Institution: University of Cumbria

Unit of Assessment: 17 – Geography, Environmental Studies and Archaeology

Title of case study: Impacts on land management to mitigate climate change through biomass based renewable energies and carbon sequestration.

1. Summary of the impact

The research led by Dr Convery and Dr Weatherall with other staff members within the unit represents a diverse body of work around the practicalities, implications and uptake of land management to mitigate climate change, particularly through application of biomass based renewable energies and also through carbon sequestration. The group have influenced practitioners (particularly within the forestry and farming sectors), community groups developing renewable energy projects, small to medium enterprises (SMEs) involved in renewable energies, and other non-governmental stakeholder organisations, such as the Lake District National Park.

2. Underpinning research

The group has undertaken a diverse research programme around biomass renewable energy, which synthesises approaches from forestry with a social science focus on the practical application and uptake of renewable energy processes by practitioners and communities. The research forms the major strand for the unit in examining interdisciplinary issues surrounding the development of energy policy centred on renewable energy provision in the UK.

Projects have included examining routes for forest management practice to maximise yield, exploration of community-level responses to biomass as sustainable energy and have also extended to land management for carbon sequestration. The work has spanned assessment of eucalypts as UK woodfuel, woody biomass harvesting techniques, techniques for assessing nutrient flow between trees and the soil system, the engagement of farmers with biomass production, and social acceptance of community based woodfuel projects in small rural communities. Research approaches have included both scientific assessment and stakeholder engaged action research, in order to approach the complex issues holistically. The variety of the work reflects the novelty of the biomass research programme in addressing the interdisciplinary nature of the topic and includes economic issues, changing management practices of existing woodlands for woodfuel and the design of new woodlands for woodfuel production.

Specific insights from the research include:

- Assessment of the suitability of eucalypts as a source of woodfuel in the UK, due to their quick growth but limitations in hardiness.
- The implications for biomass forest management due to the negative growth implications of whole tree harvesting on the next generation of trees.
- That intensifying management of woodlands is currently the most effective route to increasing biomass production for renewable energy, due to the fact that a critical mass of incentives for farmers to switch from food production is unlikely to be reached in the short term.
- New methodologies for measurement of carbon sequestration and storage in trees and forests.
- That there is a strong rationale for using action research in relation to community renewable-energy projects, and that engagement with communities is crucial to the success of local renewable energy schemes.
- That public engagement for support rather than leadership of renewable energy projects is more feasible, as community stakeholders perceive themselves as advisers rather than leaders in such projects. Support and frameworks to enact projects are required if community projects are to be successful.
- Community renewable energy projects can raise awareness of a wide range of renewable energy technologies and increase uptake of renewables.

The research took place at the University of Cumbria within the assessment period, and the key researchers were:

- Dr Ian Convery, Lecturer at the University of Central Lancashire (UCLan) from 2003, and at Cumbria following transfer of the Penrith campus and academic unit on the formation of the University in 2007, appointed as Reader in Conservation and Forestry in September 2010.
- Dr Andrew Weatherall, Research Fellow UCLan then Cumbria, Senior Lecturer from Dec 2011.

- Mr Andrew Leslie, Lecturer at UCLan since 1999, then Senior Lecturer at Cumbria and Head of the National School of Forestry from 2012.
- Dr Andrew Ramsey, Senior Lecturer at UCLan and Cumbria from 2001, and Faculty Research Co-ordinator from September 2010 to June 2013.
- Dr Eunice Simmons, Dean of Faculty from August 2007 to July 2010.
- Dr Andreas Ottitsch (Senior Lecturer at UCLan and Cumbria since 2006), and Professor David Robson (Head of National School of Forestry 2008 to 2010 and Faculty Associate Dean 2010 to 2012) were also employed by the University during the research.
- Dr Jenny Rogers was employed in a number of casual academic posts between 2007 and 2012, and undertook a UKERC funded studentship.

3. References to the research

- Convery, I., Robson, D., Long, M and Ottitsch, A. (2012) The willingness of farmers to engage with bioenergy and woody biomass production: A regional case study from Cumbria. *Energy Policy* 40: 293-300. (Impact factor 2.743, cited by 2).
- Leslie, A.D.; Mencuccini, M. and Perks, M. (2012) The potential for Eucalyptus as a wood fuel in the UK. *Applied Energy* 89: 176-182. (Impact factor 4.781, cited by 12).
- Rogers, J.C., Simmons, E.A., Convery, I. and Weatherall, A. (2008). Public perceptions of community-based renewable energy projects. *Energy Policy*, 36: 4217-4226. (Impact factor 2.743, cited by 79).
- Rogers, J.C., Simmons, E.A., Convery, I. and Weatherall, A. (2012) Social impacts of community renewable energy projects: findings from a woodfuel case study. *Energy Policy* 42: 239-247. (Impact factor 2.743, cited by 11).
- Mason, W., McKay, H., Weatherall, A., Connolly, T. and Harrison, A. (2012). The effects of whole-tree harvesting on three sites in upland Britain on the growth of Sitka spruce over ten years. *Forestry* 85 (1): 111-123. (Impact factor 1.677, cited by 7).
- Churchland, C., Weatherall, A., Briones, M.J.I. and Grayston, S. (2012). Stable-isotope-labeling and probing of recent photosynthates into respired CO2 soil microbes and soil mesofauna using a xylem and phloem stem-injection technique on Sitka spruce (Picea sitchensis). *Rapid Communications in Mass Spectrometry* 26: 2493-2501. (Impact factor 2.509, cited by 2).

