogue over environmental issues (Burt, 1997; Burt, 2000; Newman and Dale, 2004; Evans, 2012) such as between the majority of Government Agencies and Environmental Regulators and the Land managers.

Another apparent strength of the Dark Peak carbon governance network is that it is a low centralised network, which means stakeholders seem to be evenly distributed in terms of influencing each other on carbon management issues. In adaptive governance terms this is a highly resilient to change social network. Change in this respect can be any change induced in the socio-ecosystem from human to climatic change. The reason behind this network’s resilience lies in the fact that the network itself does not rely only on one or a small number of central individual actors to hold it together; all actors are connected with each other and contribute in the co-production of knowledge around carbon management. It is resilient in the face of many deliberate disturbances or accidental disasters - many stakeholders or relationship ties can fail while allowing the remaining stakeholders to still reach each other through alternative other network connections. However, all stakeholders in the Dark Peak socio-ecosystem do not contribute in the same level
in the production of knowledge and neither do they all have the same power of controlling the flow of information around carbon management produced. This is precisely one of the disadvantages of this social network which will be discussed more profoundly in Chapter 6 and which also highlights the necessity for a more adaptive approach to managing and governing the stakeholders which will be explored in the final Chapter 7.

However, the nature of certain relationship ties despite being strong is non-reciprocal, or in other words one directional, and therefore indicates the lack of dialogue, in example among the Academic Institutions and Consultants group (purple), and the Environmental Regulators and Government Agencies group (orange) with the Land managing and Landowning group (brown), and also between the Environmental Guardian group (green) and the Environmental Regulators and Government Agencies group (orange). This suggests that conflict may exist or arise among these stakeholder groups, also supported by the qualitative data and the grey literature, due to the stakeholders’ disparate views on land management, in particular prescribed heather burning. Social Network Analysis suggests that a large majority of knowledge is transferred in a top-down manner, or in Scheffer et al’s term in a vertical direction (Scheffer et al, 2002), which with regards to managing for a carbon agenda can prove challenging and stifle stakeholders’ activity despite its increasing financial appeal among the majority of stakeholders. Finally, the issue of knowledge exchange and transfer regarding land management practices can be traced in the abundance of red ties connecting the actors, especially in the case of the Land managers and Landowners group (brown) who feel their lay knowledge being discounted by the Environmental Regulators and Government Agencies group over that of the Academic Institutions and Consultants as has been found in other studies such as VanderHorst and Vermeylen (2011). This also reveals the existence of different types of knowledges and how the expert versus lay knowledge is being played out in local environmental political agendas. These key themes will now set the ground for the discussion that will follow in Chapter 6 where they will be unpacked and further insight will be provided in explaining the situation in the Dark Peak.
CHAPTER 6 WHY IS MANAGING FOR A CARBON AGENDA A CHALLENGE?

6 Introduction

The Dark Peak peatlands, just like the rest of the British peatlands, are a ‘land of many uses’ (Burt & Hanwell, 1992) and are currently managed for an exceptionally wide range of provisions, otherwise known as Ecosystem Services (DEFRA, 2009c; National Ecosystem Assessment, 2011). These services contribute to the regulation of the climate and well-being of the local and wider society and until recently included sheep farming, game management, and forestry as the main land uses that have shaped the landscape as we know it today (Tapper, 2005). In the last twenty years or so other Ecosystem Services have become of increasing importance such as conservation, the provision of drinking water, mitigation of downstream flooding, tourism, as well as most recently carbon storage and sequestration. These Ecosystem Services have placed the Dark Peak peatlands in a position of national and international importance as a cultural landscape with numerous benefits to the wider society.

In particular, carbon storage has risen substantially in environmental science and policy agendas nationally and internationally and is regarded as the second most significant pressured ecosystem service after water (Bonn et al, 2010, Christie et al, 2010, Reed et al, 2013). The reasons for this are related to its great contribution to climate change mitigation and especially because of the Dark Peak’s eroding patterns for the past 200 years primarily due to peat erosion. Furthermore, it is also due to the region’s general contribution as a carbon net sink of CO$_2$ of $-62 \pm 4$ k tonnes CO$_2$ equivalent. Research suggests that with active carbon management, including a combination of grazing and burning termination (English Nature, 2003), blocking drainage ditches and gullies, and revegetation of bare and eroding peat soils a total of -160 tonnes CO$_2$ eq/km$^2$/yr could be achieved (Worrall et al, 2009; Reed et al, 2013). However, such strict management regimes could prove harmful and unsustainable for the local farming and game keeping communities of the area.
who rely on these strategies as it would remove a considerable amount of their
current incomes, as well as risk disturbing the balance within the SES.

Following on from Chapter 5, where the relationship ties between the key
stakeholders were explored and the knowledge patterns regarding managing for
the carbon agenda within the Dark Peak’s social network were revealed, this
chapter will discuss the underlying problems that characterise the key stakeholders
of the socio-ecological system, which have also created the ripe conditions for the
emergence of adaptive management approaches. In particular, the key
relationships that social network analysis revealed to be in need of further
exploration are of the science-policy-society nexus between Government Agencies
and Environmental Regulators, Academic Institutions and Consultants, and the
Environmental Guardians, and how these ties affect the Land managers’
stakeholder group when managing for a carbon agenda. As has been previously
discussed in Chapter 5, the Dark Peak has a well-connected social network with an
abundance of knowledge regarding natural resource management being exchanged
and co-produced among its stakeholders. However, this knowledge exists in
different forms, such as expert, scientific, and lay, and the challenge still remains as
to how best integrate these disparate types of knowledges in a sensitive manner to
represent the needs of all stakeholders.

The predominant knowledge that drives decision-making and policy outcomes has
been heavily science-based and distributed among the stakeholders in a top-down
manner causing disputes and animosity. This is considerably observable in the
interplay between the Government Agencies and Environmental Regulators and
members of the Land-managers group where the structural nature of their
relationship causes fragmented communication, with the latter often complaining
of being unable to influence policy-decisions that will affect their livelihood and
social living. Furthermore, there also seems to be tension around how knowledge
about the local ecosystem, the moorland and its peatland, is being considered.
Policy and conservation groups rely heavily on the Academic Institutions and
Consultants for learning and decision-making. Members of this stakeholder group
seem open for knowledge transfer and communication with Land managers; this
however is received by the latter as either too formal and with language that is
challenging to understand or as mirroring their own tacit knowledge. Disappointment exists as when their knowledges concur it often is the case that the
opportunity to influence and inform decisions is offered to science when they call
for a combination of knowledges. Finally, considerable tensions due to conflicting
knowledges and interests are observed between certain members of the
Environmental Guardians and the Land managers’ group. Conservation groups have
played an undeniably crucial part in influencing via lobbying environmental
governance and policy through the years in the UK; and this is no different in the
case of the Dark Peak where key influential players such as the RSPB and the NT
who are also major landowners in the area try and shift local environmental
agendas towards conservation objectives at the expense of land managers’
livelihoods. With the current Agri-Environment Schemes (AES) allowing for more
flexibility on land management practices it seems that land managers are portrayed
as traditional and resisting change. Yet this is not a case of right or wrong, merely of
different knowledges and interests in need for avenues of more open
communication, mutual learning, and engagement. Consensus can be reached but
it is not always the desirable outcome as it may conceal other issues underpinning
the stakeholders’ relationships and therefore unresolved tensions may escalate and
eventually hinder the effectiveness of stakeholders’ activities and decisions in the
long run resulting in further land degradation and carbon emissions.

The key pressures in managing for a carbon agenda within the socio-ecological
system of the Dark Peak reflect some common issues underpinning ecosystem
services management and centre on the following three key themes: 1) the effect
on the stakeholder relationships of the highly controversial land management
practice of prescribed heather burning and of uncertainty impacting all stakeholder
activities, 2) the stakeholders’ different responses to the recent ‘carbon push’, and
in particular how the promise for future funding impacts stakeholders responses,
and 3) the ongoing conflict between the different types of stakeholder knowledges,
and in particular the effect the science-policy-conservation nexus has on the Land
managers’ attitudes. This chapter discusses each of these three issues in turn.
6.1 The ‘burning’ issue

The existence of scientific uncertainty has been identified as one of the key problems contributing to the complexity of governing the socio-ecological system at play. It has been observed that the key stakeholders of the Dark Peak socio-ecological system have disparate levels of comfort with uncertainty which is impacted by the way they produce and receive knowledge (Wright, 2004). Contrasting research findings cause dissensus among the members of the Academic Institutions and Consultants on areas such as the effects of fire on peatland moorland and in particular of the key controversial issue of controlled heather burning. Scientific uncertainty therefore impedes the pace of research and the development of more targeted moorland management strategies. The impacts of fire-prescribed, or managed, burning, and of wildfire-on carbon budgets, water colouration, and biodiversity are very contentious with various scientific results arguing either for its benefits or for its disbenefits on the Dark Peak ecosystem. The main argument revolves around whether fire, and heather burning, has a direct damaging effect on water colouration due to the levels of Dissolved Organic Carbon (DOC) and Particulate Organic Carbon (POC) found in the water (Ward et al, 2007; Worrall and Adamson, 2007; Worrall et al, 2010; McMorrow et al, 2009). In the 1970s and 1980s an array of scientific studies explored the impacts of burning on heathland vegetation (e.g. Hobbs, 1984; Hobbs and Gimingham, 1984a; Hobbs and Gimingham, 1984b). Researchers have also investigated the effect of burning on several biophysical systems, yet recently the growing concern over the peatland moorlands’ carbon stores has instigated a series of studies investigating the effects of burning on carbon budgets (e.g. Garnett et al, 2000; Ward et al, 2007; Worrall et al, 2010).

Aside from burning another pressing issue obscured by scientific uncertainty is that of raising water table levels through rewetting and revegetation strategies. Some studies maintain that gully-blocking may lead to up to a 25% reduction in DOC (Wallage et al, 2006), whereas others disagree with this magnitude and even the direction of this response (e.g. Worrall et al, 2007) arguing for the benefits of
revegetation having more significant effects on carbon budgets (Pilkington et al, 2012). However, there are concerns from others on whether reseeding and revegetating the peatlands (Figure 6.1) will increase the fire fuel load and therefore increase the chances of another severe wildfire eruption resembling the events in Bleaklow 2003 (Figure 6.2) or Marsden 2011 (Figure 6.3). This section will focus on the incertitude regarding the effects of fire, and especially of prescribed heather burning on peatland moorland, (otherwise referred to as controlled burning), as this was revealed to be the current focal point of conflict and ambiguity in the Dark Peak, a finding also supported by RELU’s Sustainable Uplands research.

Data collection has revealed that uncertainty allows for the existence of opposing scientific results over the effects of fire and heather burning on the peatlands’ ecosystem. Among the Academic Institutions and Consultants there are various results. Some argue that burning is damaging for peatland moorland water tables: by lowering the water tables the peat erodes and therefore it releases carbon in dissolved and particulate organic form. Other studies however support that a managed burning regime can have beneficial effects in reducing the fire fuel load, by burning away the dry woody shrub vegetation, and therefore reducing the risk of severe wildfire outbreaks to which the area is prone in (McMorrow et al, 2009).

Figure 6-1 The images above illustrate the effects of revegetation and gully-blocking work on Kinder Scout, Dark Peak conducted by a team of researchers at the University of Manchester. The image on the left was shot in 2010 at the start of the project and the one on the right demonstrates the results of the restoration upon its completion in 2014. (Images are curtesy of Prof. Tim Allott).
Figure 6-2 The image illustrates the aftermath of the severe wildfire in Bleaklow, Dark Peak in 2003. The group of bones in the foreground is from an unfortunate leveret (baby hare) (Image is courtesy of Julia McMorrow).

Figure 6-3 The above image demonstrates a snapshot of the Marsden Moor wildfire in 2003 (Image is courtesy of Samuel Ward).
This ambiguity over what is right or wrong, and what is best or not, seems to have created intense animosity among the stakeholders of the Dark Peak socio-ecological system. Stakeholders with an interest in wildlife conservation argue against managed burning as it can disturb and destroy nesting bird populations (RSPB interviewee, 2010), while members of the Utility Companies complain about the high cost of removing POC (water colouration) from their potable water (United Utilities interviewee, 2010), whereas others like the National Trust recall the costly and damaging Bleaklow wildfire in 2003 and are keen in minimising any potential outbreaks on the land by applying strict restrictions on their tenants.

On the other hand there are other stakeholders such as members of the Land managing and Landowning community who have long been using fire as a method to control the vegetation on their land. Under the current Environment Stewardship Agreements (ESA) farmers and gamekeepers are allowed to use controlled burning only on very limited patches of land. Despite allowing a level of managed burning, however, these agreements can often prove complex, as adjacent patches of land often fall under different types of land management requirements, with burning succeeding no-burning regimes and so on. It is often argued by Land managers that the current ESAs are relatively more flexible land management schemes allowing Land managers some room for decision on what methods to use. Yet while they acknowledge that things have improved in this regard, they still feel that their hands are somewhat tied, as one land manager explained:

’Sof the ESA has defined moorland management for the last nearly 25 years. Part way through that process we then had the rise of sort of N.E. and its predecessor in terms of trying to influence how the SSSI lands were managed. And we kind of then moved from the kind of broad approach of the ESA into almost micro-management were you have to create this mosaic of vegetation on the moorland and you can burn here but you can’t burn there etc... but don’t get me started on that!’ (Land manager 1, 2010)

This ambiguity over the effects of burning has created an interesting dynamic in the Dark Peak, in which stakeholders have been accused of using facts out of context,
or heavily editing them in order to steer decisions into specific desired pathways. In this case the key decisions involve what constitutes ‘appropriate’ and ‘inappropriate’ heather burning as has also been revealed in RELU’s study (Prell et al, 2009), and how detrimental its impact is on different peatland areas in the Dark Peak. According to one member of the Academic Institutions and Consultants:

‘The results...provided to that stakeholder didn’t show what they wanted or expected to see so they edited [them] to fit around their context’ (Scientist 5, 2010).

Despite the existence of the Heather Burning Code, which is a voluntary code providing good practice guidance to Land managers on how and where to burn (DEFRA, 2007), the existing scientific uncertainty over the effects of burning on the peatland ecosystem and its carbon budgets acts as a tool to stir stakeholders’ environmental political agendas.

Members of the Environmental Guardians and of the Utility Companies, form a tight alliance based on their ‘no burning’ mentality (Reed et al, 2013), and have a high interest in deeming burning ‘inappropriate’ to protect wildlife habitat conservation and reduce water colouration in upland streams. This aggravates the already tense relationships both stakeholder groups share with the Land managing group, who use burning as a land management strategy in the face of decreasing labour availability and climate change (Reed et al, 2013). Land managers complain about this ‘war’ that has broken out on managed burning and sees them at the end of much animosity, saying:

‘I agree that in the past we might have caused damage to the land by burning...but now we burn with ‘cool’ practice, which is burning when the ground and vegetation are still damp. I think they [policy-makers, scientist, and conservationists] should stop the thought of ‘no burning’ and start thinking about ‘the best of burning’ (Land manager 5, 2010).

The existing mentality of ‘burning is bad’ in combination with scientific dissensus over the effects of heather burning on the peatland and its carbon budgets are the main two reason why Land-managers are unsure and unwilling to commit to a
carbon agenda for improving existing and new rural management strategies such as carbon sequestration and storage management. This is in marked contrast to stakeholders whose work is more directly intertwined with ecosystem services, such as some of the more influential Environmental Guardians (National Trust, RSPB, MFFP) and the Government Agencies and Environmental Regulators, who argue that a potentially successful strategy to mitigate the level of uncertainty would be to prioritise the different ecosystem services within current or new land-management schemes. This would enable all relevant stakeholders to target their activities according to ecosystem service priority, delivering site specific knowledge and providing small scale answers (Bonn et al, 2009; Burton et al, 2009; Reed et al, 2010). The supporters of this approach maintain that prioritising ecosystem services would enable them to ‘raise more funding over the most pressing ecosystem services through Payments for Ecosystem Services (PES) schemes’ (IUCN interviewee, 2010) which would consequently enable more intensive research leading to enhanced knowledge production. Therefore this scheme could contribute to mitigating uncertainty by providing the required funds to further scientific enquiry as well as financial rewards for the local community involved, i.e. Land-owners and Land-managers for aiding the peatlands become more sustainable and resilient to climate change.

Utility Companies and the Environment Agency, both primarily committed to maintaining water quality and flood alleviation in the Dark Peak uplands, rely heavily on scientific research arguing that:

‘...when you try to influence and persuade other private landowners to change [their heather burning practice] you need to support this with very robust scientific evidence’ (Utility Company 2, 2010).

The Environment Agency, for example is not in favour of heather burning but acknowledges that due to the sensitivity of the issue it requires:

‘...more persuasion and more evidence in convincing farmers and gamekeepers to change their practices’ (Environment Agency interviewee, 2010).
The Environment Agency, however, is more concerned with the application of the WFD and flooding prevention in the Dark Peak. Yet with regards to land management practices, such as heather burning, that can have a potentially negative effect on their objectives they rely heavily on scientific data to support their claims. They believe that activities on a local scale can have a greater impact on the national scale. However the science is not yet sufficiently substantial to definitely support this:

‘...but we need the evidence to do that because if people are flooding in Derby at the moment we couldn’t justify saying we’re not going to build any flood defences in Derby we’re going to put millions of pounds into Maldon restoration of the Peak District we think it would help but we can’t prove it’ (Environment Agency interviewee, 2010).

On the other hand, the majority of Land-managers (four out of seven) seem sceptical given the uncertainty that underpins scientific knowledge over burning and its effects on the carbon budgets with one stating:

‘...carbon has still quite a shaky science behind it that just doesn’t convince us landmanagers yet, you know what I’m saying?’ (Land manager 1, 2010).

In particular the contrasting scientific results regarding the effects of managed burning for example make them too feel uncertain arguing that:

‘...we are rather concerned and sceptical over any new ‘managing for sustainability schemes’, I mean what’s in it for us? How will that help us and our businesses? ...Science still can’t answer that can it?’ (Land manager 2, 2010).

They are reluctant to submit themselves to more stringent environmental and farming restrictions and tighter regulations on how they manage the moorland which might make their business even more challenging to maintain.

However, over half of the Land-managers interviewed (four out of seven), both farmers and game-keepers agreed that they would be interested in managing for
carbon as an Ecosystem Service despite the scientific uncertainty underpinning it once they see some more sound science:

‘Well I’ll be honest with you... One report says this and another says that. If there is no agreement within the scientific community on what is best how can we commit to anything?’ (Land manager 1, 2010).

Agreement or at least some more in-depth clarification within the scientific community on carbon related issues is therefore crucial in mitigating uncertainty among the land managing community. For example, is vegetation burning really detrimental for all types of peatland moorland? Or can it be useful for others? How much would be harmful and how much would be regarded as beneficial for renewing the vegetation and reducing the fire fuel load? The nature of this ‘agreement’, is further explored in chapter 7 where consensus is briefly contrasted with compromise to argue why compromise can be a more beneficial and useful objective in managing the Dark Peak’s carbon agenda. Yet the difficulty of managing under conditions of uncertainty might not be related only to lack of consensus in itself, but rather be contingent on the access and understanding of the scientific information provided. One fact that is uncontested, however, and on which all stakeholders agree is the positive effects of peatland moorland revegetation, with stakeholders arguing for it:

‘...this can only be a good thing, but managing for carbon... [i am] not sure until I see the figures on paper’ (Land manager 2, 2010).

‘...there are effectively two phases really, one is to restore the bare peat areas and to revegetate them and the second phase, so that’s all about reducing your carbon exploitation.... we’ve almost completed the task of revegetating so...now we’re getting to the phase where we’re experimenting with techniques to make the sites wetter and reach carbon neutral state in 10 years or so’ (RSPB)

The issue of uncertainty revolves around the quality and communication of scientific data. The stakeholders expect to see collaboration and communication underpinning the processes of carbon storage and sequestration. The members of
Academic Institutions and Consultant conversely attribute uncertainty primarily to insufficient funding both at a national and European level. As stated by a member of the scientific community:

‘The project I was participating required 5 years of data. The difficulty however was that the funding finished almost every year and we had to apply every year... quite a lot of funding came because policy organisations wanted scientific data to back up their policy’ (Scientist 2, 2010)

Whereas another academic argued that:

‘...the research produced depends on the contractor and the budget they are willing to allocate to fund the research’ (Scientist 3, 2010)

This suggests that scientific inquiry is also driven by the availability or not of funding schemes. With funding becoming increasingly competitive and difficult to secure its continuity Academic Institutions and Consultants are forced to work around what is available or tailor funding bids around notions that are desirable by the international environmental policy agendas such as resilience, sustainability, biodiversity, carbon emissions mitigation as is the case in the Dark Peak.

