

Life Cycle Assessment of Alternative Tree Systems

Context

To mitigate the impacts of climate change, the UK Government aims to achieve territorial Net Zero greenhouse gas emissions by 2050. There is also a target to increase tree cover in England to 16.5% in the same timeframe. As part of this, the Defra 'Trees Outside Woodland' project is examining alternative tree systems and their impact on carbon sequestration and other ecosystem services.

Alternative tree systems include orchards, shelterbelts, hedgerows, silvopastoral and silvoarable systems, and Miyawaki forests. Due to the wide diversity of tree systems and their context-specific multifunctionality, there is a need to understand the sustainability implications through a life cycle assessment (LCA).



Fig. 1. Silvopastoral system at Little Hidden farm, Berkshire, UK (Source: Paul J. Burgess).

Research aim and objectives

The aim of the PhD (2024-2027) is to assess the environmental, economic, and social impacts of alternative tree systems in England.

The working objectives are:

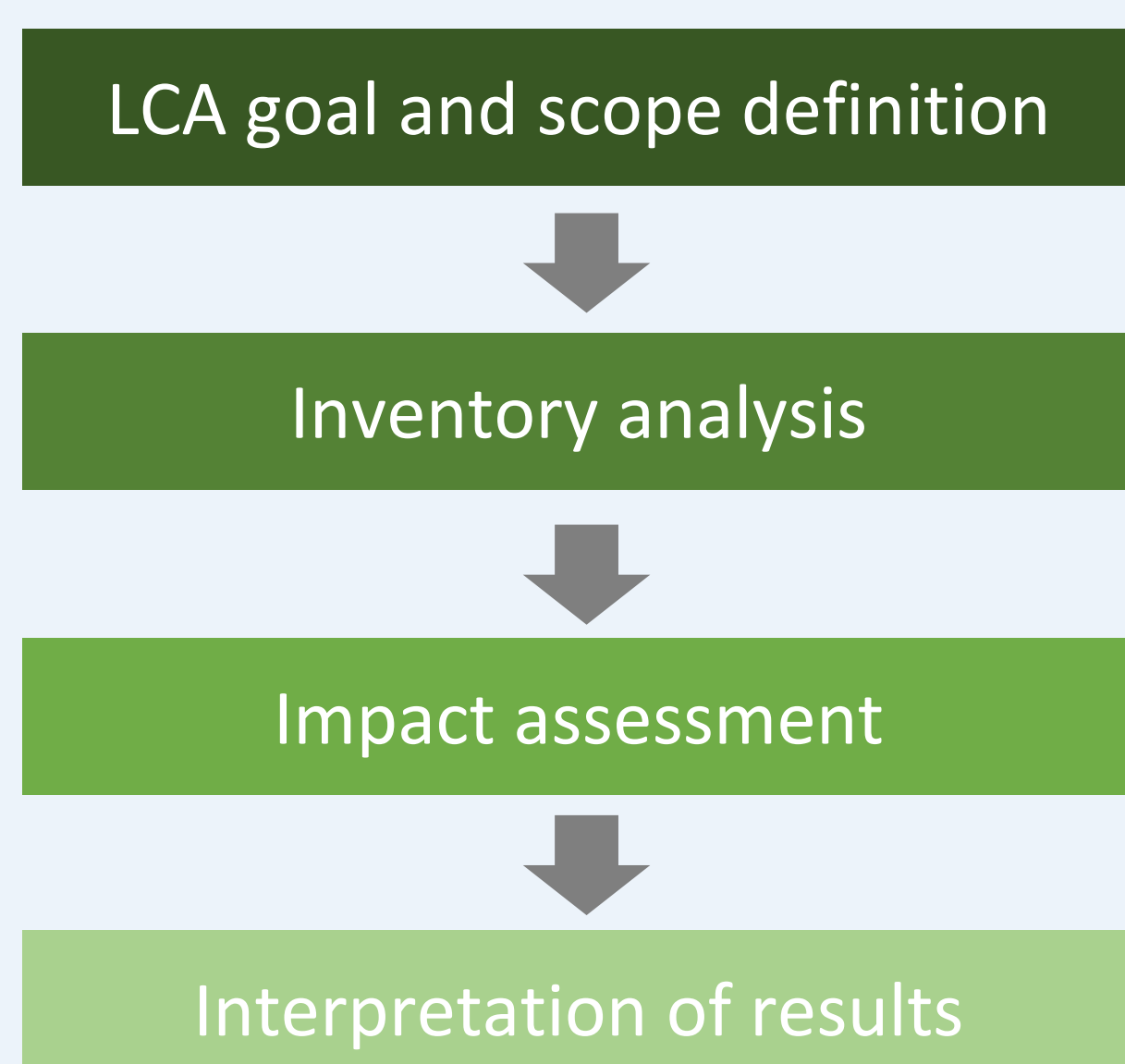
1. To review existing literature on LCAs related to alternative tree systems.
2. To investigate stakeholder perspectives on current and emerging threats to sustainability and how alternative tree systems can offer solutions.
3. To develop and use a life cycle framework to quantify the potential environmental, economic, and social impacts of alternative tree systems.



Fig. 2. Silvoarable system at Wakelyns farm, Suffolk, UK (Source: Paul J. Burgess).

Proposed methodology

The four phases of an LCA:



1. The goal and scope of the LCA will be co-defined with stakeholders to address the wide range of alternative tree system products and services, system boundaries, and spatiotemporal variability across various environmental and socio-economic metrics.
2. A comprehensive life cycle inventory will be co-designed with stakeholders. This could involve focus groups or a Delphi approach to understand stakeholder sustainability priorities and the capacity for primary data collection/provision.
3. Development and use of a comparative LCA of alternative tree systems across a range of landscapes. This research will apply the framework using data from mature sites and Trees Outside Woodland pilot studies across England.
4. Analysis and interpretation of the results in relation to projected climate change and macroeconomic scenarios, including spatiotemporal uncertainty.

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