Tiny forest project plan

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3/14/23

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Introduction

Biodiversity in UK

- Britain has been described as one of the most nature depleted countries("Why We Need Green Spaces in Cities," n.d.)

- Climate change

- Air quality

- Urbanisation

Urban restoration and nature-based solutions

- Urban restoration / nature based solutions

Tiny forests

- Tiny forest definition
- Tiny forest philosophy

Tiny forest development in UK

Putative TF impacts

Hypotheses

1. Can TF growth be detected using satellite imagery?
2. Can TFs be classified e.g. urban/rural, landcover, age, location?
3. What is the impact of TFs on biodiversity?
4. ? Impact of TFs on pollution
5. Other outcomes?

Proposed methods

Literature review

- Search strategy
    - Urban forest / tiny forest
    - Biodiversity
    - Climate change / carbon
- Search
    - Pubmed
    - Semantic scholar
    - WoS

- Grey literature

- PICO

  -

Design

Before and after control impact (BACI) design (Christie et al. 2019)

- Time series
- Control groups
- Summary measures of diversity (as dependent variable?)

  - Richness
  - Diversity
  - Communities (permutations)
- Modelling with mixed-models (GLMMs)
- Issues

  - Data
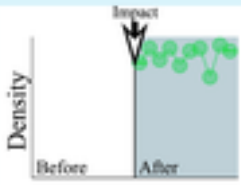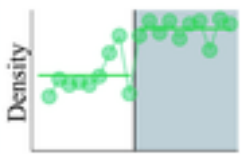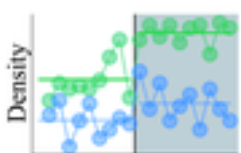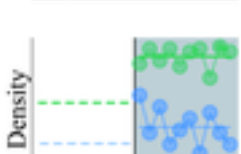 - Biases in occurrence data
  - Small size of TFs

Design	Sampling regime	Relative cost	Relative difficulty in ecology	Suitability	Ecological examples of use
After		Very low	Very low	Most systems Where control unfeasible Unpredictable impacts	Pond creation
Before–After (BA)		Moderate	Moderate	Predictable impacts Where control unfeasible Availability of pre-impact data	Wildlife tunnels under roads
Before–After Control-Impact (BACI) (BARI, MBACI, BACIPS)		High	High	Predictable impacts Appropriate control Availability of pre-impact data	MPA effectiveness, renewable energy infrastructure
Control-Impact (CI) (Space-for-Time, Impact versus Reference Sites)		Low	Moderate	Unpredictable impacts Large-scale replicates that cannot be truly randomised	Oil spill or other pollution event
Randomised Controlled Trial (RCT)		Low	Very high	Unpredictable impacts Small-scale replicates appropriate for randomisation	Peatland restoration, field margins

Figure 1: Figure (Christie et al. 2019)

Analysis plan

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                                    ┌────────┐
                                    │ Design │
                                    └────┬───┘
                                         ▼
                               ┌──────────────────┐
                               │ Units of analysis │
                               └──────────────────┘
                    ┌───────────────────┴────────────────────┐
                    ▼                                         ▼
          ┌────────────────────┐              ┌─────────────────────┐
          │ Tiny forests N = 160 │            │ Allotments ?N = 160 │
          └────────────────────┘              └─────────────────────┘
                    │                                         │
                    ▼                                         ▼
            ┌─────────────┐          ┌──────────────────────────────────────────────┐
            │ 1 km buffer │          │ 1 km buffer, random sampling from 5 km buffer around TF │
            └─────────────┘          └──────────────────────────────────────────────┘
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Descriptive analytics — Landuse/cover — Summary measures over time — Descriptive analytics — Landuse/cover — Summary measures over time
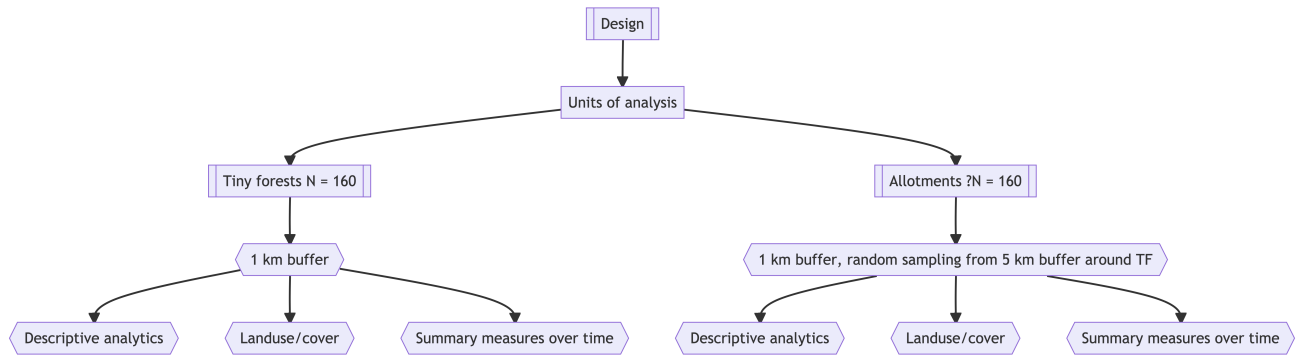
Data

