



Climate Change in Wytham Woods

2012 FIELD REPORT

Background Information

Lead PI: Daniel Bebber

Report completed by: Martha Crockatt

Period Covered by this report: 2012

Dear all,

Firstly, a huge thanks to everyone who has contributed to data collection in Wytham Woods this year. Your energy, enthusiasm, hard work, and willingness to learn new skills (sometimes under very damp conditions!) always make spending time in the field with volunteers a rewarding experience, apart from the many valuable hours you've contributed to data collection.

In 2012, we continued our research into carbon cycling in fragmented forest. This includes monthly measurements of dendrometer bands on trees to understand tree growth over the course of a season, and full re-censuses of all trees in a plot to understand longer term growth, and thus carbon storage. We have also been investigating whether fragmentation influences the decomposition rate of wood, i.e. the rate at which carbon from dead wood is released to the atmosphere, and the decomposition of organic matter in soil through measuring CO₂ efflux from the soil. We met all of our research objectives in 2012, greatly helped by our many volunteers - without you we could not conduct such an ambitious research program.

There have been a number of significant achievements in 2012. These include the successful running of our first Teach Earth team. This was a group of 10 teachers from the region brought together for one week in Wytham Woods for a course helping them to explore innovative methods of environmental education. They were an inspirational group of people, and it was fantastic to have them working with us for a week, as well as to be able to help them develop as environmental leaders. We are looking forward to our reunion event in spring 2013.

Over the three years that our dendrometer bands have been measured, we have amassed ca. 36,000 data points. After three days locked up in a room with a lot of spreadsheets, we have cleaned up the dendrometer data and started preliminary analysis. We have begun by looking at the variation in growth rates between 2010/2011, which were relatively dry years, and 2012, which was (as many of you remember) much wetter. We will continue to work with the data to better understand the complex picture of how variation between species, tree size, tree height, plot, tree density and weather impact growth and thus carbon uptake of the trees in our fragmented forest. Initial findings will be presented at the British Ecological Society annual conference in December in Birmingham.

This November saw the harvesting of our woodblock experiment, which was established to understand the variation in wood decomposition between the warm, dry forest edge and cooler, moister forest core. We have been excited to find a significant edge effect on wood decomposition, with wood blocks at the forest edge decomposing more slowly than those in the forest core. This has implications for carbon budgets in fragmented forests, as well as nutrient cycling and dead wood habitat for fungi and invertebrates. We are currently analyzing the data and will publish our findings during 2013.

Over the winter we're replacing overgrown dendrometer bands, harvesting wood blocks, analyzing data, writing papers, and preparing for the 2013 field season, which is going to be a busy one.

Thanks again to everyone who has contributed to the project. It is very exciting that we are now starting to analyze the data, and see the results of so much hard work.

Best wishes,

A handwritten signature in blue ink, appearing to read 'Martha Crockatt', with a stylized flourish at the end.

Martha Crockatt

SECTION ONE: Scientific research achievements

Top highlight from the past season

Dead wood is an important carbon stock in forests. We have discovered that in temperate woodland dead wood decomposes more slowly at the forest edge than core (fig 1), probably due to the forest edge being drier and inhibiting the fungi that break down the wood. In the fragmented woodlands of the UK, this knowledge has a significant impact on our understanding of carbon stocks and fluxes, and thus the role that forests have in mitigating climate change.

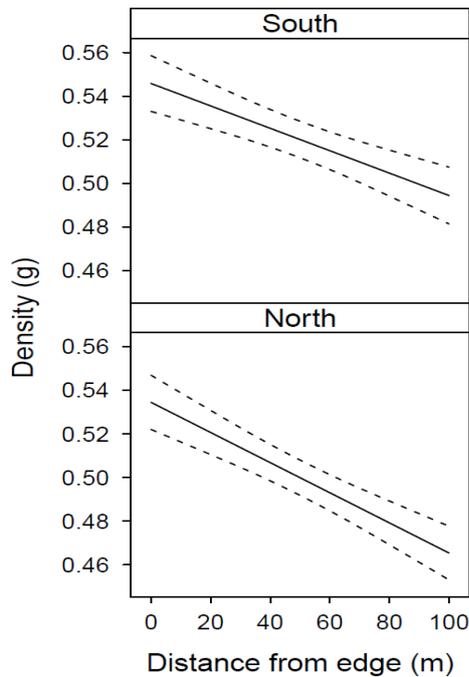


Figure 1: Density of wood blocks decreases with distance from the forest edge, showing that the wood blocks have decomposed more slowly in the forest edge than the core.