Moreover, members of the Academic Institutions and Consultants have revealed that stakeholders such as members of the Utility Companies and the Environmental Guardians are pushing their own political agendas

‘...by heavily editing scientific results regarding the effect of specific land-management practices they have tried to influence local land-management and policy-making’ (Scientist 5, 2010).

Despite the existing scientific uncertainty they seem committed to continue delivering good water quality and flood management ‘by working in partnership with other people in this case the National Trust, Natural England and the PDNPA’. Uncertainty, however, emerges as the key reason that most members of this stakeholder community are reluctant to make any bold commitments on managing specifically for carbon.
This produces incompatible conclusions, adding to the uncertainty that underpins scientific knowledge instead of mitigating it. This process, however, seems to be the reverse of the traditional linear model, whereby the statutory bodies/policy makers, are driving the production of science to support different agendas. The disparate benefits and interests in the way the Dark Peak is managed also account for the contested results and contradicting reports produced by the scientific community.

A final issue that augments the uncertainty of the socio-ecological system of the Dark Peak is the current property rights and ownership regime, or as one stakeholder of the Government Agencies and Environmental Regulators group argued:

‘...the difficulties of determining who has control of the land use and management of individual areas of peatland, and the extent of this control’. (Gov.Ag. and Env. Reg. 2, 2010)

As a result, there are multiple stakeholders who want to be involved in how the socio-ecological system is managed. However, according to another policy-maker:

‘...private property regimes still dominate in peatlands, particularly in uplands, and as such, few stakeholders beyond land owners are able to influence management decisions’ (Gov. Ag. and Env. Reg. 4, 2010).

However, the requirement of management strategies to be created in partnership with Natural England permits the government to fundamentally exercise land-management rights over the peatland moorland. This can cause disagreements and friction between Land managers and the Government Agencies and Environmental Regulators as has also been observed by the Sustainable Uplands team in RELU (Quinn et al, 2010). According to one land manager, the attitude of the government agencies towards farmers is very top-down driven:

‘This is what we decided and this is what you will do. They don’t really come to us to say ‘we want to deliver this, how together can we deliver this?’ Now I semi-understand that government policy doesn’t work like that, does it?’ (Land manager 1, 2010).
With regards to managing for carbon, the primary question is ‘who owns it?’ According to the PDNP interviewee (2010), if carbon is treated as a mineral, then the ownership rights would have to be with the freeholder, who owns the minerals of the land. If it is treated as part of the vegetation then it would be owned by the grazer who has those rights. Furthermore, it could also be for the shooting tenant who owns the shooting rights and can manage the land in any way they see fit to maximize those shooting rights. Finally, if carbon was found in water company land then it would be owned by the water company who has the rights to the water resources that pass over the land which stores carbon. In the current property rights regime, however, some landowners still have difficulty over directly influencing the management practice of their tenants. Utility companies for example with Land managers in long-term agreements find themselves ‘unable to directly control how the land is managed’. So they try with scientific data but where there is uncertainty and no compromise can be reached they become more assertive and seek the enforcement route (Utility Company 2, 2010).

This type of uncertainty results in many landowners and land-managers remaining not only unrewarded for positive environmental impacts but also unaccountable for any negative impacts they create while managing for Ecosystem Services. As argued by two different stakeholders, a member of the Academic Institutions and Consultants and a member of the Environmental Guardians, in many ways the uplands can be seen as a repository of largely unpriced public goods of major national importance. In their view the issue of uncertainty could be overcome by prioritising ecosystem services according to their value and attaching their provision to a PES scheme.

The Land manager’s mistrust in scientific results along with feeling their lay knowledge being discounted over scientific knowledge, as will be discussed in detail in section 6.3), leads to the reproduction of the land-management practices that are deemed controversial and detrimental to the peatland environment. So far, the route to convince farmers to change their practices has been conducted in a very top-down manner which has also been acknowledged by previous studies in the area such as RELU (Prell, 2009). Landmanagers expressed their concerns that
‘policy-makers and scientists act in a unified front directing suggestions and then demands when those suggestions are not taken seriously by [land-managers]’ (Landmanager 5, 2010).

The objective was to change the behaviour of the land-managers, yet without being able to provide any strong incentives. The interview data suggests there seems to be a common observation from Land-managers that the behaviour of their landlords, and in particular of the National Trust (NT), a large conservation stakeholder and member of the Environmental Guardians:

‘...has in fact become more aggressive in their behaviour when trying to push for changes in their land-management practices’ (Landmanager 3, 2010).

Working very closely in recent years with the Government Agencies and Environmental Regulators, they are considered to have become more corporate as has been revealed by one of the NT’s audit officers themselves who happened to share the same views as his farmer friend arguing that

‘...the Trust has become less and less caring towards its tenants... and at times has even threatened to evict farmers or reduce their rents if they do not comply with management regimes, whereas 10 years or so ago there were strong ties build on mutual trust and understanding between tenant and landlord’ (NT interviewee, 2010).

This is causing considerable frustration among this NT’s tenants with some claiming that they are already buying land in the North of the country such as the Yorkshire Moors and once their contracts expire they will move there to carry on farming (Landmanager interviewee 5, 2012). Others who do not wish to leave their farms argue that they are being treated unfairly and suggest that a more respectful attitude towards them from their landlord, the NT, would result in less conflict and better land management

‘...treat us like human beings and [we] will probably come quietly back to you’ (Land manager 3, 2010).
These claims have also been supported by a member of the main landowners, a Utility Company and also major landowner in the Dark Peak, who claims that when there seems to be no consensus on land management objectives the NT threaten ‘to go down the enforcement route’ (Utility Company 2, 2010).

Uncertainty can be a coin with two sides, either acting as a driver for change or as a driver for stifling activity. It will always be the case that more funding will be necessary to mitigate scientific uncertainty. Equally, government agencies will always argue that they require more robust evidence and will blame science for ineffective policies. Yet the interviews point towards the direction of ineffective communication and the necessity to enhance trust and understanding among the disparate stakeholder groups. This communication needs to be enhanced and supported by the existing institutional arrangements through active learning-by-doing, allowing this to develop into the co-production of knowledge in order to escape from its top-down configuration.

6.2 The ‘carbon push’

The analysis reveals that financial resources for carbon management are the next most important issue influencing the progress of scientific research. It has been roughly estimated that...

‘...around £3–£4 million are required in order for scientists to provide policy-makers with ‘the answer’ to the carbon questions’ (Academic 2, 2010).

Yet according to another, Government Agencies and Environmental Regulators ‘...seem reluctant to invest anything more than one third of that amount and therefore the scientific information they receive reflects their ‘willingness-to-pay’ (Academic 5, 2010).

Government Agencies and Environmental Regulators are increasingly becoming interested in carbon science, yet the uncertainty around its science and its benefit for them finds them slow to commit to releasing more funds in this regard. DEFRA, for example, has started exploring ways to incorporate PES into existing and new
Agri-Environment Schemes (AES) through projects such as SP1202 and SP1205 which provide evidence on the positive effects of peatland restoration in reducing GHG emissions (Evans et al, 2013). Their concern is whether the price paid for the carbon is enough to pay for restoration, and if not how is the remaining money generated as one cannot sell the same carbon twice.

Furthermore, due to the existing uncertainty around ground carbon science it is challenging to find financial resources for carbon management alone. However, there seems to be great interest from government bodies and the market to enhance carbon budget research and knowledge as it is believed to have great potential for allowing the UK to participate in competitive carbon trading and offsetting schemes. Since the presence of carbon, namely POC, DOC, and CH₄, has been scientifically linked with compromising the quality of other Ecosystem Services such as water quality and conservation of biodiversity it is becoming a trend to focus on more than one ecosystem services:

‘...the funding schemes recently move around multi-benefits and public goods’ (Environmental Guardian 3, 2010).

Consequently, it is becoming increasingly popular to attract funding for carbon management through water and biodiversity schemes, as has been argued by stakeholders of both the Environmental Guardians, and the Government Agencies and Environmental Regulators groups. For example, there seems to be consensus among most stakeholders regarding the ‘water story’, which has been on the top of environmental policy agendas and has caused a clear shift in financial support and incentives:

‘...restoring the quality of the Dark Peak’s water resources has a direct effect on carbon stored and sequestered by the [peatland moorlands], as carbon appears to be more closely linked with water quality’ (EA interviewee, 2010).

Therefore, managing for a good water quality also aids in managing for carbon.

Land-owners and Land-managers on the other hand seemed sceptical at first about managing directly for carbon storage and sequestration, even if these were to be
attached to a PES or other financial reward scheme. For example, Land managers and Gamekeepers, who are also members of the Moorland Association (MA), are primarily concerned with sustainable grouse moor management whilst also delivering biodiversity and wildlife conservation in the moorlands. Their funding is consistent as it is generated by the heavily subsidized grouse shooting industry. The biggest part of the grouse shooting industry, whose members are also part of the Moorland Association, is sustained by the wealthiest families of the country who are willing to pay Land managers and Gamekeepers up to £300,000 per year to go shooting in the Dark Peak. Therefore, this suggests that those who manage for grouse appreciate the peatland moorlands for more than their value in carbon as

‘...managing for grouse is also good for wildlife conservation and biodiversity’ (Land manager 2, 2010).

Seeing that grouse moor management contributes to maintaining cultural activities part of the Land managers’ identity they are unsure whether managing directly for a carbon agenda would benefit them as much. Another concern raised about receiving subsidy payments based on a carbon policy is their value of the moorland which for landmanagers’ seems to have a sentimental value apart from a business one, with one farmer stating that

‘...the [peatland moorland] is about more than [carbon]. Isn’t it?’ (Land manager 1, 2010).

On the other hand, the gamekeepers observed that ‘carbon pushes’ the current funding regimes and acknowledged how this plays into the local environmental politics when Dark Peak stakeholders apply and bid for grants. In the words of one land manager

‘Anybody bidding for money has to push the right political buttons, and carbon is the big button’ (Land manager 2/Game-keeper, 2010).

The majority expressed interest in receiving financial rewards for carbon management as they recognise that their farms are a business and it’s vital to look after their business’s longevity and sustainability. This might at first seem to
reinforce beliefs that Land managers can be convinced to cooperate into new Agri-
Environment Schemes if a financial incentive is made available (Burgess et al, 2000; 
Morris, 2004), thus strengthening some stakeholders’ views, such as Utility 
Companies, Government Agencies and Environmental Regulators, and some 
Environmental Guardians, that landowners are only driven by money as has been 
also observed by Tsouvalis et al (2000). Yet what this may also suggest is a ‘carrot 
stick vs donkey’ attitude which may be partially motivating but does not guarantee 
long-term commitment and success to land and Ecosystem Services management.

When the potential of a carbon payment scheme, through Payments for Ecosystem Services, was mentioned a common response by Landmanagers was that 
Government Agencies and Environmental Regulators would have to involve the members of the Land-owners and Land-managers group, and especially the farmers and gamekeepers:

‘...by floating ideas with me and other land-managers and land-owners as to how you would construct such a payment model based on carbon’ management’ (Land manager 1, 2010).

Their key concern is not to upset the balance among their stakeholder group as well as wanting to feel more involved in the future decisions taken regarding the land they manage. The National Trust, a major land-owner in the Dark Peak, and member of the Environmental Guardians, however, in 2010 quite vociferously called for the government to direct more funding and payments to the restoration of peatland landscapes because of carbon. Ever since farmers and gamekeepers managing NT land fear that

‘...if carbon becomes the priority in the Dark Peak this might lead to more fencing regimes on each other’s land. The profit incentive could turn Land managers against each other therefore resulting in disrupting the current community conduct, severing their communication ties and relationships, land mismanagement’ (Landmanager 5, 2012)
Suggesting that further land degradation, and carbon emissions might take place (Evans et al, 2010). Decisions on management strategies that extend beyond their official land remit, such as the commencing or ceasing of managed burning, usually take place either in the pub (Woods, 2011, p.207-208) or for the younger generations over the phone or social media. In the words of one Land manager

‘... it would be very difficult to start giving one owner so much because he happens to have a lot of [carbon], whereas someone who has moorland dominated by grassland with more dry heath... might say ‘to hell with that, it’s not worth it, I’ll put sheep on.’' (Land manager 1, 2010).

The Academic Institutions and Consultants, on one hand, agree about the current and future funding packages and seem to be politically driven by the importance and priority of carbon in environmental agendas. As argued by one of its members

‘...funding of managing the moorland is increasingly coming on the back of carbon management and you know maybe being able to show there’s a link between wildlife and carbon is quite important’ (Academic 3, 2010).

Another Academic stakeholder who didn’t support Cost Benefit Analysis (CBA) methods at first seemed more flexible arguing that

‘...I would be open to the idea if that would raise enough funds to restore the peatlands and their carbon budgets’ (Academic 4, 2010).

One Environmental Guardian argued that

‘...CBA would differentiate the payments that researchers and land-managers receive according to the most important ecosystem services’ (Environmental Guardian 4, 2010).

Moreover, the majority of Academic Institutions and Consultants seem to favour the potential of carbon offsetting schemes based on managing for peatland moorland restoration. It is argued that this can potentially deliver tradable carbon credits and in return continue funding further peatland research in an iterative manner (Reed et al, 2013). Additionally, as stated by another member of the
Academic Institutions and Consultants, for this to be achieved within the current coalition government

‘...changes in policy are necessary to enable the trading part’ (Academic 2, 2010).

With regards to rewarding the delivery of ecosystem services such as carbon emissions reduction, another member of the Academic Institutions and Consultants seemed less convinced and more critical over any potential PES scheme for carbon and in particular the recently piloted UK Peatland Carbon Code in 2013. Arguing that it is ‘a very dodgy basis’ they agreed that it would do some good yet not at the scale and magnitude that has been envisaged by a lot of their colleagues.

‘...the issue with this Code would be that it promises payments and investment for land management activities involving bare soil revegetation which won’t be particularly helpful for a large number of projects in the Dark Peak’ (Academic 5, 2010).

As has been aforementioned it is challenging to put a price on carbon storage and sequestration in order to construct specific payments. Therefore policy-makers such as the Environment Agency argue that

‘...it seems that viable and direct financial rewards for carbon management might be very difficult to achieve independent of other services delivered by the moorland such as conservation of biodiversity and clean water provision’.

Furthermore, if a Peatland Carbon Code becomes official it would beg the critique of what effects this would have on the landscape and the social ties between stakeholders if the Dark Peak landscape becomes open to the market. For market supporters, the purpose in developing carbon credits through peatland carbon management would be to trade them like any other good in voluntary carbon trading systems. This is claimed to raise further investments which would then be directed to fund further peatland restoration projects. Yet to privatise a common pool ecosystem resource like carbon (POC, DOC, CH₄) it must firstly be enclosed into privately owned pieces of land (PDNP interviewee, 2010). In the example of the Dark Peak that would mean more fences raised across the shared-grazing
landscape. In order for this to take place, however, one would have to establish who is entitled to own this carbon. Would it be the government, the scientific institutions, the environmental guardians, or the landowners who would make this decision? The Dark Peak’s current complex landownership regimes renders this an extremely challenging task. If such an option were to be considered it would have to employ participatory decision-making processes in order to avoid social conflicts of the kind that arose in 18th and 19th Century Britain under the Enclosures Act. The Sustainable Uplands team has employed such participatory processes in their work for RELU where they engaged stakeholders with different interests in natural resource management in an attempt to identify the most pressing issues and through adaptive management approaches facilitate policy and land management.

The biggest challenge with a peatland carbon code and its attachment to a carbon trading system, however, is the surplus of credits in the system. This was the reason the price of CO₂ dropped to such low levels in 2012, when the failure of the price to recover resulted in the collapse of the Global Carbon Trading System. While markets may catalyse wealth creation, they also create inequalities. In the current example of the carbon trading system, as with most experiments in creating new markets (Evans, 2012), the market has an inherently delicate and volatile structure that requires strict regulations to survive (Wilson, 2014). In the case of the Dark Peak, however, it seems that if such an option were to be implemented it would require governance structures that would be adaptive enough to support the change brought about in the local stakeholder community. The Sustainable Uplands research team was the one that lay the foundations for such adaptive approaches with their initial workshops and consultations with stakeholders on managing natural resources in the PDNP; this lead to the creation of a pilot carbon code which is discussed in further detail in chapter 7.

McNeely and Scherr (2003) observed that increasing flows of subsidies returned from conservation projects have managed to transform local communities’ approaches about biodiversity and Ecosystem Services management and also made them more appreciative and better engaged in their conservation. Additionally, Pretty and Smith (2004) conclude that some protected areas have seen success
stories with regards to managing for Ecosystem Services due to local communities receiving wild-resources-related returns. They have then in turn become more involved in the long-term management of Ecosystem Services through increased collective incentives. The key stakeholders should consider linking on-the-ground carbon management efforts of local Land-managers with more conservation benefits. This would allow local Land-managing communities to receive payments which originate from their conservation efforts to ensure their long-term commitment to active participation in this process (Ho et al, 2012).

However, financial rewards can be a driving force for direct –if regular- participation by local Land-managers in the governance of the Dark Peak socio-ecological system. This thesis would argue that, in the long run, enhancing relationship and communication ties among the actors of the socio-ecological network through a mutual ‘learning-by-doing’ approach to management is the key for more environmentally aware and responsible behaviour. According to adaptive management theory, learning-by-doing implies agency which translates into actively engaging all stakeholders in collaborative processes where one learn from the other building therefore new shared knowledge (Fazey et al, 2006a and b). Such activities create trust among actors and can lead to improved land management through improved policies as will be explored in the following section 6.3. Regulations and payments for Ecosystem Services may aid changing stakeholders’ attitudes towards more carbon friendly practices yet may not change their personal behaviour (Gardner and Stern 1996, cited by Pretty, 2003). Thus, stakeholders may return to their old modes of practice when financial rewards cease or regulations lose their force. A long-term governance strategy should be adaptive to change and therefore rely on a combination of financial rewards, regulations, and iterative social learning in the form of knowledge co-production, as discussed in the following chapter.
6.3 The conflict of knowledges

‘The point is not to sweep aside one knowledge form and to replace it with another. Instead, we need to recognize the contextual and partial nature of all ... forms of understanding.’

Irwin (1995, page 173)

A further significant element to have emerged from this research concerns the conflict between different types of knowledges - between the experts or explicit knowledge holders (Polanyi, 1997) and the conservation and policy communities who make use of that expert knowledge on one hand, and the lay, or implicit knowledge holders on the other (Olsson et al, 2004). A common problem within natural resource management is that these non-expert, or ‘non-scientific’ knowledges ‘have for centuries been denied a legitimate status...referred to as folk theories, myths or superstitions and have been interpreted as subjective, unreliable and as place and time specific’ (Tsouvalis et al, 2000, p. 911; as adapted by Morris, 2006). In particular, it has been found that the non-expert knowledges held by Land-managers, both farmers and gamekeepers, have often overlooked or undervalued in the course of agricultural modernisation (Harrison et al, 1998; Morgan and Murdoch, 2000; VanderHorst and Vermeylen, 2011; Evans, 2012).

Since the fate of carbon budgets has been related to human land-management practices its future is strongly dependent on rural land managers’ decisions and actions (Bonn et al, 2009). In the Dark Peak, as in the whole of the Peak District National Park, livestock farming has been responsible for preserving the mosaic of biodiversity and cultural heritage (NE interviewee, 2010), which constitutes the unique British rural landscape. However, over the last four decades an intense debate has developed over how the moorlands should be managed for the conservation of biodiversity (Dougill et al, 2006; Evans and Warburton, 2007; Moors for the Future, 2007; Bonn et al, 2009; Evans et al, 2013). This debate has been driven in large part by the successful lobbying actions of conservation groups such
as some members of the Environmental Guardians, including the RSPB and the Ramblers, who contributed in the 1980’s to the creation of the voluntary Agri-Environment Schemes (AES) (Whitby, 1994; Potter, 1998). This won the support of land managers as the incentive payments offered by the AES meant that agricultural policy privileges remained intact despite managing for environmental conservation.

