

Data chapter

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1 Introduction

As part of this PhD an extended period of time has been spent at the Alice Holt Research Station (Hampshire, UK) working with Forest Research (The research arm of the UK Forestry Commission). After initially completing one year of an ongoing field campaign to measure stem respiration using an infra-red gas analyser, a measurement campaign was designed to produce a set of observations for use in this PhD project. This fieldwork campaign is outlined in this chapter.

2 Alice Holt research site

The Alice Holt Forest is a research forest area managed by the UK Forestry Commission located in Hampshire, SE England. Forest Research have been operating a CO₂ flux measurement tower in a portion of the forest, the Straits Inclosure, continuously since 1998. The Straits Inclosure is a 90 ha area of deciduous broadleaved plantation woodland located on a surface water gley soil and was initially planted with oak in the 1820s [Schlich and Perrée, 1905] and then replanted in the 1930s. The majority of the canopy trees are oak (*Quercus robur* L.), with an understory of hazel (*Corylus avellana* L.) and hawthorn (*Crataegus monogyna* Jacq.) [Pitman and Broadmeadow, 2001], but there is a small area of conifers (*Pinus nigra* ssp. *laricio* (Maire) and *P. sylvestris* L.) within the tower measurement footprint area depending on wind direction. An aerial photograph of the site is shown in Figure 1. The Straits Inclosure is a flat area at an altitude of approximately 80m, surrounded by mixed lowland woods and both arable and pasture agricultural land. An analysis of stand-scale 30 minute average net CO₂ fluxes (NEE) from 1998-2011 for the Straits Inclosure and more details of the research site can be found in Wilkinson et al. [2012].

As part of the management regime, the Straits Inclosure is subject to thinning, whereby a proportion of trees are removed from the canopy in order to reduce competition and improve the quality of the final tree crop. At the Straits an intermediate thinning method is used with a portion of both subdominant and dominant trees being removed from the stand [Kerr and Haufe, 2011]. The whole of the stand was thinned in 1995. Subsequently the eastern side of the Straits was thinned in 2007 and then the western side in 2014. The flux tower at the site is situated on the boundary between these two sides. This allows for the use of a footprint model to split the flux record and thus analyse the effect of this disturbance on carbon fluxes at the site. In Wilkinson et al. [2015] a statistical analysis of the eddy covariance flux record found that there was no significant effect on the net carbon uptake of the eastern side after thinning in 2007. In this paper we focus on the effect of disturbance on the western side after thinning in 2014. We therefore refer to the western side as “thinned” forest and the eastern side as “unthinned” forest.