(Impact factors from journal web-sites, citations from Google Scholar).

Grant funding:

- £60,000 from the Joule Centre at Manchester University to investigate farmer/land owner attitudes towards biomass as an energy option in Cumbria.
- £5,000 from the Forestry Commission for whole-tree harvesting research.
- The work was partially supported through PhD studentship funding (2006, 2007, 2009, 2010) from the UK Energy Research Centre (supported by the Natural Environment Research Council), primarily underpinning research relating to community uptake of renewable energies.

4. Details of the impact

The research undertaken by the group has had a wide range of impacts on practitioners and communities, in addition to some uptake in policy.

Exploration of community level responses from a wide range of stakeholders to issues relating to sustainable energy has had effects on those involved in community action research projects, primarily at Brampton, Eskdale, Witherslack Estate and Askham in Cumbria. The action research approach helped to directly support these specific projects, by catalysing activities and bringing expertise into the project, which has helped these communities to make progress through developing action plans and following through with the implementation of renewable energy solutions to power remote local communities. Through the action research, Thirlmere residents and the Impact Housing Association were provided with a report which outlined the community voice and provided an independent view of attitudes. As a result, additional funding is sought to install a community biomass boiler: the report informed the work and provided a mandate to pursue a scheme. Eskdale had already developed a community renewables scheme and were seeking ways to take the idea forward, whereas the work with Askham centred round a community valuation exercise. Witherslack were seeking ways of understanding the local market for renewable energy products. The research undertaken considered woodland management practice in terms of maximising biodiversity as well as economic benefits in order to engage and benefit local

communities. The work had specific impact through informing silviculture decisions by the estate as an important small business land owner and contributor to the local economy, supporting conservation of ancient woodland and through facilitating community engagement with carbon management and renewable energies. The research programmes were developed and led by staff, and data collection for these projects was facilitated through the use of PhD studentships.

Whilst these specific examples have small localised impacts, the broader findings are applicable to small rural communities globally. The specific impacts have included reducing the barriers to the adoption of woodfuel heating, increased engagement of individuals within communities with sustainable energy issues and with other forms of renewable energy. Further stakeholder engagement has also been gained through dissemination at the University of Cumbria Climate Change Symposium for local sustainability stakeholders in 2009, and at the Rural Entrepreneurship conference in 2011.

In terms of production of biomass, the research has primarily had impacts via stakeholders involved in woodland and wider land management, both those influencing policy, affecting practitioners and directly through practitioner engagement. Impact on these aspects of sustainable energy has been created through dissemination in practitioner focussed publications, such as the *Quarterly Journal of Forestry* and the *Forestry Journal*, and through practitioner conferences. The effectiveness of this form of dissemination is shown in the direct take up of these publications by stakeholders, for example:

- Cope, M., Leslie, A. and Weatherall, A. (2008) The potential suitability of provenances of *Eucalyptus gunnii* for short rotation forestry in the UK. *Quarterly Journal of Forestry* 102 (3): 185- 194. This paper was used as part of the evidence base used by the Forestry Commission in 2009 to design small scale research trials of Eucalyptus compared to other species, but also of larger scale operational trials focussed solely on Eucalyptus.
- Leslie, A., Mencuccini, M. and Perks, M. (2011) Eucalyptus in the British Isles. *Quarterly Journal of Forestry* 105 (1): 43-53. This paper was cited in the 2nd edition of 'The Silviculture of Trees Used in British Forestry' by Peter Savill, which is the standard text used by forest managers to help them with species selection choice in the UK.
- Weatherall, A. (2009) Food and wood – or fuel? Where is the land for planting dedicated energy crops in the United Kingdom? *Forestry Journal* 5: 26-7, picked up the research insights to recommend sustainable forest management to produce renewable energy as a by-product in a forest industry read publication.
- Weatherall, A., Connolly, T., Craig, J., Dutch, J., Griffiths, J., Harrison, A., Mason, B., McKay, H.M., Proe, M.F. and Pyatt, G. (2008) Effects of whole-tree harvesting at three forests in upland Britain, in: *International Energy Agency* (*IEA) Bioenergy Workshop*, September 2008, Warwick University. This was also presented to Forest Research, and attended by Tom Nisbet, Programme Manager at Forest Research and the main author of 'Guidance on site selection for brash removal' (a simple traffic light system for forest managers assessing site suitability for brash harvesting according to soil type). (The research was not cited in the outputs as the peer-reviewed publication of the work presented was delayed, and it was not ready before the protocol was published).