Government Agencies and Environmental Regulators have tended to conceive of Land managers, both farmers and gamekeepers, as the root of all problems that needs to be dealt with conceiving them as ‘the agricultural intensifiers’ (Morris, 2006) and some Government Agencies and Environmental Regulators such as Natural England argue that landmanagers:

‘...have caused considerable damage to the upland moorland environment’ (NE interviewee, 2010).

Yet on the other hand, Government Agencies and Environmental Regulators such as the Peak District National Park Authorities present the Land managers as the solution to peatland degradation:

‘Land managers own or manage the moorland and have avenues to other crucial resources, such as equipment, manual labour, technical skills for livestock and moorland vegetation stewardship’ (PDNPA interviewee, 2010).

Yet, at the same time Land managers are being perceived of having insufficient knowledge to moorland management, as has also been observed in other studies (Johnston and Soulsby, 2006; Morris, 2006; Tsouvalis, 2000). This seems to be a common shared belief among Academic Institutions and Consultants and the Environmental Guardians as well, despite not being directly expressed. This knowledge is transferred to Land managers in a top-down fashion for example through AES documents, technical information on moorland and peatland management practices such as the voluntary Heather Burning Code (DEFRA, 2007), newsletters, and agri-environment scheme Project Officers.
Furthermore, other studies (Morris, 2006; Tsouvalis et al, 2000) have also observed that land managers are considered to be persuadable only if a financial incentive is provided for them to agree with and implement a new knowledge. This is also reflected by one of the Environmental Guardians in the Dark Peak:

‘...you know it’s negotiation and it’s delivered through a combination of United Utilities capital money and government Agri-Environment money, so quite frankly most farmers don’t care about why they’re being paid as long as they’re being paid’

(RSPB interviewee, 2010).

However, if this fails then less diplomatic routes are followed with land owners threatening to increase the rents of land managers (Land manager 4, 2010) or to use the enforcement route as has been argued by a member of Yorkshire Water and the National Trust, adding fuel to the already tense relationship ties between them. The AES documents build upon notions of ecosystem science, biology and ecology of landscapes, hydrology, geomorphology, conservation biology (Vanderhorst and Vermeylen, 2011). It is apparent that a scientific understanding underpins the AES and the designation of a site as of special scientific interest (SSSI’s) and therefore in need for an AES. The Dark Peak has 31,852 hectares under their designation (PDNPA, 2013). Namely, the centrality of the science-policy nexus in environmental understanding is quite evident in the case of the AES in an attempt to ‘speak truth to power’ (Price, 1965; Jasanoff and Wynne, 1998; Chilvers and Evans, 2009).

From the Land managers’ perspective it is

‘...the [Government Agencies and Environmental Regulators’, who are unable to understand how [peatland moorlands] are managed, primarily due to their physical separation from the land...and on relying only on books and papers to learn what happens on the land’ (Landmanager 3, 2010).

This demonstrates how the boundaries between these two disparate knowledges are perpetuated and also expresses the significance that Land managers place on lay, tacit knowledge (Tsouvalis et al, 2000). For example, with regards to the
contentious heather burning issue, despite the existence of the Heather Burning Code and the AES allowing some prescribed burning, land managers feel that the institutions responsible for creating these policies are not being sensitive or thoughtful enough to their needs. One land manager complained about the nature of his AES plans being complicated and challenging to implement and deemed them ‘impractical’ explaining that ‘the reason it is impractical is that it’s been put together by people who have never done any burning’ (Land manager 5, 2010).

The same farmer went on to mirror other Land managers’ concerns that this attitude of being detached and unaware of the actual problems on the ground often adopted by policy-makers is also part of the problem of why moorlands have not been managed in the most sustainable way. The policies reflect the demands of society at a given time which are passed down to land managers to implement and deliver the required objectives, whether it is to add livestock numbers one year and reduce them a few years later, or to plant more crops, or to drain the peatland yet decide to revegetate it a decade later due to carbon emissions and so on. The same farmer called for better communication and knowledge exchange among policy-makers, scientists, and the moorland managers:

‘Here’s the lighter and the matches, and you go and burn the heather exactly as you want me to. And I will respect you if you show me how you want me to do it. But they don’t know... they are terrified. If [they] show me a better way to do it, then I will take my hat off and agree to do it [their] way’ (Land manager 5, 2010).

This is also a point shared among some Academic Institutions and Consultants in particular regarding Land managers’ activity and its effect on the peatland’s carbon budgets (Bain et al, 2011; Brown et al, 2014). They regard them as a threat because land management practices on the moorlands, such as draining, overgrazing, intensive burning have contributed in the degradation of peatland moorlands. With regards to carbon, the fear is currently not to decrease the size of the carbon sink or even transform the peat ecosystem into a carbon net source as has been argued by three members of the Academic Institutions and Consultants, two scientist and one consultant. However, from a land manager’s perspective there still needs to be
more integration of knowledges, in which farmers for example can confront scientific knowledge with their own accumulated experiential knowledge. Firstly, land managers are unsure what more an Environmental Stewardship Agreement could accomplish in terms of increasing the carbon stores in the Dark Peak, as they already find the current regime to be stringent and to limit their practices in order to deliver its desired conservation and climate mitigation objectives. Secondly, land managers while appreciating scientific knowledge feel that the current paths used for knowledge exchange do not acknowledge their own valuable knowledge enough to make them feel involved and appreciated:

‘I went to these conferences for a while and [the University of Manchester scientist] put up a graph of gullies and it was exactly what I was saying practically. But we [land managers] communicate our knowledge of successful management by word of mouth in the pub and not in fancy rooms’ (Land manager 2, 2010).

This reveals how land managers negotiate information they acquire in complex ways and also how informal social settings play a significant part in their knowledge exchange and learning activities. As has been argued by Woods (2011), informal settlements such as ‘the pub’ are spaces preferred by farmers to interact and negotiate their tacit knowledge. Another Land manager (interviewee 5), mirroring the voices of his peers, argued for the need of more knowledge brokering by individuals or institutions who understand both aspects of practical and scientific knowledge and for their mediation in integrating these:

‘One method I thought of is that if you had discs or something you could throw into the ground and depending on the temperature they could change colour. If they change colour then you don’t burn [the heather]’ (Land manager 5, 2010)

Avenues for this kind of knowledge brokering do in fact exist, (as will be discussed in chapter 7). These include informal contacts between farmers and scientists, as well as more structured environments such as the Moors for the Future Partnership (MFFP) conferences and workshop or the Knowledge for Wildfire (KfWf) project by the University of Manchester. Yet there still is much room for improvement in engaging Land managers in discussions and knowledge exchange.
Government Agencies and Environmental Regulators, also argue that land management can embody a prospect for improving the peatland and moorland condition and enhancing their resilience as the management practice can be more easily changed than external natural drivers such as increase in air temperature (Morris, 2006). They therefore argue that land management can also represent an opportunity to enhance carbon uptake in this unique terrestrial carbon store (Scientist 5, 2010). This opportunity however comes through ‘voluntary’ environmental stewardship schemes, such as the High Level Stewardship Scheme (HLS), that require limiting livestock numbers on the upland moorland hills in favour of less intensive practices that risk harming other ecosystem services such as carbon storage and sequestration.

In addition, some Environmental Guardians appear to be more polemic than others towards land managers practices and knowledge over ‘good’ moorland management. Stakeholders, such as the National Trust and the RSPB for example, due to their strong conservation objectives tend to overlook Land managers’ views. In particular, the National Trust appears to have its power and influence attributed to its role as the major landowner and conservation group in the Dark Peak. Its stronger ties are shared between Natural England, Environment Agency, and PDNPA, which suggests the sharing of very similar views and actions regarding the importance and effect of carbon budgets in the moorland. The National Trust has a strong conservation of flora and fauna angle, and according to the interview data they hold a ‘burning is bad’ mentality despite allowing the Land managers to continue with the practice.

Two thirds of National Trust’s tenants (five out of seven Land managers interviewed) have expressed their deep disappointment in the charity’s corporatised behaviour towards them. This issue frequently emerged in the interviews with land managers, both farmers and gamekeepers, voicing their disappointment with their tenant, the National Trust, as they were frequently treated as ‘rent cheques’ or ‘non-human’ rather than genuine partners in delivering jointly the charity’s conservation objectives:
'...it's often a case of 'This is what we’ve decided and this is what we would like you to do'. They don’t really come to us to say ‘We want to deliver this, how can we deliver it together?’. Now I semi-understand that ‘cause government and landowners generally don’t work like that, do they?’ (Land manager 1, 2010)

Furthermore, Land managers that are tenants of the National Trust are allowed to use controlled heather burning in accordance to each ones’ environmental stewardship agreement with Natural England. However, their objection as has been argued earlier is with the nature of their current AES and also with the manner that their tacit knowledge around their management practices is being discounted in decision-making and policy. In particular, despite the fact that the NT allows them to burn their land this can only be conducted within tight geographical spaces that neighbour areas where burning is prohibited due to biodiversity conservation regulations. Burning therefore becomes challenging for them despite their experience due to fire’s difficulty to command upon will. This sometimes results in fire crossing over to areas that according to NT’s maps and plans should be avoided, and therefore land managers receive fines and penalties. Whilst land managers appreciate the flexibility they are offered to burn the heather they disagree with the NT’s command-and-control approach.

‘National Trust never comes see us burning. They just send us the maps of where we are allowed and not allowed to burn and we are left to our own devises. They come and measure the land to see if we crossed the boundaries of where we are allowed or not allowed to burn and fine us for any mistakes’ (Land manager 5, 2010).

Other managers under the National Trust’s tenancy argued that if there were new avenues of communication and their landowner was more open in engaging with them, learning from their experience, and integrating their views on their management plans then the Dark Peak uplands would be become more sustainable with less effort and deliver more ecosystem services for both stakeholders.

However, it seems that this conflict of knowledges or the lack of respecting different knowledges has led land managers to accuse the NT of lacking the appropriate expertise to making sensible decisions on property management with
the older generations considering moving to other upland areas under other private
land owners to avoid these conditions.

‘A lot of the farmers in Glossop are fed up with the changing demands of the land-
management policies and the National Trust’s agenda, as well as the manner they
go about enforcing it, that we have been buying our own land elsewhere, in the
Yorkshire moors. [We] are considering moving up there when [our] contract with the
National Trust finishes in order to carry on doing what we know best, farming’ (Land
manager 5, 2010).

However, the conservation charity has acknowledged the concerns that land
managers have regarding less intensive cropping regimes, reductions in stocking
densities and the changing future of farming in the Dark Peak uplands. Yet they
argued that it is not impossible to combine the highest quality of food provision
alongside sustainable biodiversity conservation. Furthermore, their position was
firm on producing a larger and more joined up landscape in the whole of the PDNP,
and the UK’s national parks for that matter, in order to increase biodiversity by
promoting renewable energy such as wind and hydro energy or other ecosystem
services such as cleaner potable water, carbon storage in peatland soils which can
be traded as credits in voluntary carbon markets. This viewpoint was echoed 4
years later in a recent interview given in May 2014 by NT’s current general director
Dame Helen Ghosh, who stated that the charity’s purpose is not ‘to protect ways of
life’ (Ghosh, 2014). Additionally, the charity made it clear that social change in the
ways the uplands are governed and managed is unavoidable as part of their current
objectives and with regards to carbon they are currently exploring avenues for
creating carbon markets based on the country’s carbon stores. This suggests that
there is indeed a conflict in the communication among these two stakeholders, in
particular in the way their needs are being negotiated or not. It also reveals another
element, a culture of resistance on behalf of some land managers to changing their
traditions in the face of agricultural modernisation. Chapter 7 will discuss how in
contrast to farmers and gamekeepers resisting change there are others who have
successfully diversified their business and included the provision of educational and
tourist services in their rural livelihoods.
With regards to the RSPB, land managers have frequently accused them of focusing only on the negative effects brought about by moorland management. The RSPB has incurred the animosity of farmers, gamekeepers, landowners, and even rural communities among whom it operates (Linklater, 2012) due to its strong opposition to land management activity in the Dark Peak. The RSPB’s oppositions stems from Land managers’ choice to use controlled heather burning to maintain the vegetation at short lengths, below 1 meter (3,28 feet) (DEFRA, 2007), both for young grouse and sheep but also to assist Natural England’s landscape conservation plans to maintain the mosaic of cultural heritage (NE interviewee, 2010). The RSPB frequently condemns Land managers in the media, public interviews, and campaigns, blaming them for using ‘damaging agricultural practices’ (RSPB interviewee, 2010) that have led to a considerable drop in the population of rare local birds of prey such as the Goshawk and the Peregrins to name but a few.

On the other hand, Land managers argue that RSPB’s attitude against them in such a public manner is rather exaggerated:

‘We acknowledge that rare species such as the Goshawk are under threat but not in the level they [RSPB] are presenting it... Not all land managers are using damaging practices, not all land managers illegally kill them [rare birds of prey]...Some of us have been doing a really good job to manage for bird conservation alongside moorland restoration’” (Land manager 1, 2010).

The Land managers claim there are two sides of this story, and there is evidence produced by the British Trust for Ornithology (BTO) from the latest Breeding Birds Survey that suggests that species such as goshawks, eagles, peregrine falcons, and kites are stable in their populations despite previously declining in numbers (REF). Furthermore, they admit having a more mixed view about birds of prey, given that they are also predators that attack young pheasants and grouse and occasionally small farm animals, which are part of their source of income. Land managers observed that if there were more avenues for better engagement and mutual communication with the RSPB then less conflict would exist.
‘If they [RSPB] were more approachable and spent more time working with us and treating us as partners and not tell us what to do and not do all the time things would be different...’ (Land manager 5, 2010).

While the RSPB claims that it is committed to collaborating with Land managers for moorland biodiversity conservation and management its actions suggest otherwise. Another farmer, and gamekeeper, argues that the problem lies in the lack of communication between influential and powerful stakeholders such as the RSPB, the National Trust, and Natural England and their group. Yet, his interview reveals that the problem may not be the lack of communication per se rather the manner in which this knowledge is being communicated among disparate types of stakeholders -a belief held by the majority of land managers regarding other types of stakeholders -a belief held by the majority of land managers regarding other types of stakeholders and their attitude.

[They] have all gone and gotten degrees and all they’ve learned about moorland management, farm management and things like that has come out of a book!...you know I’ve been learning about my environment and how to look after it the last thirty years and I still don’t know everything about it... [They] think they know 10 times more things than we do, when we [are here] everyday managing it. So feels like we’ve been told how to do our job by people who have no idea how to do our job!’ (Land manager 3, 2010).

Landmanagers feel that the RSPB and the National Trust have both contributed to a culture of blame against them, in which the benefits and achievements that their moorland management brings to a whole range of other rare species and ecosystem services with moorland management such as lapwings, curlews, and snipes (Shelley-Jones, 2011) that are hunted by foxes and crows are rarely acknowledged either publicly or privately. They feel there is a focus only on their ‘failings’, and on cases of land managers gone wrong suggesting a clear bias from conservation groups against their practices in general. Similar conclusions can be also found in Morris (2006) who observed that farmers and gamekeepers hold pre-existing knowledge about the natural environment and the world that contrast to
scientists, policy-makers and conservationists (see also found in Burgess et al, 2000; Burton, 2003).

Furthermore, with regards to land managers’ concerns it has been revealed that the continuation of tacit farming knowledge is regarded as a significant condition in managing and farming upland areas. Yet with the current status quo the knowledge transfer from elder land managers, both farmers and gamekeepers, to the younger generations is frequently broken by migration and a progressive ageing of the land managing community. As is the case in the Dark Peak, other studies in the Dartmoor Fringe, in the South UK (DEFRA, 2004), and in Lincolnshire and Suffolk (Tsouvalis et al, 2000) highlighted that rural lay knowledge can be overlooked by policy and conservation interests, whilst scientific knowledge was heavily employed to inform decision-making and policy outcomes.

Additionally, as was also identified in all case studies above, diversification is increasingly becoming popular among agri-environment schemes. It is therefore a necessity for government and landowners to provide training among the land managing community with regards to business management and development, conservation management, controlled heather burning, IT, walling and so on. This could provide opportunities for local land managers to feel more included by providing this training to other less experienced peers who use the same non-codified non-scientific language, have tacit expertise and enhance their integration in the knowledge exchange process. As observed by Tsouvalis et al (2000,) a farmer from Durham would have preferred advice and knowledge training from a lay person with expertise on farming and local conditions.

6.4 Conclusion

This chapter has demonstrated the key themes that emerged from the analysis of interviews in the Dark Peak socio-ecological system. The problem with managing for carbon is rooted in other long-standing conflicts that impact the peatlands and moorlands such as social conflicts among different types of knowledges and interests of its key stakeholder groups; for example when a decision in one sector such as conservation affects another sector such as farming and vice versa. Table
6.1 below briefly summarises the key objectives that drive experts, policy-makers, and lay people’s knowledge. This table’s structure is adapted by Edelenbos et al (2011) and developed according to qualitative data from the Dark Peak.
<table>
<thead>
<tr>
<th>Drivers/</th>
<th>Expert</th>
<th>Policy</th>
<th>Lay/Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>For producing</td>
<td>Technical legitimacy</td>
<td>Managerial, administrative effectiveness</td>
<td>Authority among local group of peers</td>
</tr>
<tr>
<td>knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For justifying</td>
<td>Vocational recognition, anticipation of academic publications</td>
<td>On-par with principles and demands set by government</td>
<td>Match up to social group's status, know-how and wellbeing</td>
</tr>
<tr>
<td>knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For using</td>
<td>Scientific inquiry: methodical and technical interpretation</td>
<td>Regulation, policy creation and enforcement</td>
<td>Every day activities, agri-business, protect local livelihood stakes</td>
</tr>
<tr>
<td>knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For progress</td>
<td>Authenticate theory; contributing to the global pool of knowledge</td>
<td>Managerial-political aid for planning and policy</td>
<td>Advance personal livelihoods and business</td>
</tr>
</tbody>
</table>

Table 6.1 Key distinctions between expert, policy, and lay knowledges for the Dark Peak. Source: as adapted from Edelenbos et al 2011, p. 677.

How can we guarantee that peatlands and moorland of the Dark Peak are managed to protect the delivery of natural resources, or ecosystem services, such as carbon storage and sequestration? How can we reduce conflicts and animosity to combine the disparate moorland knowledges and management practices in peatlands and minimise some of the damaging effects linked with current management?

This chapter then concludes with three preliminary responses to these questions:

Uncertainty over the effect of land management practices and climate change on the moorland will never cease to exist. The carbon agenda adds to the complexity and difficulty in governing the Dark Peak. To mitigate this, stakeholders will need a more adaptive approach to land management and policy-making which acknowledges uncertainty and works with it through learning-by-doing.

Financial flows to fund carbon budget research, conservation projects, and to reward land management activities alone do not secure continuity and commitment on the carbon agenda. Once these expire or regulations lose their
force continuity is not guaranteed. A long-term governance approach here needs to be adaptive in relying on a mixture of funding inputs, payment rewards, and regulations. These need to be underpinned by a process of iterative mutual learning among stakeholders in the form of knowledge co-production.

Disparate types of knowledges will always exist in managing for natural resources, or ecosystem services. Therefore conflicts can be very common when different interests meet. There needs to be more integration among scientific, policy, and conservation knowledges with local, tacit, knowledges, not uncritically however. This integration can be achieved through more participatory ways in decision-making, and should be encouraged through co-production activities facilitated by skilled knowledge brokers.

Improving communication and integrating different types of knowledges is crucial; yet it is well recognized that information alone does not generate action (Mileti and Peek 2002). These messages need to be communicated using a variety of avenues and interpersonal ties and trusted messengers, in other words knowledge brokers. In a socio-ecological system that is characterised by constant uncertainty and uneven levels of co-production of knowledge an adaptive management approach can be quite beneficial.