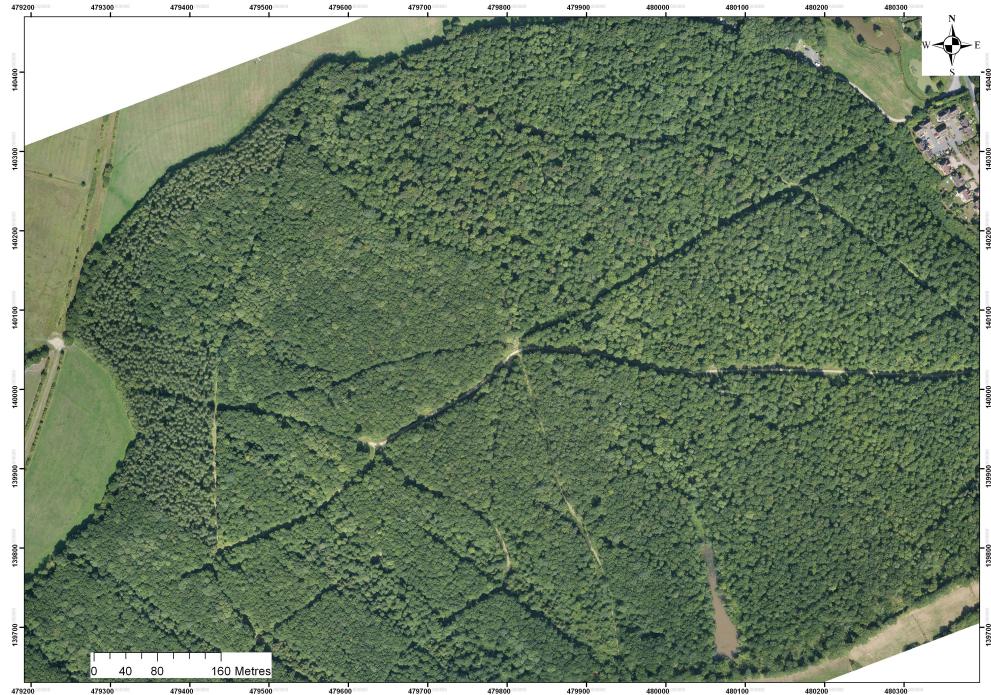


Figure 1: The Straits Inclosure research site in 2013.

3 Establishment of sampling points

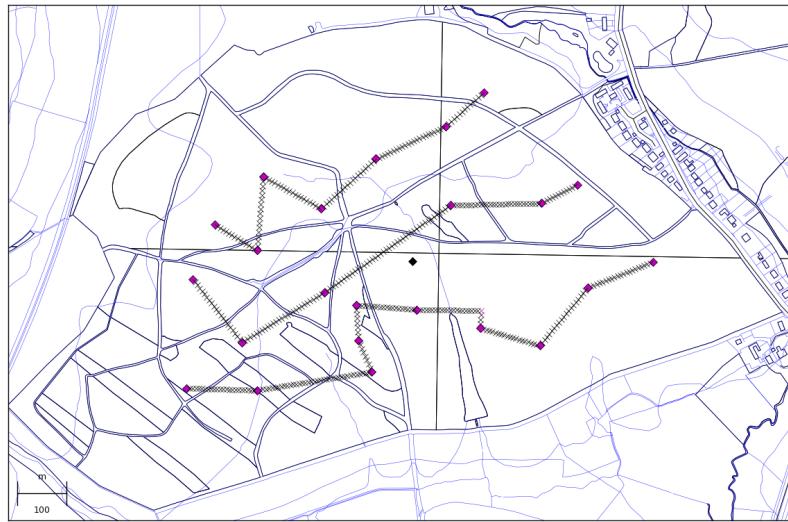


Figure 2: Sampling transects. Black crosses: sampling points at 10m intervals, pink diamonds: Forest Research mensuration plots, black diamond: Forest Research flux tower.



Figure 3: Sampling point 291, showing how fluorescent spray paint used to mark sampling points.