The main research outputs themselves have also been noted by practitioners, as exemplified by the fact that Mason et al. (2012) received the Silvicultural Award for Best Paper in 2012 in Forestry, which is read by UK forest managers, as well as academics. The award was presented at an Institute of Chartered Foresters Annual Conference, which is a key event attended by UK forest managers to gain access to knowledge for continuing professional development.

The Joule project research was intrinsically stakeholder and community focussed, as it was participatory in nature, with the Cumbria Farmers Network as a co-investigator. Findings of the research were disseminated at a Cumbria Farmers Network meeting at Newton Rigg, Penrith in September 2011, including a workshop for famers and land owners. The research led to a number of farmers exploring biomass options at a later stage, including the use of hedge trimmings as an energy source by a farmer in Ennerdale, Cumbria). The research has also fed into the strategy and

action plan for Cumbria Woodlands, who support the efficient usage of woody biomass for conservation, environmental and economic gain. This has also contributed to further impact through community projects, such as through support provided by Cumbria Woodlands to the Witherslack estate, catalysing the move towards woodfuel as a major strand of the business.

The body of research has also underpinned engagement with the Lake District National Park in managing land for carbon. This Knowledge Transfer Partnership (KTP) hosted by the University has drawn on research insights relating to community engagement for sustainability projects and novel findings around managing and measuring carbon sequestration to deliver on project objectives. The KTP has resulted in a production of a total of 1000 hard copies of the 'Managing Land for Carbon' booklet, which has been promoted through press releases, National Park launch events, plus access to materials on the web-site, including facility to download electronically. Copies have also been provided to stakeholder organisations for further dissemination, including Cumbria Woodlands, Cumbria Wildlife Trust, Nurture Lakeland, Royal Society for the Protection of Birds, United Utilities, Friends of the Lake District, through the Carbon Landscapes Forum, and to attendees at the Farming and Forestry Task Force, including farmers, foresters, businesses within relevant sectors, private advisors to and representatives of farmers and foresters (including the National Farmers Union and land agents). These stakeholder targeted outputs are therefore now being disseminated by these additional organisations to land management consultants and landowners beyond the Park. Wider uptake is demonstrated through copies sent to or requested by others, including Natural England Leeds office, Forest Enterprise (the land-owning element of the Forestry Commission), the Cornwall Development Company (Rural Development Programme for England funded body of Cornwall Council) and the Cairngorms National Park Authority. The wide relevance and usability of the guide is also shown by its promotion on a range of stakeholder websites, including the Natural Environment Research Council *Planet Earth* site, the *Farming Futures* blog which aims to help farmers manage challenges and opportunities relating to climate change, and the *Foundation for Common Land* website, who aim to conserve agricultural systems.

5. Sources to corroborate the impact

- Rogers, J.C., Simmons, E.A., Convery, I. and Weatherall, A. (2008). Public perceptions of community-based renewable energy projects. *Energy Policy* 36: 4217-4226 (impact factor 2.743, cited by 74) has been cited in a policy document – Upham *et al.* (2009) Public Attitudes to Environmental Change: a selective review of theory and practice A Research Synthesis for the Living with Environmental Change Research Programme. http://www.esrc.ac.uk/_images/LWEC-research-synthesis-full-report_tcm8-6384.pdf
- The same paper was also cited in Ariel Bergmann and Nick Hanley (2012) The Costs and Benefits of Renewable Energy in Scotland. Report to the Expert Group on Environmental Studies 2012:5 Government Offices of Sweden, Ministry of Finance. The final section of the report suggests some lessons which Sweden can learn from the Scottish experience. http://www.ems.expertgrupp.se/Uploads/Documents/7-jan-2013/EMS_2012_5.pdf
- Text used by forest managers for species selection, citing Cumbria research: Savill, P. (2013). *The Silviculture of Trees Used in British Forestry*. 2nd edn. Wallingford, UK: CABI.
- Cumbria Woodlands strategy and action plan, supported by the University: http://www.cumbriawoodlands.co.uk/training-and-resources/woodlands-and-forestry-strategy.aspx

Web dissemination of the Managing Land for Carbon project outputs by stakeholder organisations:

- http://www.farmingfutures.org.uk/blog/managing-land-carbon-guide-farmers-land-managers-and-advisers
- http://www.foundationforcommonland.org.uk/news/310-managing-land-for-carbon
- http://planetearth.nerc.ac.uk/features/story.aspx?id=1515

Statements to corroborate the impact:

- Lead for the Energy Action Group, Sustainable Brampton; to corroborate the impact on Sustainable Brampton in catalysing implementation of a biomass energy system.
- Chair of the Witherslack Community Land Trust; to corroborate impact on land management and silviculture practice for carbon reduction and conservation.