One cannot blame the driver if the car they are driving was not properly made or if the roads were not properly constructed. Complex problems require a holistic consideration and a holistic approach. That is why stakeholder engagement through participatory processes and social learning would be a potentially good strategy to improve the current governance regime. Through adaptive management and governance the socio-ecological system of the Dark Peak could become more resilient to disturbance, both social and natural. There have been some successful efforts to implement adaptive approaches in this area which will be explored in detail in the following chapter. Yet, the question still remains how can adaptive governance provide opportunities for the carbon agenda in the Dark Peak? Can an adaptive framework enhance the resilience of this socio-ecosystem, and at whose benefit and expense? These questions will be further explored in the following and
final discussion chapter where also the potential successes and limitations of Adaptive Governance in the Dark Peak will be traced. Finally, the lessons from this case study will be considered with regards to their application in a broader scale of managing for a natural resource agenda.
CHAPTER 7 ADAPTIVE GOVERNANCE FOR MANAGING THE DARK PEAK’S CARBON AGENDA

7 Introduction

Adaptive governance has gained increasing importance in natural resource management agendas in recent years. As discussed in chapter 3, adaptive governance places emphasis on mutual social learning and public participation of stakeholders at disparate political administrative levels and geographical scales. This is seen as a requirement for enhancing the adaptive capacity and resilience of the targeted socio-ecological system against climate change.

This chapter addresses the final research question of the thesis by considering how an adaptive framework can assist in the governance of the Dark Peak under the intricacies and disagreements generated by its carbon agenda. In section 7.1 I explore how the Dark Peak demonstrates elements of adaptive capacity (as defined previously in chapter 3). Within the Dark Peak knowledge is transferred and exchanged among all key stakeholders, and the key stakeholders have the capacity to interpret and comprehend existing and new knowledge. Yet for change to take place knowledge needs to be accessible and comprehensible to all key stakeholders.

The chapter then moves on to section 7.2 to explore the mechanisms behind adaptive management in practice in the Dark Peak socio-ecological system. The importance of social learning, of knowledge brokers, and of knowledge co-production are all discussed, with examples from the Dark Peak stakeholders. Section 7.3 then discusses the opportunities for and limitation of adaptive governance in the Dark Peak, relating them to case studies from across the world to provide for a comparison within an international context. These points are then summarised in table 7.1 as the strengths and weakness of adaptive governance. Finally, in section 7.4 the chapter offers some conjectures on future challenges with particular attention to the potential new UK Peatland Carbon Code.
7.1 From command-and-control to adaptive governance

Before going any further, it is important to provide a brief recapitulation of the key characteristics of adaptive governance. Adaptive governance focuses on stakeholder involvement and interactions in horizontal, or in other words in the same level, and vertical extents, in other words from local to global and vice versa (Folke et al, 2005). In the words of Clark and Clarke (2011), adaptive governance is both ‘cross-level’ and ‘cross-scale’. ‘Cross-level’ interactions are identified as undertakings between actors at the same level, for example in the case of the Dark Peak at the local level of the moorland grounds between farmer-farmer manifested as helping each other when carrying out large scale heather burning. Another example would be among different academic institutions such as The University of Manchester and The University of Durham demonstrated through collaborations such as on the project ‘Monitoring carbon flux from restoration and wildfire sites on blanket peat’ where both academic institutions investigated how restoration the degraded moorland in the Bleaklow Plateau of the Dark Peak affects greenhouse gas fluctuations and carbon emissions.

Additionally, ‘cross-scale’ interactions are defined as the connections among stakeholders in diverse levels of local, national, and global magnitude (Adger et al, 2005). For example, the relations between Natural England (national) and the Farmers (local) where the latter have to negotiate their Agri-Environment Schemes with the Environmental Regulator who issues those agreements, or between the International Union for the Conservation of Nature (IUCN) (global) and DEFRA (national). DEFRA recently (in June 2013) piloted the UK Peatland Carbon Code developed by the researchers that co-produced IUCN’s Inquiry on Peatlands report in 2011 (see Bain et al, 2011). All these interactions involve stakeholders at different levels in a socio-ecological system and are thought to represent the practical, managerial, and learning support necessary for building adaptation in response to climate change.

Adaptive governance is a proactive strategy designed to improve the effectiveness of management (Clark and Clarke, 2011) of socio-ecological systems. Through low-
cost innovative experiments it attempts to increase the socio-ecological system’s resilience by enhancing its capacity to adapt (Holling, 2004; Pahl-Wostl, 2007; Evans, 2012). In the case of the Dark Peak in the Peak District National Park, for example, this might involve the capacity to change the type of moorland management and adapt the lifestyles of local stakeholders, such of the Land managers (farmers and gamekeepers). Adaptive governance is therefore concerned with building institutions, or enhancing the current existing ones, that have the ability to experiment with differing solutions and learn from them in order to adapt and evolve. An adaptive institution should be capable to gather new, innovative information, understand and integrate it, and subsequently adapt and innovate. It is through this process that adaptive governance advocates suggest that institutions become more resilient, or robust. The following section will now juxtapose the elements of adaptive governance to those of a traditional command-and-control framework building on the features demonstrated in Figures 7.1 and 7.2.
Figure 7-2 The above graph illustrates the conventional, ‘linear’, mode of decision-making.

Figure 7-2 The above figure depicts the iterative process of learning-by-doing promoted by adaptive governance. Source: Author’s own.
This will help shed light into some practices that have been observed in the Dark Peak that could benefit from a more adaptive approach before moving on to sections 7.3 and 7.4 where examples of successful attempts of adaptive management and governance in the Dark Peak will be considered in detail.

Figure 7.1 illustrates a conventional command-and-control regime, where knowledge and information are highly science-based and the holistic understanding of environmental problems is hampered by gaps and a lack of integration in disparate existing knowledges. In a science-driven system the science-policy nexus are in charge of identifying the natural resource problem. Subsequently, a series of technical (Research) and managerial (Program) avenues are employed to investigate the issue and before providing its solution in the form of research results. These results are then distributed primarily among other scientific and policy institutions in the form of academic or policy reports and publications, which in turn will inform existing or new policies. Finally, these are then communicated to the local communities who manage the land for its natural resources. This avenue is not only linear but also suggests a top-down approach to knowledge transfer which was initially demonstrated in Figure 5.3 of chapter 5 under the red ties connecting the Dark Peak stakeholders. Examples include members of the Academic Institutions and Consultants such as The University of Manchester and The University of Durham with the Land managers’ group. This might seem as a contradiction as The University of Manchester also happens to be a valuable knowledge broker with an abundance of examples where knowledge is exchanged and successfully produced collaboratively with other stakeholders. What this then suggests is the need for Manchester to enhance mutual learning with Land managers which can then enable successful integration of their knowledges and an improved attitude by Land managers as they would feel more valued and engaged.

In contrast to this approach, adaptive governance aims to gain a holistic understating of ecological issues by accumulating diverse experiences (Lee, 1993; Berkes and Folke, 2002) as is demonstrated in Figure 7.2. An adaptive approach is one that encourages the active and equal engagement of science, policy, and society. A problem, or disturbance, is dealt with by active stakeholder participation.
where social learning, knowledge brokering, and collaborative knowledge production are to tools for filling in gaps and allow knowledge integration. Rather than being ‘linear’ the process involves continuous, or iterative, stages of participation and deliberation. Whereas conventional command-and-control management takes into account a limited range of quantifiable environmental factors, adaptive governance considers both qualitative and quantitative elements and their interaction. For example, the quality of communication within social networks and how this affects the decisions that the whole network takes, or the suitability of a particular institution to assist the learning and experimentation of the rest of the network’s stakeholders (Evans, 2012).

To what extent, in practice, is adaptive governance able to maintain this distance from conventional command and control systems? As we will see further on in section 7.5.2, all too often the power relations that adaptive governance tends to overlook end up reasserting themselves, reproducing many of the knowledge gaps and top-down tendencies characteristic of the very command and control systems that adaptive governance was designed to overcome. But for now the focus will turn into how the Dark Peak demonstrates potential for adaptation and the success of an adaptive framework through knowledge being transferred and exchanged within its social network, and through the opportunities for stakeholders to interpret and comprehend the knowledge available. Finally for change, in other words adaptation, to take place will require all stakeholders to have access to the disparate pools of knowledge as well as the ability to comprehend this knowledge.

**7.2 Elements from the Dark Peak’s adaptive capacity**

Chapters 3 introduced the elements a system must meet to shift from a command-and-control management type to a more adaptive one and chapter 5 followed on to analyse how the Dark Peak meets these conditions. These themes are briefly revisited here, as they provide the basis of the analysis of adaptive governance undertaken in this chapter. The following characteristics that point towards the direction of a system with adaptive capacity have been observed in the Dark Peak socio-ecological system:
7.2.1. Knowledge is transferred and exchanged among all relevant stakeholders

This takes place through formal paths such as academic conferences, stakeholder engagement forums, government consultations, and policy-target documents, or through informal channels such as communication between individual members of the Academic Institutions and Consultants and members of the Land managers on the field whereby scientists who happen to live in the same area as farmers can visit the farm to provide consultation on moorland related issues. To link this point to the one being raised previously, some Academic Institutions and Consultants may have individual members that engage directly with Land managers and have formed trusting relationships that allows the latter to seek their direct advice. This indicates on behalf of the Land managers their need for more informal interactions and in non-scientific surroundings, as has been argued in previous points throughout this thesis. It also suggests that the element of geographic level can play a significant role in rendering a stakeholder focal to link other actors across different scales and to disparate pools of knowledge, in this case an institution to a local farmer. These two stakeholder groups operate at different scales (farmers in the local and Academic Institutions at a national or even international scale) yet the individual researchers live and interact in the same level as the farmers which then enhances the bridges of their communication. This also suggests further avenues for improvement for Academic Institutions in the Dark Peak that can be facilitated through an adaptive framework. Drawing on the information on Figures 1 and 2 this would require the transition of the institution into a more adaptive one. This is not the focus of this thesis however and therefore is not examined here but it would be an excellent theme for potential future research in the Dark Peak. Another example would be the informal communication between farmers and gamekeepers who use the space of ‘their local [pub]’ to discuss when to conduct their next heather burning session. Interviews have revealed that they use a combination of weather-forecasting websites, and their own tacit experience-based knowledge to make that decision.

However, according to adaptive management this knowledge exchange and transfer must be met by performance criteria and guidelines of change which then
in turn can induce beneficial or non-beneficial outcomes (Pahl-Wostl et al, 2007). Furthermore, these need to be monitored within suitable time frames that are by and large broader than those required by short-term policy targets. It is easier to apply criteria, guidelines, and monitor processes in a formal context, but what about informal contexts? Further questions then arise: How can this be achieved without formalising relationships among stakeholders that are unique and precious because of their informal character such as the interactions and knowledge exchange among individual researchers and farmers? How will that affect informal interaction and friendships without creating disruption, distancing, and mistrust? These questions can also provide the basis for future research in the area.

7.2.2. The key stakeholders have the ability to interpret and understand this knowledge.

As has been argued in chapter 5, this ability to access and understand knowledge may be limited to the more ‘central’ stakeholders, or in other words the ones with the most connections to other stakeholders, such as Moors for the Future Partnership (MFFP), Natural England (NE), the University of Manchester (UoM), Peak District National Park Authorities (PDNPA), the Royal Society for the Protection of Birds (RSPB), and the Land managers. Yet from an adaptive framework point of view, this understanding is attained by an iterative process of learning and negotiating, in which the actors are engaged in all stages of appraisal, policy implementation, and monitoring. In the case of the Dark Peak there is no formalised process and therefore these elements have not been observed to take place at a regular basis. The instances where this has been observed is through official research projects where there is an adaptive methodology tested and there is also the relevant funding to support the social capital, monitoring, and assessment of the adaptive process. An example would be the case of the Sustainable Uplands team that specifically tested an adaptive framework for natural resource management and contributed in the creation of a pilot UK Peatland Carbon Policy. This will be discussed in further detail under section 7.3, where the future of the Dark Peak will be considered in terms of potential scenarios and how they might affect the area and its carbon agenda.
Furthermore, according to the adaptive management theory, disparate actors have differing and frequently changing political interests, constituting a complex process that requires transparency and leadership. In the case of the Dark Peak there have been occasions in which a combination of political interests and lack of transparency has led to the carbon agenda being mobilised for stressing the importance of conservation or water provision over other stakeholders’ interests. For instance, as has been previously argued in chapter 6 there have been occasions where commissioned scientific research did not yield the results the stakeholder expected and therefore data was used selectively to fit around a context that supported the environmental agenda of the particular stakeholder.

Moreover, even if an adaptive framework is implemented formally these issues will still reappear. In other words, given that stakeholders operate in different scales where different hierarchies are present, power relations will not cease to exist even under an adaptive governance regime. Some form of transparency is therefore required to facilitate such processes. This can be achieved by developing transparency through good leadership which can be in the form of stakeholders who act as knowledge brokers and therefore enable some transparency. However, it needs to be emphasised that knowledge brokers also come into the environmental arena with personal agendas and politics of their own. Transparency can be achieved by enhancing stakeholder access to the various pools of knowledge and by using vocabulary appropriate for each stakeholder’s understanding. For example, when engaging local Land managers, either farmers or gamekeepers, with novel scientific data this needs to be conducted in a language that is comprehensible and non-technical. Also, transparency can be achieved by keeping all relevant stakeholders in the learning loop, by circulating information and minutes from lay, scientific, and policy meetings that can be beneficial to all.

Another suggestion as argued by Walters (1997, p. 19), building on his 20-year experience with implementing adaptive management, can be more confrontal suggesting ‘that proponents of adaptive management will have to be forceful about exposing these interests to public scrutiny’.
7.2.3. For change to be effective it needs to be accessible and comprehensible to all the stakeholders.

To achieve adaptation it must build upon new knowledge processed in a clear way that makes it unambiguous how, by whom, and when decisions are taken to change management strategies, and what facts were used to guide this decision. In the case of the Dark Peak, this is often the complaint from local Land managers when referring to how scientific knowledge informs land management policy. One land manager, for example, observed that the Heather and Grass Burning Code has been written by ‘people who clearly don’t know how to burn!’ (Land manager 4, 2010).

Commenting on the Environmental Stewardship Agreements (ESA) with their supposedly ‘flexible’ Agri-Environment Schemes (AES), another land manager noted that they had been written by ‘people who have no idea what it is to manage the moorland and make their decisions based on books’ (Land manager 5, 2010). Clearly there is a gap here that needs to be addressed for adaptation to be more effective.

This brings us to another important question that needs addressing when managing for adaptation: Adaptation for whom, and of what? Setting clear goals can be the first step to getting clearer and more ‘successful’ results. Engaging stakeholders in this process can aid in making this new knowledge more accessible and comprehensible. Yet this does not guarantee that the outcome will be in everyone’s interests and it needs to be anticipated that conflicts may arise. In the words of a farmer

‘...I am not interested in becoming a New Age farmer who looks after carbon this and biodiversity that. Yes I understand the reasons as I’ve been to some of them conferences in Edale but farming is what I like doing. This is my passion and it’s becoming so damn hard now... I have allowed some schools to come over on the farm for educational purposes as this gives us more points in our ESA but this is not what I want to do. [The National Trust] does not asked me if I like it, I have to otherwise the monies are not enough. But my priority is livestock and I will keep farming for as long as I can...once this gets impossible I will move to the land I’ve bought up in North Yorkshire moors and carry on farming’ (Land manager 3, 2010)
In adaptive terms, this is another opportunity to learn about the context and therefore should be embraced as new knowledge. Adaptive management will not always be able to create consensus, and it shouldn’t try to force consensus either.

7.3 Elements of Adaptive Management

For adaptive management to take place, the initial step is for each management activity to be considered as an opportunity to learn through experimentation about how to adapt to changing conditions (Ostrom, 2005). This will then render policies to be treated as hypotheses, in which an iterative process of learning will ensure continuous knowledge production and land management improvement. Experiential learning and hypotheses in policy on its own however does not seem very appealing. For example, for some stakeholders such as Government Agencies and Environmental Regulators who create policy and seek ‘‘The Answer’ to their problems’ (Scientist 2, 2010), this process of hypothesis testing and learning through experience may seem too time consuming, costly, and even trivial considering the time scales they operate in (Folke et al, 2005). A significant problem in this regard has been identified by an interviewee from the Academic Institutions and Consultants stakeholder group, who noted that

‘… ‘The Answer’ requires £3-£4 millions whereas they have much less grants to provide us with, hence the answers they get are equal to the funding they provide the researchers with… Consultants promise the world to policy makers but researchers and scientists view and respond to things more realistically.’ (Scientist 2, 2010).

This is one of the more consistent reasons for the failure of adaptive management, as has also been observed by Walters (1997, p. 19) who argues that

‘Scientists are warned that more research does not necessarily mean better models, or that someone else will know how to integrate research results into a useful model, no matter how fragmentary those results may be. Managers [policy-makers] are warned that it is not yet possible to purchase sound "best use" policies just by investing more in modelling and research.’
Building up the capacity of stakeholders (individuals and institutions) to learn successfully from each other’s experiences is a significant element of producing knowledge and skills within organizations and institutions to enable good adaptive management (Fazy et al, 2005). Learning for natural resource management is frequently regarded as a social practice defined as “social learning” (Lee, 1993; Clark et al, 2001), or even “institutional learning” (Ostrom, 2005) as has been previously covered in chapter 3. Yet for adaptive management to take place learning should be supported by actors who facilitate it, (these have been given various names in the literature ‘knowledge brokers’ (Prell, 2009; Prell, 2011), ‘champions’ (Gilmour et al, 1999; Argent, 2009, Alan and Stankey, 2009), and ‘intermediaries’ (Clarke and Ramirez, 2010) to name but a few. This research has used the definition of ‘knowledge brokers’, as it was felt that this definition captured more precisely the act of making knowledge available to all stakeholders and assisting in knowledge co-production and social learning in the Dark Peak.

This section will now discuss examples of adaptive management in practice in the Dark Peak and these are structured around the three key themes of its theory: social learning, knowledge brokering, and collaborative knowledge production.

7.3.1. Social learning
A consistent, fundamental aspect of social learning is the collaboration of people who privilege different forms of knowledge or ways of knowing. This is contrary to Reed et al (2011), who argue that social learning is regularly confused with the processes that enable it, citing stakeholder participation as an example. They argue that whilst participation can be used to achieve social learning, stakeholder participation is not social learning. This thesis agrees with Reed et al’s point, yet argues that stakeholder participation is a crucial step to achieve social learning and that the two should not be treated separately.

There are many examples of social learning taking place in the Dark Peak. In some cases where effective social learning takes place it leads to the collaborative production of knowledge (see section 7.3.3), which is often due to the powerful contribution of knowledge brokers (see following section 7.3.2). For example, social
learning can take place in the Dark Peak in formal surroundings, such as
corporations, workshops, seminars hosted by the various Academic Institutions
(Manchester, Leeds, Sheffield, Durham), MFFP, PDNPA, or informal surroundings
such as on the moorland, or at a Land manager’s farm/house. Formal surroundings
encourage and invite stakeholders from heterogeneous backgrounds to attend, and
heterogeneity in adaptive management terms is regarded as a strength of social
learning (Reed et al, 2010).