4 Leaf area index observations

4.1 Ceptometer

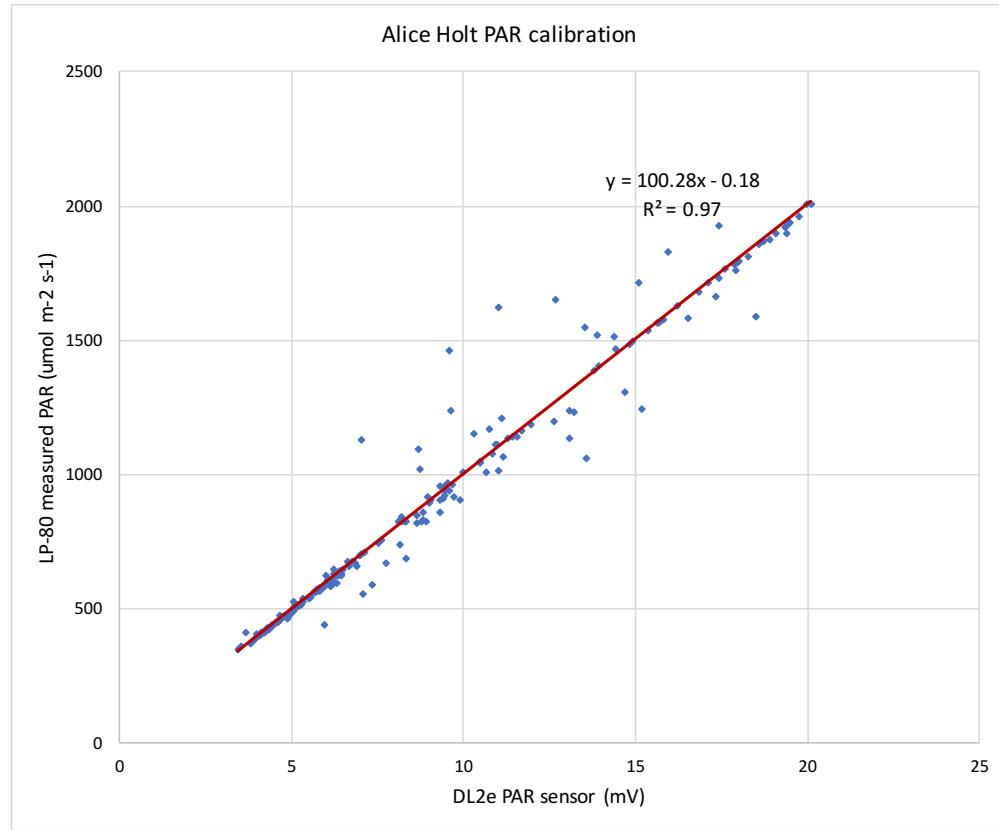


Figure 4: Calibration of above canopy PAR sensor (measuring in mV) with LP-80 ceptometer measured PAR ($\mu\text{mol m}^{-2} \text{s}^{-1}$).

4.2 Hemispherical photographs

4.3 Litter traps

4.4 Comparison of methods

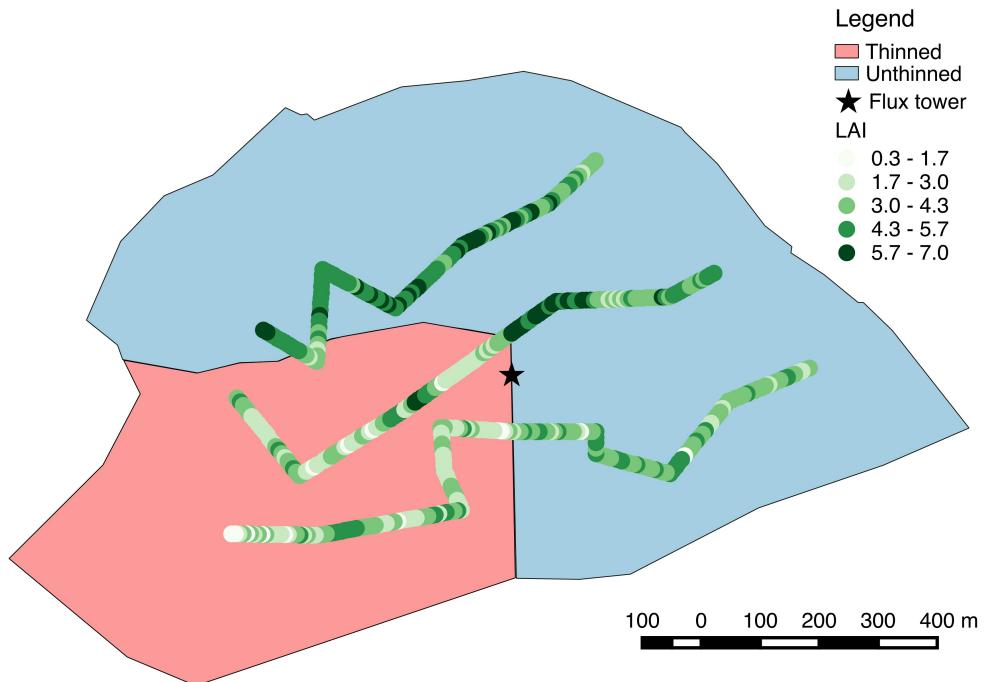


Figure 5: Ceptometer derived LAI for Alice Holt.