Reporting against research objectives

The overall objective of the programme is to investigate carbon cycling in fragmented temperate forest. We have done this through:

- continued monthly measurements of dendrometer bands during the growing season;
- measuring soil CO₂ efflux. It was agreed at the end of 2011 that it would not be possible to do this in all plots, thus measurement was limited to the core plot, as agreed.
- completing the bi-annual censuses of our 9 plots (two were due and completed in 2012);

- leaf litter collections. It was agreed at the end of 2011 that it would not be possible to do this in all plots, and had been limited to the core plot. Unfortunately, due to staffing levels and time constraints, it was not possible to complete this objective. Plans have been made to ensure it will be collected in 2013.
- harvesting wood blocks for edge effects on wood decomposition experiment. This experiment was established in August 2010. Wood blocks were harvested in November 2012 as planned.

SECTION TWO: Impacts

Partnerships

University of Oxford, Environmental Change Institute. We work closely with Yadvinder Mali's research group, sharing data, equipment and knowledge. The research was set up by Yadvinder and Terhi Riutta, but the research is now conducted by Earthwatch, in partnership with ECI. We are currently analysing data from dendrometer bands over the last three years, and will produce a joint publication with ECI scientists.

Prof. Lynne Boddy, Cardiff University. Lynne has provided expertise and advise on the wood decomposition experiment, through her knowledge of wood decomposing fungi. She has complementary research ongoing in Wytham and other woodlands, and we have an open dialogue on the subject with her, and members of her research group.

Contributions to conventions, agendas, policies, management plans

- **Local**

We continue to discuss our research with the manager of Wytham Woods. With the high possibility of ash dieback occurring in Wytham in 2013, we will be able to provide information to the manager on presence / absence of the disease within our plots, which are visited regularly throughout the season giving us a good opportunity for spotting the disease.

Developing Environmental Leaders

The Teach Earth team, which saw a group of 10 teachers from the region visit us for a week long residential course, was specifically designed to develop the teachers into stronger environmental leaders. They benefited from specific knowledge on climate change, forest ecology, and research techniques provided by Earthwatch scientists; we also brought in other scientists to share their research with the teachers. This was accompanied by a

learning program to help teachers consider specific projects and activities they could take back to the classroom, as well as provide them support and encouragement in continuing with their environmental education ideas. The impact of this program obviously goes beyond the teachers, and into the classroom. We have a follow up one day event in spring 2013 to meet with teachers and discuss progress.

In September 2012 we ran an afternoon course on tree surveying techniques as part of Oxford University's Post Graduate Certificate in Ecological Survey Techniques. This was attended by 16 students, many of whom had travelled from outside the UK to attend a week of practical classes. The students learned specific tree survey skills, placed in the context of our research in carbon cycling in fragmented forests.

Throughout 2012 we have had a range of Earthwatch interns and volunteers, students and Earthwatch staff visit the project to learn more about what Earthwatch does, or to enhance their fieldwork skills. For example, a MSc student from Oxford University joined us for a day in order to prepare for her MSc research project, a three week tree surveying project in the tropics.

Actions or activities that enhance natural and/or social capital

We contributed a display to the exhibition "Into the Woods", which was an exhibition of art and science around Wytham, held at Oxford Natural History Museum from April to September. Our display comprised a series of posters showing what research we do and why. We had hoped to develop a hands-on tree-measuring exhibit, but practicalities prohibited this.