However, the case of the Dark Peak suggests that such formal situations can create
a context for non-effective communication. Formal meetings such as those
mentioned above are experienced as exclusionary by particular groups such as
farmers and gamekeepers, who often abstain from participating, arguing they
‘don’t feel welcome as there is a weird balance of power’ (Land manager 4, 2010),
or claiming that such meetings ‘are very sciency and people speak in a way [we]
don’t understand’ (Land manager 2, 2010). These formal contexts encourage
heterogeneity in an attempt to bridge different types of knowledges, and aim to
mix scientific, conservation, and policy knowledge with local, tacit, knowledges. Yet
on numerous occasions in the Dark Peak the result of this heterogeneity was not
consensual agreement but rather an explosion of antagonism. This was most
typically the case when the discussion focused on the contentious issue of
controlled heather burning, which caused heated arguments among supporters
(farmers, gamekeepers, and the Moorland Association) and opponents (chiefly the
RSPB). This heterogeneity can become a potential weakness when it leads to
stalemates, disagreements, and secrecy (Beers et al, 2010). However, this is only
the case when these disagreements and disputes are viewed as a negative, ‘bad’,
result of participation. This thesis therefore concurs with Muro and Jeffrey (2008) in
arguing that an over-emphasis on learning through collaboration and consensus can
ignore the many instances in which learning occurs through disputes and
opposition.
A recent case in the Dark Peak is worth noting in this regard. In July 2014, the knowledge broker The Heather Trust\(^1\) provided a forum for social learning among key Dark Peak stakeholders in which stakeholders from Natural England (NE), RSPB, Moorland Association (MA), Yorkshire Water (YW), a landowner/farmer, gamekeepers, and landowners participated to provide local knowledge on moorland and fire management. The objective was to shift the focus from the polarising ‘burning is bad or good’ debate to an issue of mutual concern that could provide a point in which conflicting knowledges could meet under a common interest and inform current moorland policy. This has been previously identified in this chapter as consensus. Despite that it has been successful in this case this has only displaced the problem without resolved it, and it is certain it will resurface again. As was argued by one of the attendees, (who is also a member of the Academic Institutions and Consultants group):

‘Rewetting increases Sphagnum moss [a key peatland type of vegetation in the Dark Peak currently being restored] that has resulting in a better functioning bog, which NE want. It increases resilience to wildfire which [all] sides want. As I understand it, burning could be allowed where it was needed to manage wildfire risk in the transition to Sphagnum-rich restored bogs’ (Scientist, 2014)

This is part of a mentality of looking beyond ‘do’s’ and ‘don’ts’ and focusing on the positive outcomes that arise from managing for multiple benefits. This approach was not about creating consensus on whether burning is good or bad for the moorland as there will always be supporters and opponents. What it did was to acknowledge that heather burning is beneficial in particular contexts, such as when in need of managing the moorland for avoiding or mitigating wildfire risk. This indicates another benefit of social learning: that beyond conflict and dispute,

\(^1\) The Heather Trust didn’t make it in the final stakeholder graph as they had zero mentions from the rest stakeholders which means that their perceived influence was zero. This however does not by any means suggest that their work is insignificant rather that it wasn’t captured by the stakeholder. It could be related to the time this research project was conducted that the Heather Trust had not much involvement in the carbon agenda and therefore their presence was not acknowledged by the key stakeholders at that time. This does not mean that the Heather Trust is not a stakeholder merely that they are not part of the key perceived ones.
compromise can help overcome stalemates in land management and policy. In the case described above the same scientist was surprised by ‘how being in a field location shifts the balance of power!’ as opposed to holding stakeholder engagement meetings in more formal surroundings.

However, with regards to adaptive management social learning needs to have a mechanism that evaluates its effectiveness, and there also needs to be a balance of participatory engagement to be effective for management decisions. Agnew and Woodhouse (2011) cite an example by Van Slobbe et al (2008) from a water management project in Sri Lanka, in which bottom-up stakeholder engagement has led to over-participation and therefore to ineffective management due to the failure of regulatory instruments. This highlights the importance of embedding the notion of social learning and mechanisms of evaluating it within the institutional frameworks required to enable it to support adaptive governance, as will be discussed below in section 7.5.

7.3.2. Knowledge brokering

Various research projects throughout the literature on adaptive governance have highlighted the significance of having ‘suitable participants’ when applying an adaptive framework (Allan and Stankey, 2009; Prell et al, 2009; Morran et al, 2014). This section discusses the necessary qualities and potential benefits of knowledge brokers, before turning to a critique of this approach in section 7.4 further below.

The role of knowledge brokers is particularly crucial at the creation of any new adaptive framework. These participants can either be stakeholders of the network considered for adaptive management and therefore contributing considerable social capital from holding trusting relationships with other stakeholders over time, or external actors and hence experienced knowledge facilitators with the appropriate skills to create the space for stakeholder engagement and social learning (Rist et al, 2007). These people are identified in this thesis as ‘knowledge brokers’ and are known to bring enthusiasm and energy, established respect and trust among their colleagues and other interests, and with a commitment to change and a capacity to cope with ambiguity and uncertainty. Another attribute of
knowledge brokers when managing under an adaptive strategy should be to be adaptive themselves. In other words, to have the skill and preparedness to acknowledge disagreement and dissimilarities among stakeholders, yet have the self-assurance to be both a strong supporter of their point of view yet allow for reasoned dialogue to take place and not force stakeholders to adopt their angle (Cote et al, 2001).

For adaptive management to be effective these knowledge brokers need to have the ability to broker knowledge across various scales and levels. Knowledge brokers contribute with motivation, initiative, energy, and enthusiasm for commissioning what has been described by Smith (2009) as a ‘risky endeavour’. Therefore, knowledge brokers need to be acknowledged within adaptive management as crucial, as without their contribution the adaptive framework could easily be condemned as a strictly technical and managerial strategy. For successful adaptive management knowledge brokers also require imagination and creative thinking of adapting their methods and spaces so as to enable stakeholder involvement and engagement, as exemplified by some of the cases discussed above such as the case of the Heather Trust holding meetings directly on the moorland, or MFFP holding workshops and other knowledge exchange meetings at their offices in Edale, in the heart of the Dark Peak’s countryside.

The potential benefits of knowledge brokers are further demonstrated by other cases from around the world. In his study of sustainable agriculture intensification in the Andes, for example, Bebbington (1997) identified knowledge brokers who came from dissimilar backgrounds ranging from a university professor, European volunteers, and funding agencies, to a local priest, all of whom played important roles in disseminating information in the system under study. They contributed with novel ideas through connecting local stakeholders with their own networks. This then enabled local stakeholders, such as farmers and local land holders, to gain access to a diverse pool of contacts from non-local institutions, resources, non-governmental organisations with technical knowledge, funding benefactors, technological sources, as well as alternative trading networks.
In the case of the Forest and Range Evaluation Program in British Columbia, to offer another example, Smith (2009) argues that success was achieved when a knowledge broker with enthusiasm, energy, communication skills, and influence with stakeholders at various level and scales within the program stepped in and attained the support needed. One key element to be noted in this case is the ‘bottom up’ approach that was followed to create this management process, in which local stakeholders felt more involved.

In the case of the Dark Peak several knowledge brokers can be identified. These include individuals, organisations, and institutions, and partnerships between individuals and institutions (e.g. certain public-private partnerships). For example, Moors for the Future (MFFP), which is a public-private partnership (see Chapter 5 for more details), The University of Manchester, which is an academic institution, and individual farmers and gamekeepers, as well as the Sustainable Uplands RELU team (discussed in chapter 4). This example will shed lights on Moors for the Future Partnership (MFFP) here as their bridging skills enable them to connect and transfer knowledge to all key stakeholders in the Dark Peak. MFFP’s creation was partially based on the tenets of social learning and knowledge brokering as it aims to ‘produce knowledge in collaboration with local lay experts, scientists, policy-makers, and business companies on the best strategies to protect and manage this ecosystem’ (Dean et al, 2014). Their effort over the past 11 years since their inception has enabled them to build strong connections (comprising both strong and weak ties, see chapter 4 Figure 4.4) that enable them to be regarded as ‘the person to go to’ by a majority of the Dark Peak’s stakeholders in order to diffuse knowledge and information across the network.

The Moors for the Future Partnership is perceived the key knowledge broker in the Dark Peak by the rest stakeholders according to interview data. Chapter 5 under section 5.2 discusses this in more detail and also explains why Social Network Analysis (SNA) has revealed MFFP’s perceived influence in brokering knowledge to be in second position after Natural England (see also Table 4.5 p.100 and Figure 4.5 p. 103 in chapter 4). The organisation entered the environmental management arena in 2013 and has acquired experience of collaboration with a diverse mix of
stakeholders as well as in-house knowledge of protocols, health and safety standards, reporting processes and field site authorisation procedures from each partner and consumer. This accumulated pool of resources has placed MFFP in the forefront of moorland knowledge and social capital, and has ensured their capacity to set up and deliver moorland-based projects (MFFP interviewee, 2010).

In addition this influential position also lends MFFP the power to negotiate access on the moorland on behalf of other stakeholders. In the words of a member of the Academic Institutions and Consultants ‘Moors are very powerful in the sense that they deal with the negotiating and allow/ gain access to land and help researchers and scientific projects. They play a fundamental role in facilitating research and bringing together stakeholders. They were the only player in town at the beginning.’ (Scientist 2, 2010) This is a very interesting finding of this research, namely the power and control gained and exercised by Public-Private Partnerships (PPP’s) in the management and governance of natural resources. Further research avenues in the Dark Peak could attempt to identify those PPP’s, investigate the elements that lend them power, and explore how their own agendas impact the local environmental and social politics.

Furthermore, their wide knowledge pool is shared with all interested stakeholders across various scales and levels, including regional, national and international conservation communities such as the Derbyshire Wildlife Trust (regional), the RSPB (national), and the IUCN (international). The avenues used are through workshops, forums, conferences, and their personal website, via various forms of media such as the press, radio, and television. A crucial element for the establishment of this knowledge broker was the strong support of the Peak District National Park Authorities, which allowed the partnership to access to a vast amount of skilled staff such as Rangers and fire rescue officers. This lends MFFP considerable on-the-field-support, local expertise from farmers and gamekeepers, as well as creativity across land management, science, communications, and plan and contract delivery. Finally, the assistance of the PDNPA lending MFFP official local government approval has allowed important flows of funding to reach the partnership (PDNPA interviewee, 2010).
With regards to the carbon agenda it appears that MFFP needs to be very
diplomatic about any projects or public statements regarding the effects of carbon
emissions in the Dark Peak. This is due to the fact that the partnership is comprised
of stakeholders with disparate views on how the moorland should be managed and
how much priority should be afforded to carbon. In the words of one member of
the MFFP, any ‘too bold comment or commitment on sensitive issues such as
burning could be detrimental for [them]’ (MFFP interviewee, 2010). This could
disrupt their relationships with the disparate stakeholders as it could be perceived
as ‘taking sides’. According to social network theory (see chapter 5) this is also one
disbenefit of stakeholders who are highly central to a given social network (MFFP
scored among the top five of highly central stakeholders which in other words
accounts for a highly central stakeholder who shares the majority of ties with all the
other stakeholders and sits between otherwise disconnected members of the
network. See Table 5.2 in Chapter 5). Being in such a powerful position and in
charge of holding together so many connections and information may make MFFP
feel ‘torn’ or ‘stuck’ between two or more opinions.

This was manifested in the case of two members of the Academic Institutions and
Consultants who were commissioned to conduct interdisciplinary (natural and
social science) research in the Dark Peak and experienced this as situation stifling
temporarily the development of their research: ‘But MFF was our gatekeeper and
so they kept the gate closed basically! So it wasn’t so helpful in fact. (Scientist 3,
and Scientist 4, 2010). This behaviour points towards the power and personal
political agendas of knowledge brokers and how these can either aid or hinder the
development of stakeholders’ activity. This theme that emerged calls in itself for an
in depth investigation and can also contribute to avenues for further research on
this area.

On a more positive note, this has not been the case for this research as MFFP
provided both funding and access to their diverse knowledge resources. The data
presented here was partially funded by MFFP in 2009 and the initial findings of this
research were used in their knowledge exchange forums to highlight the need to
integrate more local tacit knowledge within local environmental agendas and
policies (Tantanasi et al, 2011). The research funded by MFFP resulted in a peer reviewed report (Tantanasi et al, 2001) that is referred throughout this thesis as the MFFP report. The key findings from this project were also used as the pillars to build upon this PhD research and are briefly discussed in the paragraphs below.

Initially, a stakeholder mapping exercise identified three major categories of stakeholders with regards to managing for a carbon agenda in the Dark Peak social-ecological system: the scientific community, statutory bodies/policy-makers, and land managers/owners.

Further on, a series of qualitative interviews shed light on the increasing interest between all stakeholder groups in managing for a carbon agenda. This, however, was found to be hampered by existing scientific uncertainty surrounding peatland carbon budgets, and conflicting interests between the different stakeholder groups on how to best manage the moorland.

In addition, Social Network Analysis (SNA) conducted suggested that stakeholders in the Dark Peak comprise a very well-connected network where knowledge flows across the network. Whilst it seemed that no stakeholder was disconnected or completely marginalised, knowledge developed by particular stakeholders was simply disseminated, rather than being created in a collaborative manner.

The MFFP report also highlighted the valuable knowledge that rested with the Land managers who have been accumulating expertise and skills through years of working on the moorland of the Dark Peak. This tacit knowledge has not been given much legitimacy or credit and the research revealed that if this knowledge was included in the decision-making processes it could improve land management policies and produce buy-in for decisions taken under circumstances of intrinsic uncertainty.

Another interesting finding highlighted by my research conducted for MFFP was the existing collaborative management arrangements between land managers which could offer big potential for enhancing and improving these communication ties
and potentially lead to more effective and stronger collaboration in managing the Dark Peak’s carbon agenda.

Moreover, it has been revealed that involving all the key stakeholders in the production of knowledge can enhance trust amongst those implementing policy and therefore lead to more robust carbon management. However, this would necessitate a shift from traditional command and control modes of knowledge production (as explained previously in section 7.1) towards more adaptive ones where all stakeholders are involved in a process of social learning in practice, or in adaptive governance terms ‘learning while doing’.

Finally, upon completion of the MFFP project I concluded that in order to produce knowledge collaboratively new innovative governance mechanisms and engagement strategies are required; for example, strategies that experiment and learn with different management approaches. Ways in which to facilitate this kind of learning warrant further investigation and this has been further explored in this current research.

7.3.3. Co-production of knowledge

Finally, with regards to producing knowledge collaboratively there are again a few stakeholders that could be named. There have been several examples mentioned throughout this thesis with regards to stakeholders’ collaboration in creating knowledge together. The focus in this section will be the University of Manchester, which as described previously in chapter 5, scored the highest betweenness centrality (refer back to Table 5.1 for clarification) which therefore renders it the top stakeholder with the most comprehensive knowledge on the issue of managing for carbon adaptation among the Dark Peak key stakeholders.

The University of Manchester has quite a few examples where this is demonstrated through ongoing projects such as Knowledge for Wildfire (KfWf) which commenced in 2012 at the Department of Geography of the University of Manchester upon receiving funding from Natural Environment Research Council (NERC). KfWf was developed as a learning platform and forum for stakeholders with an interest or profession related to fire to come together and discuss issues and research on
burning and wildfires, which as we have seen is an important issue in the Peak District. Participants include Academic Institutions and Consultants (in example natural and social scientists), Government Agencies and Environmental Regulators (such as DEFRA, PDNPA, Natural England, Environment Agency Land managers (Farmers and Gamekeepers), and fire service officers.

This project builds upon the success of its predecessor, another knowledge exchange platform called FIRES (Fire Interdisciplinary Research on Ecosystem Services) which received funding from the Economic and Social Research Council (ESRC) and NERC during 2008-2009. A series of workshops was developed by the collaborating partners: Academic Institutions (such as The University of Manchester, The University of Edinburg, The University of Leeds), the Peak District National Park Authorities (PDNPA), Moors for the Future Partnership (MFFP), Landmanagers (farmers and gamekeepers), Scottish National Heritage, the Global Fire Monitoring Centre, The Heather Trust, and the Chief Fire Officers’ Association. The aim was to facilitate cross-scale multidisciplinary discussion and knowledge exchange among researchers, moorland managers, policy-makers, fire and rescue officers, and other interested stakeholders such as members of the public (McMorrow et al, 2010) with the objective to reach decisions and produce collaboratively future actions with regards to managing moorland and heathland to prevent wildfire. One suggested management approach from this is the use of ‘appropriate’ heather burning and its beneficial impact on maintain a low level of fuel on the moorland and therefore minimising the risk of catastrophic wildfires (for the environment and society) such as the Bleaklow 2003 in the Dark Peak (see Figure 6.2 in chapter 6).

Another suggested approach was to increase social capital in terms of increasing the staffing of fire-fighting officers during the seasons where wildfires are more prone. Finally, another avenue is through enhancing public awareness on fire dynamics via educational activities. The successful collaboration led to the production of knowledge that officially recognised wildfire as a major UK hazard and saw its integration in the National Risk Register of Civil Emergencies (NRRCE).

Additionally, research undertaken at the University of Manchester with regards to peatland erosion and its impacts on hydrology and carbon balance saw the
collaboration of disparate stakeholders such as Moors for the Future, National Trust, Natural England, DEFRA and the International Union for Conservation of Nature. The knowledge produced demonstrated the value of large scale peatland restoration via the re-vegetation of bare peat in reversing soil erosion. Techniques that have developed collaboratively include that of gully blocking, which briefly is a technique whereby eroding channels within the peat bog are blocked by a combination of revegetation techniques and raising of the water tables to support the revegetation (Evans et al, 2005).

The knowledge co-produced from this collaboration led to significant influence on practice, and policy, relating to upland peatland management. A key avenue has been through the stakeholders’ engagement with the Moors for the Future Partnership (MFFP) A range of informal and ongoing collaborations, applying research evidence to guide landscape scale restoration projects have also been achieved (Allott, personal communication, 2014).

7.4 Adaptive Governance in the Dark Peak

Governance is about ‘the interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have their say’ (Graham et al. 2003, p. ii) In environmental governance terms it is about the interplay of institutional arrangements across levels and scales within a socio-ecological system (Ostrom, 1990). For governance to be robust it has to rely on the existence of nested institutions that act as boundary objects bridging together processes, other institutions, and even individuals that are part of the governance network.

Adaptive governance, as has already been addressed in detail in chapter 3, is about equipping institutions with the capacity to deal with uncertainties and complexities through frameworks of mutual institutional learning and knowledge co-production. It is about helping those existing institutions to shift from their current command-and-control status towards more adaptive practices. However, according to previous studies (see Pahl-Wostl, 2007) before assisting institutions to become adaptive their capacity to adapt needs to be assessed first as has been explored in
section 7.2 as well as previously in chapter 3. This then will establish what needs to
be done in that particular institution to enhance its adaptive capacity.

To recapitulate briefly, this thesis defines as ‘institutions’ the formal and informal
procedures governing the activities of society. Formal institutions comprise
regulations and legal protocols in example the WFD, formal executive assemblies,
and official actions. In addition, informal institutions are meant here as common
social norms, typically resting within human interactions, constructed, transferred,
and followed separate of legitimately formal avenues (Helmke and Levitsky 2004).
Informal institutions may therefore encompass mutual social rules or standards of
decent conduct in a member’s group or community. In adaptive governance terms
these formal and informal institutions coalesce in complex ways and by shedding
more light into the ones identified in the Dark Peak this section will now explore the
opportunities and limitations for adaptive governance in this case study.

7.4.1 Opportunities for adaptive governance of the Dark Peak’ carbon agenda

This section will now discuss each of these opportunities in further detail, providing
drawing on examples from the Dark Peak and from similar cases across different
parts of the world.

7.4.1.1 Ability to adapt to drivers of change

Adaptive governance creates novel responses to change and disturbance through
approaches of experimentation and learning-by-doing. Instances of
experimentation in the Dark Peak have been observed in projects as described
previously in section 7.3, whereby formal and informal institutions interact for
brokering knowledge across the network of stakeholders such MFFP successful
efforts to mobilise social, natural, financial, and technical capital to deliver the
significance of peatland restoration and managing for conservation across all
relevant stakeholders. MFFP position as a knowledge broker allows them access to
a vast pool of knowledge (social and ecological) and along with their vast
connections across the stakeholders this renders them a highly capable to adapt
institution as will be explored further in the following section 7.4.1.2.
However, having the capacity and ability to adapt to change does not also mean that one has the interest or motivation. This has been observed to be the case in the Dark Peak. The more progressive stakeholders who are interested in alternative environmental stewardship such as MFFP, NT, RSPB, NE, and the Utility companies are all committed to adaptation. Yet the majority of land managers (five out of seven) are resisting it. Nevertheless, on at least two occasions two farmers and one gamekeeper have been very successful in adapting their practices as a means of diversifying their business in an attempt not only to comply with NE’s new Agri-Environment Schemes but rather arguing that ‘that’s the way the game goes’ (Land manager 1, 2010) and ‘we have to comply or ‘perish’’ (Land manager 3, 2010) All had in common that they were more open and attended the MFFP knowledge brokering events. Others who were resisting this ‘adaptation’ were adamant about not wanting to ‘turn into New Age farmers’ and that ‘farming is all [they] have done their whole lives’ and where unwilling to do or learn anything new as stated by Land manager 5, 2010.