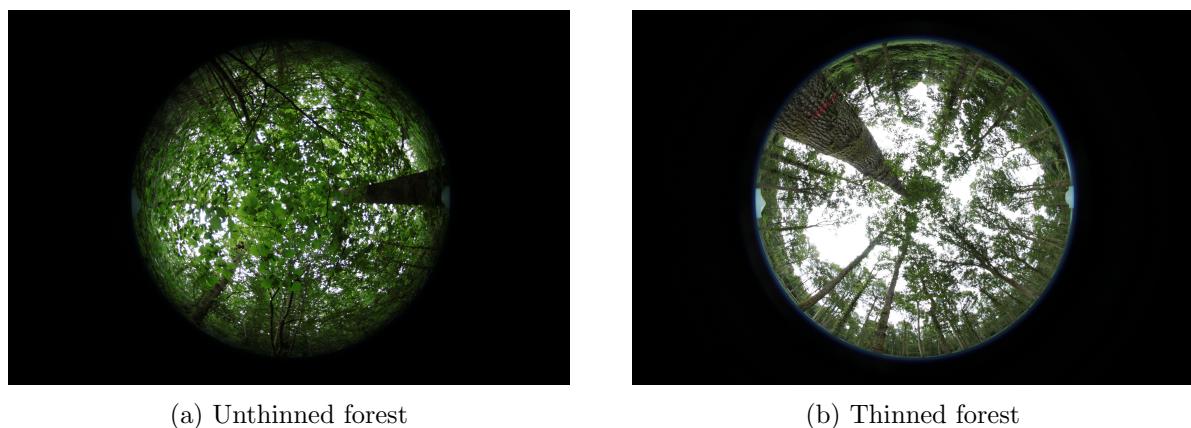


Figure 6: Hemispherical photographs from the Alice Holt flux site showing the difference between the thinned and unthinned sides of the forest.

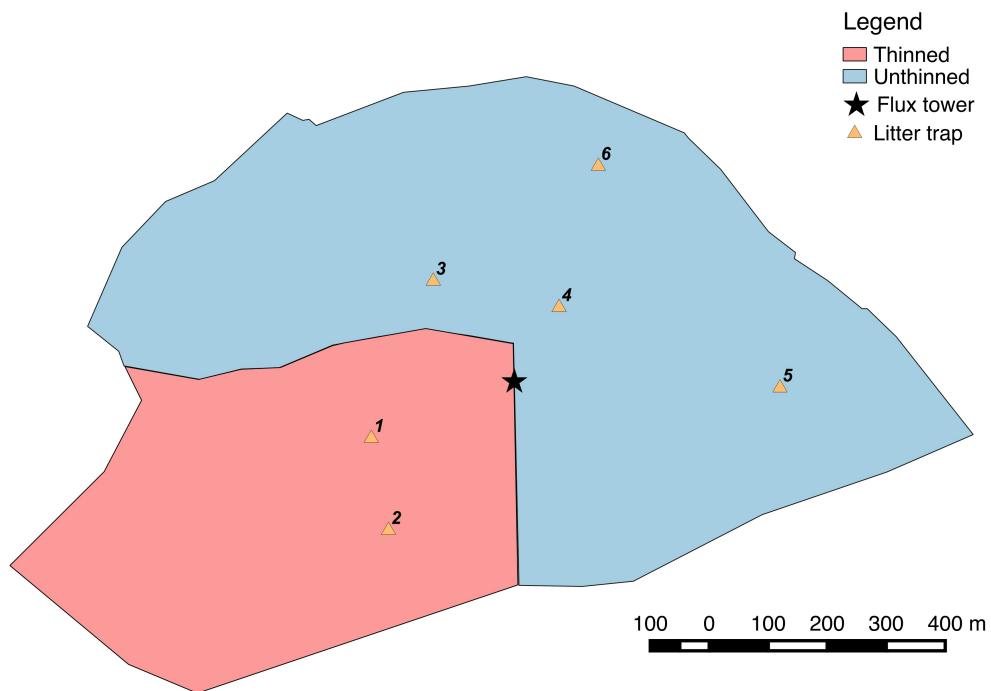


Figure 7: Litter trap locations for Alice Holt.