- TF data

  - From TF website

    * Planting dates

    * Location

    * Tree mix

    * Size

    * Who is involved

  - Citizen science data

    * Insects / butterflies / pollinators

    * Tree tagging / tree density

    * Soil health

* Flood risk

* Carbon

- Spatial data from Google Earth Engine

  - Sentintel2 satellite generates near real-time (NRT) multispectral images at 10m resolution

  - These can be used to generate vegetation indices e.g. NDVI, which can be tracked over time

  - Sentinel2 images have been modelled to generate Dynamic World - a 10m resolution NRT land-use dataset

- Control groups

  - I propose to use 2 control groups:

    * allotments (from OS Greenspace datasets) ? random sample from location (NB overlap)

    *

    *

  -

- Biodiversity

  - Primary BD dataset will by NBN atlas occurrence data which is available by taxa, time and location

  - If necessary use

  - Earth Watch has provided examples of citizen science data collected for a number of existing

Analytical methods

Descriptive analysis

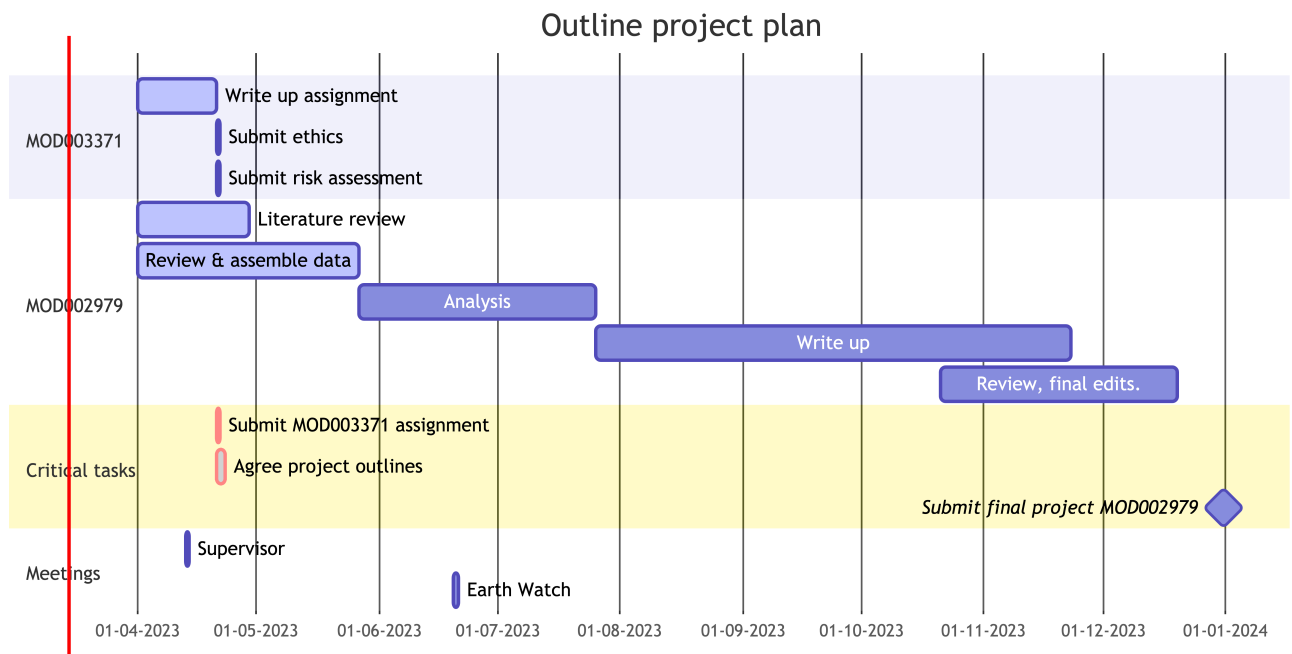- Characteristics of TF areas
- Summary of biodiversity
- Trends

Biodiversity

- Species richness and diversity estimates by area and time in study and control groups

Modelling

TBD

Project plan

Outline project plan

References

Christie, Alec P., Tatsuya Amano, Philip A. Martin, Gorm E. Shackelford, Benno I. Simmons, and William J. Sutherland. 2019. "Simple Study Designs in Ecology Produce Inaccurate Estimates of Biodiversity Responses." *Journal of Applied Ecology* 56 (12): 2742–54. https://doi.org/10.1111/1365-2664.13499.

"Why We Need Green Spaces in Cities." n.d. https://www.nhm.ac.uk/discover/why-we-need-green-spaces-in-cities.html.