These differing interests and opinions need to be respected under an adaptive management or governance regime. There needs to be a method and way for these to coexist without being mutually exclusive. The reason being that adaptation does not mean the same thing to everyone and neither does every one adapt the same way. In the case of the farmers and the National Trust, a change of approach will be required of the institution (NT) towards becoming more considerate of this and move beyond a mentality of ‘not being here to protect ways of life’ rather claiming that conservation, and carbon being their key priorities as has been echoed recently by its Managing Director Dame Helen Gosh (Farmers Guardian newspaper, May 16 2014). As an institution that builds upon the social capital of its tenant Land managers the NT has the responsibility to protect their livelihoods by providing the right adaptation for them. By enhancing their tenants’ adaptation the NT can become more adaptive in itself.
7.4.1.2 Nested institutions

This chapter has demonstrated how governing change in an adaptive way requires cross-scale (i.e. from local to national) and cross-level (i.e. from local to local) interactions among stakeholders in the frame of mutual social learning through experimentation. This is necessary in order to foster the basis for knowledge co-production that can lead a socio-ecological system to adapt. However, such process needs to be supported by institutional frameworks and institutions that are capable and flexible, (in other words adaptive or with a capacity to be adaptive), and that accept change and uncertainty as part of their modus operandi. A lot of attention is given to governance at different scales and levels and the interactions of institutions within that governance framework in relation to social-ecological systems and adaptive management (Berkes, 2002; Burger et al, 2001; Gibson et al, 2001; Svedin et al, 2001; Dolsak and Ostrom, 2003). Briefly, ‘nested institutions’ in this thesis refer to what Brondizio et al (2009) also define as ‘local and larger institutional arrangements to accommodate the goals and interests of groups organised at different levels’.

In the case of the Dark Peak a prominent example of a nested institution that interacts with other stakeholders across different levels and scales is Moors for the Future Partnership (MFFP). MFFP is the definition of a nested institution, as they have been developed through representation, negotiation and decision-making practices at various scales (Mwangi and Wardell, 2012). With regards to managing for a carbon agenda in the Dark Peak the section the preceded have provided with good examples of the means by which MFFP try to accommodation the aims and objectives of stakeholders across different levels. Yet a challenge remains for adaptive governance: how can adaptive governance avoid/overcome being driven chiefly by the agenda of nested institutions within a socio-ecological system? What means are there to ascertain that opportunities created by adaptive governance for carbon management will not only benefit a selected few stakeholders over the livelihood of others?
This section has briefly explored the idea that institutions that link stakeholders across different scales and levels facilitate the conditions of adaptive governance, as has also been argued by Folke et al (2002), Ostrom (1990). The institutions mentioned above have demonstrated elements of self-organisation, learning, and adaptive capacity. Furthermore, their nested position allows them to connect local level institutions such as the Peak District National Park Authorities (PDNPA) and ...

7.4.1.3 Connects institutions to ecosystem knowledge

As mentioned previously in section 7.3 all the activity taking place with knowledge brokering and knowledge co-production sees stakeholders connecting each other to various forms of knowledge. At different scales such land managers through MFFP to Government Agencies and Env Regulators such the Natural England and Environmental Guardians such as the National Trust and the RSPB. Also, Academic Institutions and Consultants’ knowledge is being connected to each other through collaborative projects among them, such as Manchester with Durham on gully restoration and blocking to measure and calculate its effects on carbon budgets (Worrall and Evans, 2010) or water projects between Manchester and Leeds such as [include example] or even projects such as ScAMP that connect academic institutions’ knowledge with water companies, government agencies and environmental regulators and conservation groups and land managers. Scamp is mentioned in Chapter 5. [ran out of steam]

7.4.1.4 Ability to enhance the Dark Peak’s resilience

Characterisations of resilience now reflect equilibrium as a key notion, and have the tendency to refer to the scale of disorder that can be allowed by a system before it shifts from one condition to another (Holling, 1995). Natural resource management methods that aim to enhance ecosystem equilibrium rather than to limit its disturbances are therefore being endorsed as a way of developing ecological resilience (Nystrom et al, 2000; Scheffer et al, 2001).

Seeing that socio-ecological systems are treated as an entity in adaptive governance, then striving for resilience should entail both the social and the ecological. ‘Social’
resilience is the capacity of groups and communities to adapt despite existing environmental, social, political, and economic disturbances (Adger, 2000). For societies to be resilient, they must largely have the capacity to defend themselves from disturbances, self-organize, and learn and adapt (Trosper, 2002). In other words, societies that have adaptive capacity, are considered to have the ability to cope under conditions of change (Olsson and Folke, 2001; Brooks, 2003; Berkhout et al, 2004), which is also equivalent of resilience.

In the case of the Dark Peak ecological resilience is enhanced by strengthening the ecosystem’s capacity to bounce back after a crisis or disturbance. For example, as has been previously argued through restoration activities on the moorland it has been established that eroded and degraded peatlands have the ability to return to a stable state where gullies will become successfully revegetated, which in turn will also maintain the water tables under the soil in high levels providing support for the vegetation to keep on growing healthily. The vegetation will protect the soil from eroding which from a carbon agenda’s perspective will retain the particulate organic carbon and prevent it from entering the water streams causing water colouration which is non-appealing to Utility Companies and their customers. And at the same time contribute to mitigating a small fraction of GHGs.

Another example is through maintaining appropriate heather burning regimes to manage the fuel load of the moorland it will make the moorland less prone to wildfire eruptions and therefore more resilient. Furthermore, this can also be maintained by enhancing the fire reporting incidents and by building more quickly responsive fire fighting units. Also by increasing mutual learning where local moorland residents, land managers (farmers and gamekeepers), and tourists are involved in educational programs to learn about the effects of fires and made more aware in their activities on the moorland. In example the ongoing campaign supported by landowners, local farmers, conservation groups such as RSPB, RSPCA, NT, among others about banning Chinese sky lanterns use in the countryside. Following on from successful international bans in Spain, Malta and Austria have DEFRA commissioned a desk top review in 2012 for robust evidence on sky lanterns
and helium balloons but concluded that ‘any widespread risk of injury and death to cattle and impact on the environment is low’ (Midgley, 2013).

This section will now address how social resilience can be enhanced in the Dark Peak under an adaptive regime. Enhancing social resilience will depend upon collective action facilitated by processes of social learning and knowledge production. Resilience is about being able to adapt yet in order to adapt one must comprehend and understand the key issues behind the occurring crisis or disturbance and then be able to prepare accordingly. This will then require access to these processes which are usually facilitated by institutions who act as brokers knowledge as has been discussed in previous sections of this chapter. For example, the Inuvialuit people of Sachs Harbour in the Canadian Arctic have been developing their own strategies adjusted to their specific needs in their efforts to cope with climatic change in the past few decades (Berkes and Jolly 2002). Insights from their adaptive methods comprise substituting species they hunt with alternative animals as well as altering their hunting techniques. This suggests that in the path towards adaptation and resilience flexibility is also key. From this example, the researchers have also highlighted how newly developed institutions are building links across horizontal and vertical scales (from local to global) and by communicating the local problems to a larger (global) community they are able mobilise this community for help.

In the case of the Dark Peak one could argue that social resilience of local farming communities can be enhanced through encouraging more farm diversification whereby Land managers can substitute current practices with others to enable them to cope better with environmental and economic changes. Mirroring the case of the Inuvialuit people in the Canadian Arctic who adapted their everyday practices in order to cope better with the changing climate. Yet on another note diversification is not a synonym of adaptation and neither is their situation similar to the Inuvialuit due to the existing complexities of having to manage for livestock, carbon mitigation through biodiversity conservation, and water quality provision. It could be argued that they already have unwillingly diversified and yet the majority
of them is still in financial struggle/crisis which in other words means that diversification has not contributed much to them becoming more resilient.

A solution to enhance this could be potentially by engaging them more in processes of social learning and collaborative knowledge production whereby they can have their needs expressed and opening negotiated and contribute in developing alternatives that will respect their needs and difficulties and help them become more resilient and cope with change. This research has demonstrated how with the help of analysing the social network of the Dark Peak in combination with interview data and participatory observation we gained insight how this stakeholder group, for instance, feels powerless and uninvolved in its majority which is especially manifested in their low involvement in decision-making processes as has been also argued in another case by Brown et al (2001). An interesting avenue for future exploration in this regard would be to investigate how local land managing communities can improve their presence within their social network, and therefore extend and amalgamate their spaces of engagement?

7.4.2 Challenges of Adaptive Governance in the Dark Peak

Just as every coin has two sides so does adaptive governance have its own limitations. The theory can always sound very promising yet as with any managerial tool the problems emerge when putting it into practice. These challenges have been derived from the data and are discussed in the points below.

1. Learning-by-doing may risk reducing local politics

Learning-by-doing, can also be described as social learning through active stakeholder participation, which in adaptive terms translates as another opportunity to learn about the context and therefore should be embraced as new knowledge. As much useful as it is to engage all stakeholders in learning-by-doing this can conceal some inherent dangers. For example, placing too much focus on collaboration through learning and also consensus ignores the many occasions where new knowledge is acquired through opposition and disagreement (Muro and
Jeffrey, 2008). This therefore suggests that adaptive management will not always be able to create consensus, and it shouldn’t try to force consensus either.

Adaptive management should not limit itself to the pursuit of consensus as this risks of concealing some people’s voices beneath the voices of the more powerful. It should instead be about compromise, about seeing the vested interest of ‘good moorland management’, not only for a carbon agenda but for a combination of other benefits provided in the Dark Peak such as sustaining local livelihoods, farming, tourism, water provision, conservation of biodiversity. Involving all stakeholders can make management more effective and enhance trust and buy-in within the network.

2. Challenge of implementing local knowledge in national or international context

One of the problems with this framework is that it is no one-size fits all solution and therefore adaptive strategies are developed on context specific cases as it is easier to organise, monitor, assess, and also fund. Furthermore, in smaller scales coordinating efforts of stakeholders is much easier than in a larger extent where the complexities and dynamics can get too difficult to map and manage (Gunderson et al, 1995). Another issue is that due to the context specific frame that adaptive governance is developed it can be a challenge to scale-out its lessons and make them relevant to larger cases. What is often an alternative is to draw generalised lessons from multiple cases and build the adaptive strategy on an amalgamation of those building upon the literature around the area under future adaptive management.

3. Restricts decision-making into a technical and managerial feedback practice

In addition, within adaptive governance the focus often relies heavily on producing new knowledge that is building upon science relevant to the problem under investigation. This new knowledge then will be fed into an ongoing policy aiming to continuously improve the policy and its outcomes. This in itself suggests a focus of adaptive governance on the technical and managerial aspects of learning.

4. Unclear/ambiguous who will benefit from adaptive governance’s resilience
Within an adaptive governance paradigm the policy problem becomes one of addressing inconsistencies between evolving multiple goals and the achievement of past and future outcomes. This contrasts with a centralised expert management paradigm in which the goal is to meet predetermined and unchanging scientific targets. In the notion of adaptive governance, the characteristics of the environmental problem are the ones used to develop relevant scientific methodologies and tools for investigation, rather than policy problems being redesigned to fit available scientific methodologies. Under adaptive governance science serves rather than dictates the information needs of policy makers and resource users, facilitating ‘critical deliberation’ between scientists and resource-users to integrate local knowledge (Dietz et al., 2003; pg 1910). (from Pahl-Wostl, 2007)

7.5 What of the future?

Adaptive management is about policy experiments and learning-by-doing as new knowledge and information is fed into the policy-making cycle. It is therefore important to consider the possible future scenarios confronting the Dark Peak. Following from the previous section in which examples from successes and limitations of an adaptive framework in the Dark peak were discussed, this section will therefore offer some reflections on the likely future of the Dark Peak uplands under a ‘business-as-usual’ mode and under a prospective UK Peatland Carbon Code.

7.5.1 Business-as-usual

In the context of the Dark Peak, business-as-usual would involve the continuation of levels of upland hill-farming supported by pre-reform Common Agricultural Policy (CAP) type subsidies. This possibility is based on the current trends observed while doing research in the Dark Peak and consulting the literature. It assumes that it would be possible to halt and potential reverse the decline of upland farming in some areas. The area of land used by land managers under Agri-Env. Agreements (AES) such UpHLS (Upland High Level Stewardship –targeted specifically at rural
activities in the UK uplands) or HSL (High Level Stewardship – targeted at agricultural activities in both lowland and upland areas), or SFP (Single Farm Payments) will remain primarily unchanged from existing levels with small changes towards alternative types of land use. Also, diversification, according to which farmers and gamekeepers are encouraged to scale out from land managing activities towards tourism, education, or other environmental stewardship alternatives such as managing for more biodiversity conservation or carbon budgets reduction), is expected to open the avenues of income flow through a reduced reliance on farming for cattle or sheep or game. This diversification under a business-as-usual model would continue at current levels with small levels of marketing, and that would mean that the majority of farm incomes would flow away from agricultural production. There would be restricted controls on the use of pesticides and other chemical enhancers. There would also be restrictions on farming practices on environmentally protected grounds (i.e. moorlands under SSSI’s and AOAB), such as limited burning, which would only be allowed in areas designated by the land owners and Natural England. The focus would be on production and commercial outputs with relatively intensive farming activity to secure the local livelihoods (Arblaster, 2009).

My research suggests that this would be the preferred scenario for local communities of farmers and gamekeepers which also resonates with the literature on why a status quo scenario is usually preferable and why stakeholders tend to resist change (see Samuelson and Zeckhauser, 1988). Certain elements of my research support the claim in this literature that this preference is due to peoples’ natural aversion to take risks and embrace uncertainty.

‘I’ve been a farmer all my life, that’s what I know how to do best…. I am not interested in managing carbon… I am not convinced how this will help us for the better… at the end of the day we run a business here and farming is what we know how to do best to run this business. Carbon is still based on flaky science and there’s too much risk…’ (Land manager 1, 2010).
Yet with the current interest by powerful stakeholders in the carbon agenda (MFFP, University of Manchester, NT, NE, RSPB), and its strong benefits to other ecosystem services such as biodiversity conservation and water quality improvement, it seems unlikely that this scenario will continue for long. The carbon agenda is appealing to those stakeholders for many reasons, and primarily because it will increase the chances of having more investment and funding flowing in their area of expertise.

7.5.2 UK Peatland Carbon Code

The work of the Sustainable Uplands team with experimenting on adaptive learning and stakeholder engagement for natural resource management in the Peak District concluded with the development of a pilot UK Peatland Carbon Code. This Code was launched in a trial and error mode by DEFRA in June 2013 with the broad objective of raising enough interest and investment among the corporate sector to invest in peatland restoration project across the PDNP. The Code has a lot of potential in terms of promising to achieve flows of funding for peatland restoration, by directing the funding directly to rural communities, which is claimed to be in the form of rewards for managing for sustaining and storing the carbon produced in these upland moorlands:

‘The Code gives corporations the opportunity to sponsor UK-based projects linked to their brands as part of their Corporate Social Responsibility portfolio, with the potential to turn these investments into future assets if it becomes financially viable to trade the carbon on the international voluntary carbon market. The Code also provides an opportunity for land-owners and managers to generate financial rewards from restoration and sustainable land management.’ (Sustainable Uplands website, 2012)

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2 Funded by the Rural Economy and Land Use programme (UK Research Councils with DEFRA and SEERAD) as part of the Sustainable Uplands project (RES-227-25-0001) a team of researchers constituted by Mark Reed, Klaus Hubacek, Cristina Prell, Claire Quinn, Lindsay Stringer, Anil Graves, Norman Dandy, Helena Posthumus, Joe Morris, Evan Fraser, Mette Termansen, Joe Holden, Sarah Buckmaster, Pipa Chapman, Nan Lin, Mike Kirkby, Brian Irvine, Bill Kunin, Stephen Cornell, Dan Chapman, Tim Burt, Fred Worrall, Gareth Clay, Sigrid Stagl, Ioan Fazey, Anna Evely, Jan Sendzimir, and Aletta Bonn.
If this is to be considered as a formal avenue to help carbon management and
moorland management in UK peatlands then there are some points that needs
serious consideration as they appear to contradict each other. The Code mentions
that funding will go directly to the agricultural communities, yet in the same text it
mentions that the funding ‘during the pilot scheme will go to the landowning
environmental charities like the RSPB, and the Wildlife Trusts who have long
wanted to restore their land but lacked the resources to do so’ (Reed, 2012 via
Sustainable Uplands website). Furthermore, the Code adamantly stipulates it is not
just another offsetting scheme, yet in a promotional video the creators confirm that
companies will be able to offset their emissions (although not during the pilot
phase and only under the approval of the Code’s Steering Committee (Reed, 2012)).
There seems to be a lack of transparency however as there is no clear indication yet
as to how local rural communities, landowners, businesses, and other relevant
stakeholders will benefit. This Carbon Code has also received criticisms from
members of the Academic Institutions and Consultants arguing that

‘if your project doesn’t particularly involve revegetation of bare soil then there is
originally no value for you there. So basically, the land managers in the Dark Peak,
and the game keepers will not benefit that much from the Carbon Code’. (Scientist
5, 2012).

Furthermore, the responsibility for carbon sequestration is chiefly placed in the
hands of the market and therein lies its potential danger. A market-based approach
when managing for natural resources risks reducing the ‘value’ of the resource, and
in this case of the peatland and the moorlands, into a monetised figure although it
should be noted that monetary value appears to provide the strongest practical
basis of consensus in the Dark Peak (as discussed above). There is an abundance of
critiques in the literature on the commodification or neoliberalisation of nature
(Harvey, 1974; Castree, 2003; Swyngedouw, 2004; Kaika, 2005; Evans, 2012; Wilson,
2014)

On one hand, Land managers have expressed their concern as the agreed that the
moorland and the peatlands are so much more than their ‘value for carbon’ and
even if further payments for managing for carbon budgets were available they fear that a new Code would add to the management complexity and restrict even more their activities. Whereas on the other members of the environmental guardians are very keen on receiving the Code’s support as it promises to deliver carbon mitigation on the basis of biodiversity conservation. Also according to the creators of the Code the pilot phase, which is the current one, will direct the initial flows of funding to landowning conservation groups such as the RSPB and the Derbyshire Wildlife Trust which unarguably would see their avid support.

However, as is the case with any form of natural resource management there needs to be critical consideration as to how this market-based approach will affect the local society and change the landscape. As has been argued by Kaika (1996) in her work on the Water Framework Directive (WFD):

‘The increasing involvement of the private sector in water management adds an extra complication, while the role of the central state remains instrumental, thus making the formation of social capital a three-part process between the state, civil society and the private sector (the market)’.

Will this turn the Dark Peak and the rest of the UK peatlands into large carbon farms where land managers will take on the role of ‘New Age farmers’ (Land manager 5, 2010), forgetting their traditional skills and managing for environmental conservation and climate change? Will the business sector find such appeal that it will start purchasing land in bulk to offset parts of its pollution? The flaws of the carbon trading and offsetting market are abundant and also led to the official collapse of the European Carbon Trading System in 2012. How can then the Code promise to create carbon credits that will be tradable? How can it ensure additionality\(^3\)? Rural land policies in the last decade are increasingly encouraging extensification of upland hill farming and promote farm diversification. Caution

\(^3\) According to Valatin (2011: p. v) ‘Additionality is the concept is used in a climate change context to mean net GHG emissions savings or sequestration benefits over and above those that would have arisen anyway in the absence of a given activity or project’.
needs to be made that the Code does not encourage intensification of carbon
management for the business sector at the expense of local livelihoods.

Finally, before dismissing this approach as a tool to be avoided it needs to be
acknowledged that this Code was the product of an adaptive learning approach that
connected stakeholders across levels and scales, enabled knowledge exchange and
co-production, and facilitated social learning in a learning-by-doing process (Bain et
al, 2011). Furthermore, should this Code come into force this would be an excellent
opportunity and challenge to further its capacity as an adaptive management tool.
Will it allow new knowledge to be fed iteratively into the learning loop by
continuously engaging stakeholders? As supported by the notion of adaptive
management, a change may be brought about for instance by alterations in
external markets, shifts in property rights, and new government legislation or policy
(Folke et al, 2005). We cannot predict such changes in advance, and it remains to be
seen how they will affect the adaptive capacity of the Dark Peak, or any other
peatland socio-ecosystem in the UK.