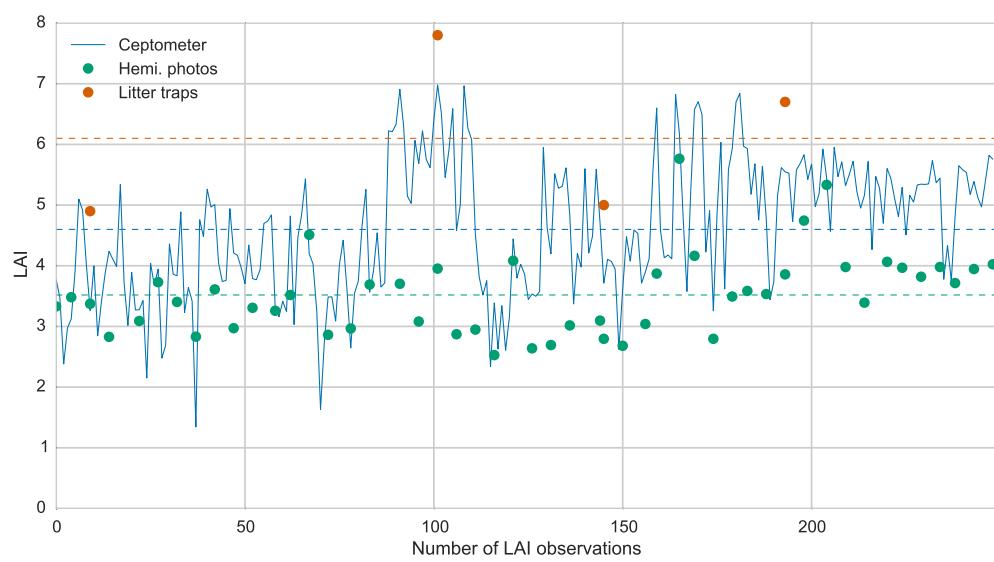


Figure 8: LAI comparison for unthinned forest.

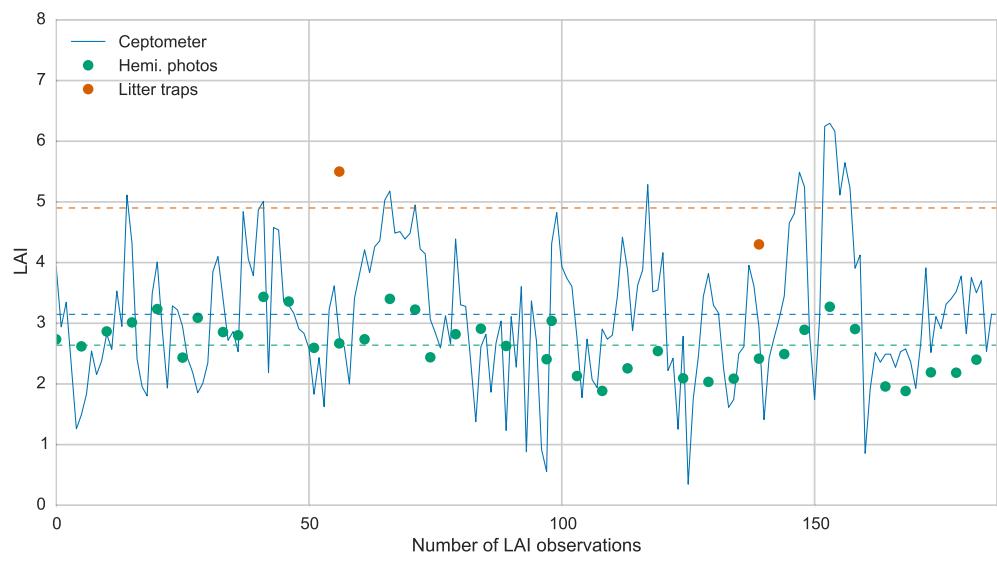


Figure 9: LAI comparison for thinned forest.

5 Point-centred quarter observations



Figure 10: Taking diameter at breast height measurements at Alice Holt.

6 Flux tower observations and data processing



Figure 11: At the top of the Alice Holt flux tower.

References

- G. Kerr and J. Haufe. Thinning practice: A silvicultural guide. *Forestry Commission*, page 54, 2011.
- R. Pitman and M. Broadmeadow. Leaf area, biomass and physiological parameterisation of ground vegetation of lowland oak woodland. *Forestry Commission, Edinburgh*, 2001.
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- M. Wilkinson, E. Eaton, M. Broadmeadow, and J. Morison. Inter-annual variation of carbon uptake by a plantation oak woodland in south-eastern england. *Biogeosciences*, 9(12):5373–5389, 2012.
- M. Wilkinson, P. Crow, E. Eaton, and J. Morison. Effects of management thinning on co₂ exchange by a plantation oak woodland in south-eastern england. *Biogeosciences Discussions*, 12(19), 2015.