Conservation of Taxa

Our detailed data collected on ash trees throughout our plots may be a valuable bank of knowledge if ash dieback becomes a significant problem in Wytham in 2013.

Conservation of Habitats

Our research contributes to knowledge of ecology of fragmented temperate woodland.

Impacting Local Livelihoods

Our intern program provides young scientists with valuable hands-on experience that helps to better equip them for the job market.

Local community activities

With our Teach Earth team and display at the "Into the Woods" exhibition, many more people in the local area now know of the research that we are doing at Wytham. We are investigating ways of including more local volunteers in our research program.

In June 2012 the first urban bioblitz took place in Oxford, organized by the Science Oxford. Local natural historians spent the weekend searching for and recording all the plants and animals they could find, joined by members of the public. Special events were created to help the public get involved. This included two "Tree and Fungi Walks" conducted by Martha Crockatt, which helped members of the public learn to identify trees and understand their ecology, in combination with fungi. Approximately 15 people in total attended the walks.

At the Wilderness Festival (August 2012), held 5 miles north of Oxford, Martha Crockatt conducted a tree walk, and took a group of festival goers on an hour-long walk around the site to talk about trees, forest ecology, and carbon cycling. Approximately 10 people participated in the walk, and gave great feedback.

Dissemination of research results

Scientific peer-reviewed publications

Crockatt, Martha E. 2012. Are There Edge Effects on Forest Fungi and If so Do They Matter? *Fungal Biology Reviews* 26: 94–101.

NB the following two publications are the result of work conducted by previous researchers on the project.

Riutta, T., Slade, E. M., Bebber, D. P., Taylor, M. E., Malhi, Y., et al. 2012. Experimental evidence for the interacting effects of forest edge, moisture, and soil macrofauna on leaf litter decomposition. *Soil Biology and Biochemistry* 49: 124–131.

Simpson, J. E., Slade, E., Riutta, T., & Taylor, M. E. 2012. Factors affecting soil fauna feeding activity in a fragmented lowland temperate deciduous woodland. *PLoS ONE*: 7, e29616.

Grey literature and other dissemination

Conference session organised:

Ecology and Function of Disturbed and Fragmented Forests. Held at British Ecological Society Annual Meeting, Birmingham, December 2012. Session organised to showcase research conducted under the HSBC Climate Partnership (2007-2011) by us and our research partners around the world.

Crockatt, M. E. and Bebber, D. P. 'Edge effects on forest carbon cycling: Wood decomposition'. British Ecological Society Annual Conference. Birmingham, December 2012. Poster.

Bebber, D.P., Riutta, T., Butt, N., Crockatt, M.E. and Malhi, Y. Interannual carbon balance in fragmented temperate forest. British Ecological Society Annual Conference. Birmingham, December 2012. Talk.

Bebber, D.P., Capretz, R., Reginato, M., Zwiener, V. and Britez, R.M. 'Tree diversity and above-ground biomass in succession of the Atlantic Forest, Brazil'. British Ecological Society Annual conference, Birmingham, December 2012. Talk.

Crockatt, M.E. 'Are there edge effects on forest fungi and if so do they matter?'. British Mycological Society Annual conference. Alicante, Spain, September 2012. Poster.

Lesson plan: Tree Survey Techniques for Postgraduate Certificate in Ecological Survey Techniques. Delivered for University of Oxford, September 2012.

Museum exhibit: "Earthwatch research in Wytham".

Poster display for "Into the Woods" exhibit at Oxford Natural History Museum, June - September 2012.

SECTION THREE: Anything else

Acknowledgements

We would like to thank everyone who contributed their time to this project in 2012, including volunteers from HSBC, our Teach Earth team and volunteers from the Earthwatch office. We would also like to thank all the Earthwatch staff who work behind the scenes on finance, field briefings, logistics and so on, who make it possible for people with no scientific background to get into the field and work with scientists. We would like to acknowledge the importance of the financial contributions from those visiting our project, which enables the research to continue, and the ongoing support from HSBC.