7.6 Enhancing Adaptive Management

It is necessary for mutual learning to be enhanced among all the Dark Peak
stakeholders in order to mitigate uncertainty. If different viewpoints are respected
and allowed to be expressed in open dialogue then mutual learning can take place
(Reed, 2008). This not only has the potential to transform adversarial relationships
among stakeholders (such as the Moorland Association and RSPB, or Land
managers and RSPB, or Land managers and NE) but can also enable stakeholders to
work more collaboratively. Collaborations of this kind can in turn provide a sense of
ownership over new knowledges produced, and policy informed by the resulting
new knowledges will have great potential for long-term support and active
implementation (McCrum et al, 2009; Glass et al, 2013).

It is argued by members of the Government Agencies and Environmental Regulators,
Utility Companies, Environmental Guardians, and by some Academic Institutions
and Consultants that for Land managers to comply ‘they need more persuasion and
more evidence to realise that some of their practices such as burning are
potentially harmful to ecosystem services such as carbon and water and should be stopped’ (YW interviewee, 2010). As has been argued in chapter 6, however, the implications of this persuasion are perceived differently by each member of the social network. For the Government Agencies and Government Regulators such as Natural England, the implication may be tighter regulations; for Utility Companies and Environmental Guardians (both of whom are major land owners in the Dark Peak) it can mean a combination of tighter regulations, threats to use enforcement or in some instances even a threat to raise the rent. Academic Institutions and Consultants provide the supporting evidence for this but as is the case with science there are contradicting results which add confusion to making set decisions for particular land management practices.

On the other hand, Land managers who hold substantial knowledge from accumulated experience working on the moorland argue that controlled burning could render the land less prone to wildfires, whose damage can be irreversible; an option which if properly communicated across policy-makers and scientists could potentially result in a future positive collaboration between all members of the network. Land-managers feel their expertise and knowledge is undermined when in reality it could add great value to future research and policy-making as ‘at the end of the day we all want the best for the land’ (Land manager 1, 2010).

That is not to say that future Agri-Environment Schemes (AES) should be designed only according to lay knowledge, but only that they should more considerate and sensitive to the needs and livelihoods of a community that has been given the great responsibility of providing food and the conservation of environmental goods in a declining economy in which it is becoming increasingly challenging to sustain their own livelihood. For adaptive management to be enhanced in this context would not only require mutual learning and collaboration in the design of new agricultural policies but also *compromise*, which is not the same as ‘consensus’. Adaptive management should not limit itself to the pursuit of consensus as this risks of concealing some people’s voices beneath the voices of the more powerful. It should instead be about *compromise*, about seeing the vested interest of ‘good moorland management’, not only for a carbon agenda but for a combination of other benefits
provided in the Dark Peak such as sustaining local livelihoods, farming, tourism, water provision, conservation of biodiversity. Involving all stakeholders can make management more effective and enhance trust and buy-in within the socio-ecological system.

Government Agencies and Environmental Regulators and Land-managers argue that there is an undeniable role for the scientific community (Academic institutions and Consultants) to communicate the evidence on best practices and on the best ecosystem services that are provided by the peatlands such as water, carbon, and biodiversity.

‘It is essential that we are following science for robust evidence, but at some point that has to be communicated and translated into management actions and I think both need to inform one another’ (MFFP interviewee, 2010). Stakeholders seemed keen on managing for a carbon agenda as long as they were provided with convincing and robust evidence that would not jeopardise the current ecosystem services their land provides nor risk their in-between relations as well as with their suppliers. The role of institutions like MFFP is to enable stakeholders to come to an agreement on the figures concerning carbon, and then facilitate a debate on how to test different management options as has been argued by their interviewee.

This will require each stakeholder group to be informed of the needs of the rest of the members, and have to have space to discuss and reach an agreement on the extent to which everyone’s needs can be met for effective land management within the Dark Peak and finally, to agree on management actions. For example, many existing land-use management practices such as burning, grazing, forestry and recreation are not under present circumstances compatible with carbon sequestration. It is vital to be unambiguous about the objectives for several land-management practices, while also retaining room for compromise. If the main objective is carbon sequestration, for example, it is inevitable that any workable policy agenda will require ‘compromises and [will have to] accept that stakeholders may not be able to achieve all their objectives all of the time in all the places that they would wish to’ (YW interviewee, 2010). Further, it appears that the scientific
community holds a slightly distorted perception of the status quo within the land-managing community, as according to two members of different scientific institutions, when it comes to land management ‘foxes cross and grouse cross boundaries but for carbon there is no boundary crossing so there is no collaboration...there is no consensus needed...everybody can do whatever they want basically’ (Land manager 1, 2010).

The final critical issue identified as necessitating communication is that of the ‘value’ of carbon. Many disparate stakeholders agree on this point, and it could therefore potentially be a great driving force in learning how to manage for carbon, and in reaching a consensus on the best carbon management practices as ‘politically money talks to people’ (PDNPA interviewee, 2010). The general argument is that ‘everyone can relate to’ money and the majority of ‘people find it very hard to value something purely from an aesthetic standpoint’ (EA, 2010). Furthermore, according to the majority of stakeholders, it is also the means that will raise ecosystem service management to a whole new level when it comes to protecting, restoring and sustainably managing the peatlands. Therefore, it is necessary ‘to translate science into words that are coherent and comprehensible by everyone’ but equally to ‘respect and consider everyone’s views’ (MFFP interviewee, 2010). The necessity for creating more resilient knowledge paths that allow mutual learning between disparate stakeholders is therefore crucial. Adaptive management can enhance collaboration among these different actors through mutual learning from one another, but must also allow for experimentation on land-management practices in order to find the most suitable one that will meet the majority’s needs. These initial steps could pave the way towards a more resilient socio-ecological system that will be able to tackle and mitigate climate change at a local level.

7.7 Conclusion

This chapter considered how an adaptive framework can help the Dark Peak to operate under the complexities and discrepancies produced by its carbon agenda. In doing so the chapter explored how the Dark Peak has exhibited features of
adaptive capacity: 1) knowledge is transferred and exchanged among all key stakeholders, 2) the key stakeholders have the capacity to interpret and comprehend knowledge, 3) for change to take place knowledge needs to be accessible and comprehensible by all key stakeholders. The chapter then moved on to explore the mechanisms for adaptive management met by the Dark Peak socio-ecological system such as the importance of social learning, of knowledge brokers, and of knowledge co-production by providing relevant examples from the Dark Peak stakeholders.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>Ability to adapt to drivers of change</td>
<td>‘Learning-by-doing’ may risk reducing local politics</td>
</tr>
<tr>
<td>Embedded institutions</td>
<td>Challenge of implementing local knowledge in national or international context</td>
</tr>
<tr>
<td>Connects institutions to ecosystem knowledge</td>
<td>Restricts decision-making into technical-managerial feedback practice</td>
</tr>
<tr>
<td>Enhances resilience of the social ecological network</td>
<td>Unclear/ambiguous who will benefit from this resilience</td>
</tr>
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Table 7-1: The strengths and weaknesses of the Dark Peak socio-ecological system under Adaptive Governance.

Furthermore, this chapter discussed the possibilities and limitations for adaptive governance in the Dark Peak, linking them to case studies across the world to provide for a comparison within an international context. These points are summarised in table 8 as the strengths and weakness of adaptive governance. Finally, chapter 7 offered insights into the future and how the landscape would change under the potential new UK Peatland Carbon Code.
CHAPTER 8 CONCLUSION

8 Introduction

Increasingly environmental problems of conservation, social welfare, and climate change cannot be managed effectively by command-and-control strategies. Our ecosystem, which is characterised by complexity and constant change, interacts with society at multiple-scales, creating a vast array of probable effects from any management and policy practice. Therefore new modes of governance are required that are adaptive and that acknowledge this interplay as a socio-ecological system and accept its convoluted regimes. Climate change poses a particularly prominent and urgent case of the need for new governance mechanisms of this kind. To this end, this thesis has examined the potentials of ‘adaptive’ modes of management, through the case of the Dark Peak of the Peak District National Park, Britain’s first national park. The Dark Peak provides an excellent example of a complex socio-ecological system with a history of conflicting knowledges and interests, a web of diverse policies and management activities, a tangled mesh of property rights regimes, and a landscape profoundly implicated in the governance of carbon emissions to mitigate climate change.

The Dark Peak is part of the UK’s largest carbon store, and is in danger of turning into a carbon source. As such, understanding and unpacking its carbon agenda is both interesting and crucial. In contrast to other similar case studies such the Sustainable Uplands project for RELU that looked into identifying broader stakeholder groups with an interest in natural resource management in the Peak District National Park, this thesis’s key original contribution is that it has employed the carbon agenda as an agent which restructures the Dark Peak’s social network. The thesis applies methods that allow to identify emerging actors and to develop a better understanding of how old and emerging key stakeholders adopt and respond to the carbon agenda., it also explores how an adaptive framework can be useful in managing and governing the complexities that such an agenda creates.
The aim of this concluding chapter is to summarise the results of this PhD research by providing a brief synthesis in section 8.1 of the findings from the empirical chapters 5, 6, and 7 before considering its empirical (section 8.2), theoretical (section 8.3), and methodological (section 8.4) contributions. Finally, section 8.5 will conclude this thesis by providing recommendations for further investigation.

8.1 Synopsis of the thesis’s empirical findings

Each of the thesis’s empirical chapters addresses respectively the three research questions. Chapter 5 discussed the first research question: ‘How does the carbon agenda re-structure the Dark Peak’s social network?’ The chapter began by briefly listing the role of each key stakeholder under their stakeholder group. These were identified as follows: Government Agencies and Environmental Regulators, Academic Institutions and Consultants, Utility Companies, Environmental Guardians, and Landowners and Land Managers. Building on the social network analysis set out in the previous chapter, this chapter then continued by examining the role of each key stakeholder as well as their position within the social network. The chapter delved into the patterns through which the relationships of stakeholders were organised into the network. It was argued that social network analysis (SNA) provides important insights into environmental governance. By shedding light on the way stakeholders in the Dark Peak connect with each other, SNS allowed me to trace the relationship avenues (or ties) through which knowledge travels through the network. This was also illustrated in the SNA graph (Figure 4.5 p.103) that was produced by processing the interview data. There is abundance of communication ties in the Dark Peak yet the majority is one-directional (red lines), suggesting top-down knowledge transfer and hence limited instances of mutual social learning (green lines) among stakeholders. In addition, there is also an abundance of relationship ties that are lacking in trust, which is a necessity for in-depth dialogue when managing complex environmental issues, as good communication can lead to conflict resolution. Among the key stakeholders there are 6 actors that stand out as being the most influential or ‘powerful’ in the network. These are Natural England, Moors for the Future Partnership, Peak District National Park Authorities,
Landowners and Land Managers, National Trust, and RSPB. Their influence, or ‘power’, stems from holding ties with the majority of stakeholders, and therefore according to social network theory this allows them access to diverse pools of knowledges (scientific, policy, conservation, tacit/lay). In other words they have the ability to act as ‘knowledge brokers’ of the carbon agenda and connect stakeholders with each other or just allow access to these disparate pools of knowledge. Just as every coin has two sides so does the power of knowledge brokers, as they also have the ability to withhold or manipulate information to their advantage. Revealing the weaknesses of the social network naturally leads to questioning the underlying structure of the issues with managing for a carbon agenda, as was then considered in chapter 6.

Chapter 6 addressed the second research question: ‘How do the Dark Peak stakeholders adopt and respond to the carbon agenda?’ This was pursued through a consideration and exploration of the key challenges for managing the Dark Peak’s peatland moorlands for carbon. Data analysis identified three key themes that contributed to these difficulties. The first was the controversial subject of controlled heather burning, a practice historically favoured by farmers and gamekeepers that was initially introduced by government’s agricultural policy. This has now become an issue of great concern due to its potential future impacts on degraded land, and the Dark Peak’s carbon stores. This has further complicated land management and policy decisions, due to the scientific uncertainties linked with its benefits and dis-benefits, the polarised interests between ‘pro-burning’ stakeholders such farmers and gamekeepers, and the Moorland Association, and ‘no-burning’ actors such the Environmental Guardians, some members of the Academic Institutions and Consultants, and Utility Companies. Second, the increasing demand for funding was a concern for all stakeholders. Stakeholders’ responses were analysed with regards to the recent ‘carbon push’ and the chapter investigated how this potential new funding opportunity has affected their views and activities. Finally, this chapter discussed how the existence of different types of stakeholder knowledges with seemingly different objectives in moorland management caused further conflict when negotiating a carbon agenda in the Dark
Chapter 6 then concluded by arguing that an adaptive framework in this convoluted socio-ecological landscape could contribute to managing the Dark Peak’s ecosystem in the face of constant uncertainty. Success, however, would have to build upon successful integration of knowledges, the facilitation of the key knowledge brokers and flexible institutions open to experimentation with the incorporation of these knowledges into current and new agri-environment policies.

Finally, chapter 7 considered how an adaptive framework can help the Dark Peak to operate under the intricacies and disagreements generated by its carbon agenda. In doing so the chapter argued how the Dark Peak has displayed elements of adaptive capacity: 1) knowledge is transferred and exchanged among all key stakeholders, 2) the key stakeholders have the capacity to interpret and comprehend knowledge, 3) for change to take place knowledge needs to be accessible and comprehensible by all key stakeholders. The chapter then moved on to explore the mechanisms for adaptive management met by the Dark Peak socio-ecological system such as the importance of social learning, of knowledge brokers, and of knowledge co-production by providing relevant examples from the Dark Peak stakeholders. Following on, chapter 7 analysed the opportunities and challenges for adaptive governance in the Dark Peak linking them to case studies across the world to provide for a comparison within an international context. These points where then summarised as the strengths and weakness of adaptive governance and presented in table 7.1 at the conclusion of the chapter. Finally, chapter 7 offered insights into the future and how the landscape would change under the potential new UK Peatland Carbon Code.

Furthermore, it has provided a deeper understanding of the power of knowledge brokers in the Dark Peak to facilitate social adaptation through mutual learning, and knowledge co-production, and ecological adaptation through improving land management practices (such as ‘cool’ heather burning which is burning when the soil and vegetation are still damp to avoid drying out and damaging the peat soil) and introducing new ones (such as peatland revegetation, and gully blocking). Secondly, this thesis presented a critical reflection on the potentials and limitations of adaptive governance as a practically-oriented theoretical approach. It also
provided an innovative synthesis of natural and social sciences in the analysis of a complex socio-ecological system. And thirdly, this thesis has employed a combination of social network analysis (SNA), stakeholder mapping, participatory observation and semi-structured interviewing to generate a comprehensive list of the key stakeholders in the Dark Peak affected by and driving the carbon agenda.

The following sections will now address the three contributions of this research beginning with section 8.2 where the empirical contributions will be discussed.

8.2 Empirical contribution

This thesis sought to understand how the social and ecological elements coalesce with regards to managing a carbon agenda in the Dark Peak of the Peak District National Park. This has been the first research to conduct social network analysis with regards to a carbon agenda in the UK. In addition, this research has contributed to the understanding of knowledge brokers and their power to facilitate social and ecological in the Dark Peak. The two empirical contributions will now be considered in further detail in the following paragraphs.

8.2.1 Social Network Analysis (SNA) on the Dark Peak’s carbon agenda

This research has employed SNA to map and investigate the patterns of the Dark Peak’s key stakeholder relationships. Analysis in combination with qualitative data revealed the strengths and weaknesses of the Dark Peak’s social network under managing for a carbon agenda.

This study identified the key stakeholders within the case study area, traced and explored the connections among them through the lens of operating with a carbon agenda. This study then sought to investigate how these key stakeholders respond to this carbon agenda and what changes to management and governance this has created. This directly addressed the first part of the thesis’s aim: to understand how the carbon agenda drives the management and governance of the Dark Peak. The second part of the aim is addressed under the theoretical contribution where the opportunities and limitations of an adaptive framework discussed in chapter 7 are summarised.
Beyond academic understanding, however, another contribution of the research presented in this thesis has been to actively contribute to local policy debates and stakeholder engagement processes. The research was partially funded by Moors for the Future Partnership (MFFP) in 2009, and in 2010 preliminary results from SNA, interviews, and analysis were presented in a report that contributed empirically to MFFP’s knowledge exchange forums to highlight the need to integrate more tacit local knowledge within local environmental agendas and policies as well as initial stakeholder responses to the carbon agenda (Evans et al, 2010).

As discussed in chapters 4 and 5, analysis has revealed that there are five key stakeholder groups in the Dark Peak with an interest in the carbon agenda. These have been identified as Government Agencies and Environmental Regulators, Academic Institutions and Consultants, Utility Companies, Environmental Guardians, and Landowners and Land managers (see Figure 4.2 p.76 chapter 4). The stakeholders in the above groups have been found to operate and connect with other key stakeholders at multiple levels and scales spanning from the local-local (Land managers - Land managers), to local-regional (Land managers – Peak District National Park), to local-national (Land managers-National Trust), to local-international (Land managers-University of Manchester), to regional-regional (MFFP-Peak District National Park), regional-national (MFFP-NT), to national-national (Environment Agency-United Utilities), to national-international (Natural England-IUCN), and international-international (University of Leeds – IUCN).

At first the role of each actor in each of the five key stakeholder categories was briefly considered to provide an understanding of each stakeholder’s background and role. Drawing from Social Network Analysis theory, this research investigated the role of each of the five key stakeholder groups and examined their position within the social network. Furthermore, chapter 5 delved into the patterns the relationships of stakeholders are organised into the network.

Social networks are significant in providing insight in environmental governance, and by gaining an understanding of how the stakeholders in the Dark Peak social network relate to each other the researcher can trace how knowledge travels
through the social relations of the network. The quantitative outcome of social networks analysis was presented in Figure 4.5 p.103 where red ties represented one-way communication, whereas green ties indicated mutual communication. Social Network Analysis revealed a rather complicated network, which was expected after referring to the literature review and interviewing process. Nonetheless, an important and encouraging aspect is that all stakeholders are well connected with each other and no one is left outside the network. Additionally, in SNA terms, the Dark Peak is a low centralisation network which means that communication ties are more evenly distributed and do not rest only between a select few stakeholders. This indicates that the Dark Peak social network already has some well-established communication ties.

There is a considerable amount of knowledge regarding carbon budgets, and their management, produced and transferred across the network which also suggested that there is great interest in the carbon agenda. It can also be inferred that in the face of many drivers of change or random failures many stakeholders or communication ties can collapse while allowing the remaining actors to continue reaching one another through alternative network paths. The ones that are more likely to collapse are stakeholders linked with ‘weak ties’ (thin lines in Figure 4.5 p.103), such as between the RSPB and the Moorland Association or the Land managers and United Utilities, as they are lacking in trusting qualities due to their on-going conflict over heather burning. It is in cases as such that the power and contribution of knowledge brokers such as MFFP in stakeholder engagement processes and knowledge exchange is extremely significant as will be discussed in the following section 8.2.2. With regards to ‘weak ties’ this by no means aims to suggest that they are of lesser importance rather that stakeholders connected this way may be less likely to trust one another, yet these ties are very beneficial to communicate and disseminate simple knowledge among dissimilar people.

In addition, the ties that are less likely to collapse are the ‘strong ties’ (thick lines in Figure 4.5 p.103), which again does not suggest they are more desirable or effective compared to the ‘weak ties’ rather that they are beneficial to communicate and disseminate complex knowledge and that the stakeholders connected with such
ties trust each other and are therefore more likely to influence one another. The existence of an abundance of strong ties among the Dark Peak stakeholders such as Natural England and DEFRA, The University of Manchester and The University of Durham, The University of Manchester and The University of Leeds to name but a few, implied that there is some form of social learning and participation in knowledge production and exchange already taking place. However, stakeholders’ engaging in social learning alone does not necessarily entail or warrant that there is also knowledge co-production (Reed et al, 2010).

In the Dark Peak network, analysis revealed that Natural England (NE) has the most direct connections in the network (see Table 5.4.5 p.100), making them the most active stakeholder in the network. NE’s influence and power comes from being in a position of authority and in charge of dealing with local and national policy. This also allows NE to influence the government’s decisions (DEFRA) and therefore lending NE the power to mobilise the network.

The second most influential stakeholder is MFFP who appeared to share an almost equal balance of strong and weak communication ties making them a valuable member of the network. MFFP’s balance of ties allows them to diffuse information directly to the large majority of the Dark Peak network. They hold strong ties with Academic Institutions and Consultants that allows them to build their conservation actions chiefly on scientific data. They also hold strong ties with Government Agencies and Environmental Regulators such as the PDNPA through informing local policy such as the Peak District National Park Management Plan (PDNPA, 2013). Additionally, their weak ties with actors such as the Land managers suggested they bridge dissimilar stakeholder through their knowledge-sharing activities as will be discussed in more detail under the next section of knowledge brokers.

The third stakeholder with great influence in the area is the PDNPA whose influence and ‘power’ in the Dark lies within its delivery partners such as the National Trust, Natural England, RSPB, Utility Companies, and MFFP. The PDNPA’s ties in majority are non-reciprocal (red in Figure 4.5 p.103) which suggested the stakeholder’s top-
down approach to communication perhaps also due to its structural position as a body of authority.

In addition, the National Trust (NT), fifth in centrality as revealed by the analysis (see Table 4.5 p.100), appeared to share stronger connections with the three out of four Government Agencies and Environmental Regulators (NE, EA, and PDNPA) which supported the interview data that all these stakeholders favour conservation activities over heather-burning when it comes to land management in the Dark Peak. What was of surprise in the SNA graph was the seemingly strong ties among the NT and its tenants, the Land managers. The interview data revealed a series of complaints and conflicts shared among these two stakeholders that relying solely on the SNA graph would have been concealed.

Moreover, the RSPB has been identified through analysis as belonging to the highly influential stakeholders. The ties shared between the charity and the NT were expected to be stronger due to their similar views on conservation in the area, yet according to the literature their collaboration had only recently commenced and perhaps it was too early to be captured by the SNA graph. Also, the RSPB indirectly influences government rural policy through its strong ties with its tenants such as United Utilities (UU) and Yorkshire Waters (YW). This suggested that in the case of UU, the RSPB manages 50% of UU’s land in the Dark Peak which makes the charity a significant influence on the water company regarding the best ways to manage the land.

It might appear that the more links a stakeholder has the better but this is not always the true as highly connected actors may consider themselves trapped among two or more differing views and may feel obliged to take sides (Prell et al, 2009a; Prell et al, 2009b). The key here lies in where those connections lead to and how they connect the otherwise unconnected. This now leads us to section 8.2.2 where such connections, in other words knowledge brokers, bridged the otherwise disconnected stakeholders through facilitating processes where social learning, knowledge and even co-production took place in the Dark Peak. According to the
theory of adaptive governance, all these three elements are core for enabling a
system to adapt to change, and the Dark Peak seems to have that capacity.

8.2.2 The power of knowledge brokers in facilitating adaptation

In the case of the Dark Peak the power to mobilise and facilitate adaptation has
been found to rest with highly influential stakeholders who have been proven to
have the ability to broker knowledge across various scales and levels. They have
been observed to contribute with initiative, energy, motivation, and enthusiasm for
what Smith (2009) has called a ‘risky endeavour’. The knowledge brokers that have
been examined in this thesis are Natural England (NE) and the Peak District National
Park Authorities (PDNPA) who with their regulatory powers have the ability to
facilitate social and ecological adaptation by developing and putting to force rural
policies.

Also, with Environmental Guardian Moors for the Future (MFFP) who contribute to
social adaptation by providing the main spaces for knowledge exchange and social
learning among the key stakeholders; they also engage in ecological adaptation
initiatives through co-producing knowledge to improve land management in the
Dark Peak such as peat revegetation and gully blocking. MFFP has been engaging in
collaborative knowledge production projects with the majority of stakeholders,
ranging from all members of the Academic Institutions and Consultants, to National
Trust, RSPB, all the members of the Government Agencies and Environmental
Regulators, all the Utility Companies, and the Land owners and Land managers’
group. This therefore makes them the most crucial knowledge broker whose efforts
have benefited the Dark Peak socio-ecological system in a deep level as discussed
previously in chapter 7.

Furthermore, the next knowledge broker was the University of Manchester which
contributes by providing a great deal of natural science that aims to improve land
management activities whilst improving the ecological condition of peatlands. This
is achieved through experimenting with different projects on the Dark Peak
peatlands, from the soil, to the underground hydrology, to air pollution, and
wildfire, a lot of which is done collaboratively with MFFP and other Academic
Institutions and Consultants such as The University of Durham, as well as Natural England, and United Utilities to name but a few. Furthermore, the University of Manchester also contributes to social adaptation through knowledge exchange projects such as FIRES (Fire Interdisciplinary Research for Ecosystem Services) and its successor KfWf (Knowledge for Wildfire) which focus on advancing wildfire and controlled burning knowledges by connecting the Dark Peak stakeholders to each other and also to others in a regional and national scale.

Finally, the Land managers have been identified as an influential knowledge broker. Their contribution however is limited in the local scale, as they broker knowledge among each other. For example individual farmers and gamekeepers (who cannot be named due to anonymity reasons) have been engaging in fostering social learning and knowledge brokering such as through consulting and advising other farmers and gamekeepers either on issues regarding their land management practices such as methods and tips on how to conduct ‘cool’ heather burning or on how to construct their Environment Stewardship Agreement to meet their needs. These key individuals seem to have the enthusiasm and initiative to not only liaise with other local Land managers but due to their links and connections act as representatives and broker their knowledge to the other key stakeholders. Sometimes reaching as far as the media where they will also partake in newspaper interviews and try to raise more awareness of the issues Land managers are faced with today, such as from conflicts and disputes with the largest tenant the National Trust and its declining interest to support livestock production in the uplands, to concerns about the changing nature of policy-makers’ views on turning farming into an environmental stewardship role rather than food provider. On the one hand, what has been voiced strongly is their complaint of not being treated as partners, and rather than being involved in discussions that collaboratively decide how change should take place in the uplands (the Dark Peak included) the ‘decisions have been passed down to us and we just have to deliver’. On the other hand, Landowners and policy-makers argue that there is ‘extensive consultation with the land managers’ which suggests that either this is an understatement or that there is not enough knowledge integration which leaves Land managers feeling uninvolved.
and their skills and expertise unacknowledged as has been discussed in chapter 6.

In other words the local tacit knowledge of Land managers is not reflected enough in upland decisions and policies and therefore they feel marginalised and not confident enough to commit to a specific agricultural policy and in this case managing for a carbon agenda.

8.3 Theoretical contribution

This thesis has contributed to theory through its critical reflection on the potentials and limitations of adaptive governance as a practically-oriented theoretical approach. It has also provided an original synthesis of natural and social sciences in the investigation of a multifaceted socio-ecological system such as the Dark Peak. Using Table 7.1 (see conclusion of chapter 7) the potentials and challenges of adaptive governance are considered with regards to aiding the Dark Peak cope with the complexities and conflicts brought about by the carbon agenda.

Most notably, this thesis shed light on the stakeholders’ ability to adapt to social and ecological change. Following on from the argument of chapters 5 and 7, the Dark Peak demonstrated the capacity to adapt to social and ecological change. Namely, the socio-ecological system has demonstrated that knowledge is transferred and exchanged among all relevant stakeholders; the key stakeholders have the capacity to understand and grasp this knowledge; and finally, for effective change to take place this knowledge needs to be accessible and easy to comprehend by all stakeholders.

Furthermore, it has also revealed the existence of nested institutions that are crucial for lubricating the machinery of adaptive governance by bridging other institutions and individuals across levels and scales, and with their knowledge brokering skills and expertise enable social learning, knowledge exchange and co-production to take place within the Dark Peak.

Additionally, in adaptive governance terms, a socio-ecological system must have the ability to mobilise the adaptive framework to connect its current institutions to ecosystem knowledge. This is also the case in the Dark Peak where an abundance of
institutions and individuals are connected to ecosystem knowledge, as has been previously argued in chapters 6 and 7. For example, stakeholders such as Natural England and the Peak District National Park Authorities who come from a regulatory authority angle are increasingly acknowledging the need and even including adaptive governance notions (stakeholder engagement, participation, and need for knowledge integration) in their policies and management plans. Yet it still remains to be seen at what level these elements will actually materialise on the ground.

Finally, according to the adaptive framework, adaptive governance can enhance the resilience of the social and the ecological system. In the Dark Peak there have been plenty efforts that could point towards that direction. Examples include, the efforts of the University of Manchester’s knowledge exchange initiatives (FIRES and KfWf as explained in previous chapters 6 and 7) to raise awareness of the impacts of wildfire and the beneficial effects controlled heather burning can have in reducing the fire fuel load and therefore reduce the risk of wildfires. Or by collaborative natural science projects (between The University of Manchester, MFFP, The University of Durham, the Environment Agency, and United Utilities to name but a few) where knowledge around restoring degraded peatland through peatland revegetation and gully blocking can have a positive correlation with maintaining the balance of carbon budgets. And according to resilience, theory a system is regarded resilient when it can bounce back and regain equilibrium or balance after a shock or disturbance as is the case of degraded peatland in the Dark Peak.

Another example draws on the experience and experimentation of local Landmanagers. In particular an individual farmer/gamekeeper in the Dark Peak (who cannot be named for confidentiality purposes) has developed their own innovative method to enable heather regeneration on his previously degraded moorland by a combination of cutting, burning, and wiping the unwanted vegetation followed by sowing heather seed. This individual has developed their own technique on seeds too whereby the seeds are treated in a certain way to improve their germination and prevent attack by midge larvae. After getting approval from his landlord the National Trust (NT) and Natural England to experiment with different restoration approaches this person managed to restore
successfully 6,600 acres of NT-owned land to heather-covered moorland housing stable numbers of red grouse too. This individual is also a key knowledge broker on lay tacit knowledge and has been engaging in knowledge exchange with other stakeholders such as Natural England, DEFRA, and other moorland owners.

The previous examples have demonstrated how adaptive governance focuses on experimentation and learning, and connects research on institutions and organizations for collaboration, collective action, and conflict resolution in relation to natural resource and ecosystem management. Furthermore, they have also highlighted the empirical and theoretical contributions provided by this thesis. The essential role of individuals and institutions that act as knowledge brokers was recognised in this study and their crucial role in diffusing information across the Dark Peak social network, providing spaces and opportunities for social learning and knowledge co-production to take place, elements crucial to support adaptive governance paradigm. Furthermore, the previous examples have shed light in the cross-scale and cross-level stakeholder activities, another crucial element for managing uncertainty through an adaptive framework. Finally, the idea of adaptation suggests the ability cope with change and even bounce back from a disturbance into an improved state, in that sense the elements described in the empirical and theoretical sections render the Dark Peak a resilient socio-ecological systems where adaptive governance has some positive role to play.

8.4 Methodological considerations and limitations

Stakeholders’ engagement in social learning alone does not necessarily imply or guarantee that there is also knowledge co-production (Reed et al, 2010). Furthermore, what the SNA graph cannot reveal is the negotiation for effective social learning among stakeholders, or mutual learning, the deadlocks and dissents that can arise, as well as the occasions where social learning takes place due to resolving or accommodating uncompromising stalemates and disputes. Also obscured is the lengthy process of collaboration which necessitates extensive dialogue between actors with likely adverse outcomes for those whose time is restrained (Rist et al, 2007; Ison et al, 2013).
In addition, using SNA as a method to explore communication ties and relationship patterns may gloss over qualitative dissimilarities in the nature of ties (Prell et al, 2010). For example a relationship tie held between employee-employer such as Land managers-National Trust, or Land-managers-United Utilities is differing from a friendship tie such as Land managers-Moorland Association. This study did not proceed with categorising the stakeholders into friends and non-friends as in doing so this might have insinuated that those who are not ‘friends’ are not friendly or are enemies. The aim was to treat all stakeholders as neutral at the outset and let the data from the SNA, the qualitative interviews, and the grey literature guide my analysis and discussion.

Furthermore, what the SNA graph cannot reveal is the negotiation for effective social learning among stakeholders, or mutual learning, the deadlocks and dissents that can arise, as well as the occasions where social learning takes place due to resolving, or accommodating uncompromising stalemates and disputes. Also obscured is the lengthy process of collaboration which necessitates extensive dialogue between actors with likely adverse outcomes for those whose time is restrained (Rist et al, 2007; Ison et al, 2013). In addition, using SNA as a method to explore communication ties and relationship patterns may gloss over qualitative dissimilarities in the nature of ties (Prell et al, 2010), for example a relationship tie held between employee-employer such as Land managers-National Trust, or Land-managers-United Utilities is differing from a friendship one such as Land managers-Moorland Association. In this project I didn’t proceed with categorising the stakeholders into friends and non-friends as in doing so this might have insinuated that those who are not ‘friends’ are not friendly or are enemies. My aim was to treat all stakeholders as neutral and let the data from the SNA, the qualitative interviews, and the grey literature guide my analysis and discussion.

8.5 Reflections

This section reflects on how the challenges and limitations involved in the completion of this PhD research project can be useful in taking the theory of adaptive management forward in a critical manner. The section also poses these
same limitations as openings for future research, where emerging themes can be explored further either in the form of a post-doc research project and/or in the form of journal article publications.

8.5.1 Lessons from the Dark Peak

I am aware that drawing conclusions from any single case study can be tricky. Nevertheless, some observations (including limitations) drawn from the research conducted for this PhD and the Dark Peak case study can be used as input for other studies that combine social network approaches with adaptive management (Crona et al, 2009; Prell et al, 2009; Ernstson, 2009; Sandström, 2009):

1. Enhancing the avenues of communication amongst stakeholders (in this case, Land managers and Environmental Guardians, such as the National Trust and RSPB) is crucial if improvements in land management are to take place.

2. Integrating disparate types of knowledges, such as scientific and lay, can lead to building more trust in the decision-making process, and increased level of commitment to implementing agricultural policy.

3. Institutionalising a culture of social learning and knowledge co-production stakeholder engagement activities can potentially lead to conflict resolution.

4. Skilled and experienced knowledge brokers, (in this case, for example, Moors for the Future Partnership (MFFP), the University of Manchester, and certain Land managers), are vital to facilitate and sustain bridges among diverse stakeholders and allow knowledge to be diffused across the whole Dark Peak social network.

5. The Dark Peak has adaptive capacity and therefore the ability to support a formal adaptive governance framework. To mobilize this ability, however, the Dark Peak’s institutions themselves would need to shift towards more adaptive regimes. This conclusion is in line with observations by Reed et al (2013) in their Sustainable Uplands project for RELU.
8.5.2 Avenues for future research

Building upon this, a potential avenue for further research would be to assess the adaptive capacity of each key stakeholder. One would have to start by identifying the key stakeholders at that given point in time, and then investigate their willingness to adapt, the conditions they need in order to adapt, how useful adaptation would be for each one, and what each regards as adaptation. This could then be compared with other case studies of adaptive management, drawing from their own lessons of successes and limitations to develop a framework that would apply for the Dark Peak’s unique context.

Adaptive governance is not a one-size-fits-all solution. Building upon the notion of treating policy as a continuous process of experimentation and continuous evolution of the policy new results being raised by the various land management experiments conducted could then be continuously fed into policy. Timeframes should be decided and set collaboratively, Once those have been met, new knowledge obtained through deliberation, dispute, collaboration, and negotiation can be fed into the creation of the new round of policy. Certainly there is an issue of requiring continuous monitoring of these processes, which in turn will require social and financial capital. Perhaps this can be the aim and achievement of the piloted UK Peatland Carbon Code. In terms of adaptive governance, this Code is built upon multiple stakeholder engagement, knowledge co-production, social learning, facilitated by skilled stakeholders of the social network that operate across various levels and scales. It only remains to be seen whether the Code is resilient itself and can actually deliver the adaptive framework.

For a broader context of managing for a carbon agenda the following generalised recommendation can be made. This thesis acknowledges the inherent danger with generalising recommendations, and by no means do I mean to imply that this is a one size fits all solution. I merely wish to suggest that the recommendations below might be of use as a guiding tool to structure future research projects with an aim to attempt an adaptive framework. These recommendations should always be
tailored on the specific context of the case study in a combination of existing
literature in the area and qualitative and quantitative investigation:

- Social learning while doing is key for enhancing knowledge transfer
- Integration of different knowledges is also crucial to create more trust
  and inclusivity in decision-making process
- Skilled and well networked knowledge brokers play a key role in this
- There needs to be more dialogue between the physical and social
  sciences in order to enhance social learning and knowledge co-
  production
- Before creating official adaptive governance frameworks the
  stakeholders themselves need to be carefully identified through formal
  stakeholder identification methodologies. They then need to be
  engaged into meaningful dialogue, facilitated by a skilful and
  experienced knowledge broker in order to consider and agree upon
  what kind of adaption and resilience is the objective, and how this will
  impact and benefit them. Thus creating transparent avenues of
  deliberation and participatory decision-making, key for supporting
  adaptive governance mechanisms.
- No one-size fits all, adaptive management needs to be context specific,
  to allow a governance that will respect and consider all actors’ input

Finally, this is a significant point to be considered at all times: adaptive governance
is not and should not be only about consensus, as this can hide and marginalise less
powerful voices. Consensus here is meant as the condition where all stakeholders
find a new alternative that they all value more than the one they preferred when
entering the deliberation (Dryzek, 1994; Renn, 2001; Stoll-Kleemann and Welp,
2006). For example, with regards to the contested heather burning which often
causes heated debates without any permanent resolution, consensus means
shifting the focus from the controversial issue towards a common objective. In the
case of the Dark Peak, and often in other natural resource management conflicts, this is done by focusing on the lack of funding sources. Consensus then can be reached as it is a undisputed concern that limited flows of resources hinder all stakeholders’ activities. The conflict still remains unresolved however. Conflict is part of the learning process as it allows new knowledge about natural resource management to arise, be considered, and then incorporated into the management process. This by no means suggests that conflict should be encouraged but neither that is should be treated as a dire problem plaguing the Dark Peak. An alternative here for adaptive governance could be reached by focusing on compromise. Compromise in this particular case study is defined as the settlement of a dispute that is reached by each stakeholder group through a process of deliberation and negotiation (Stoll-Klemmann and Welp, 2006). In the words of Renn (2006):

“All parties involved would rather choose the option they preferred before starting deliberations, but since they cannot find a ‘win-win’ situation or a morally superior alternative they look for a solution that they can ‘live with’ knowing that it is the second or third best solution for all of them. Compromising on an issue relies on full representation of all vested interests”

For example, in the Dark Peak there are instances where this has already been the case such as among Utility Companies and Land managers. There are unofficial agreements where a Utility Company will allow the use of some pesticides and heather burning on their land whilst their tenant Land manager continues to deliver biodiversity conservation and manage for better water quality. As stated by one member of the Utility Companies:

“I think burning is very bad for the moorland. However, it is better to accept a controlled level of damage if it gives you the opportunity to influence for the better. If a compromise is reached on this regard and some controlled burning and/or pesticides are allowed, then this will maintain the balance between us and them [the Land managers].”
8.6 Concluding remarks

In summary, this thesis has therefore made contributions in the following three areas: empirically, theoretically, methodologically. This study is one of the first analyses of the social network of a carbon agenda in the UK. Furthermore, it has shed light into the power of knowledge brokers in facilitating social adaptation through enhancing social (mutual) learning, and collaborative knowledge production among the Dark Peak key stakeholders; and in aiding ecological adaptation by contributing to the production of improved land management strategies and introducing new ones. This thesis has provided a critical reflection on the potentials and limitations of adaptive governance as a practically-oriented theoretical framework. Additionally, the thesis has also developed an innovative synthesis of natural and social sciences in the analysis of a complex socio-ecological system. This research has employed a combination of social network analysis (SNA), stakeholder mapping, participatory observation, and semi-structured interviews to develop a comprehensive record of the main stakeholders in the Dark Peak influenced by and steering the carbon agenda.
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APPENDIX 1

Sample Interview Schedule

- How did you come to work in the Peak District?
- Describe your professional role in the Dark Peak.
- How do you understand, value the peatlands and the moorland?
- Who are the key stakeholders (individuals, institutions, businesses) that influence what you do?
  - Where do you agree or disagree with their influence?
- Whom do you regard as authority in the Dark Peak and how do you associate with them?
- What are the key policies you work with?
- Do you create policy?
  - If so how is the role of peatlands in storing carbon being incorporated into policy?
- Has scientific uncertainty hampered the development of a policy for peat or carbon?
  - If so why do you think the UK Peatland Carbon Code has been piloted now when there is still considerable uncertainty over a number of issues in moorland management?
- According to your experience who has the biggest stake in managing for carbon in the area?
  - Why do you think that is?