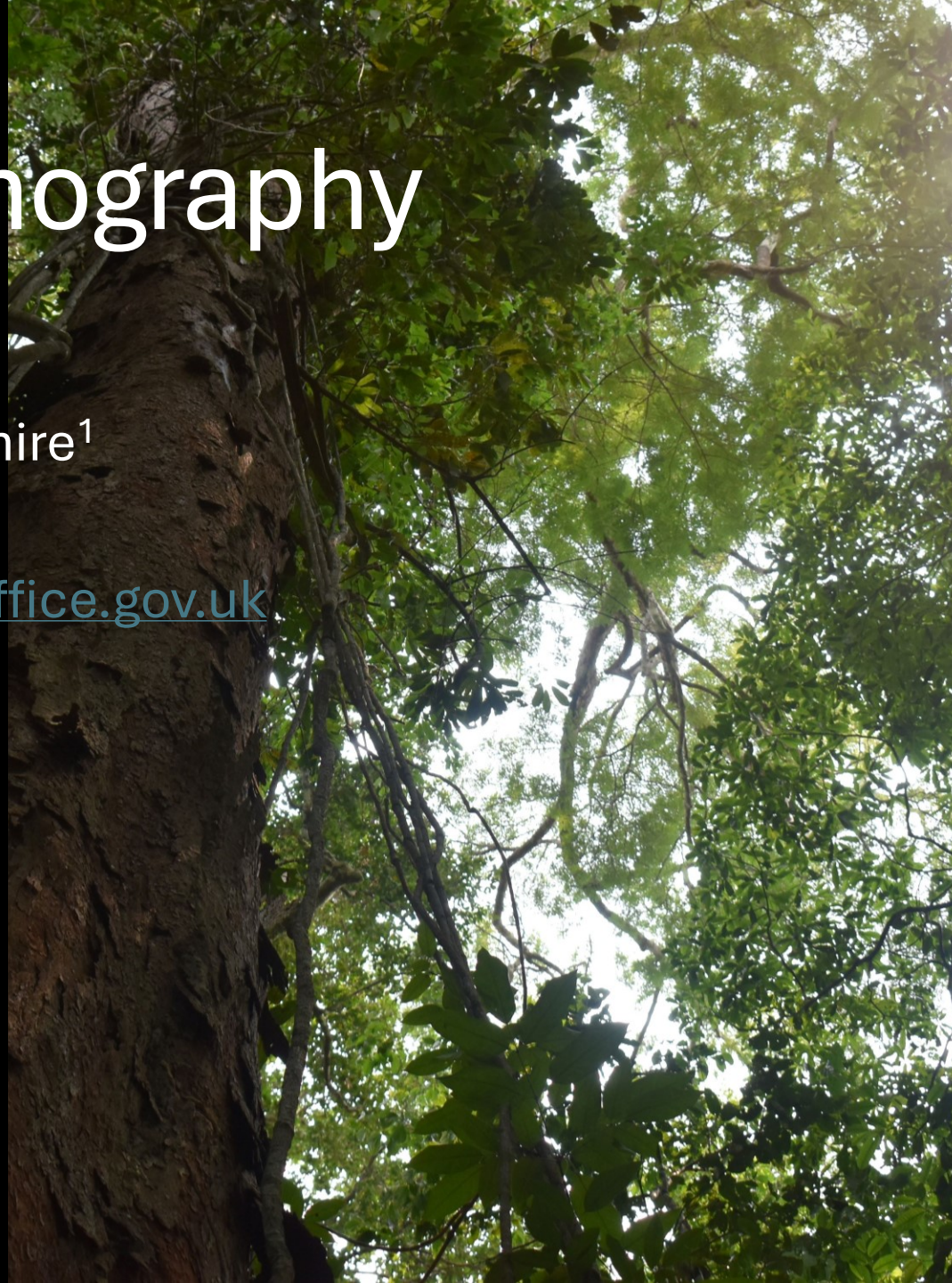# Veg3 RED Demography Update - 2024
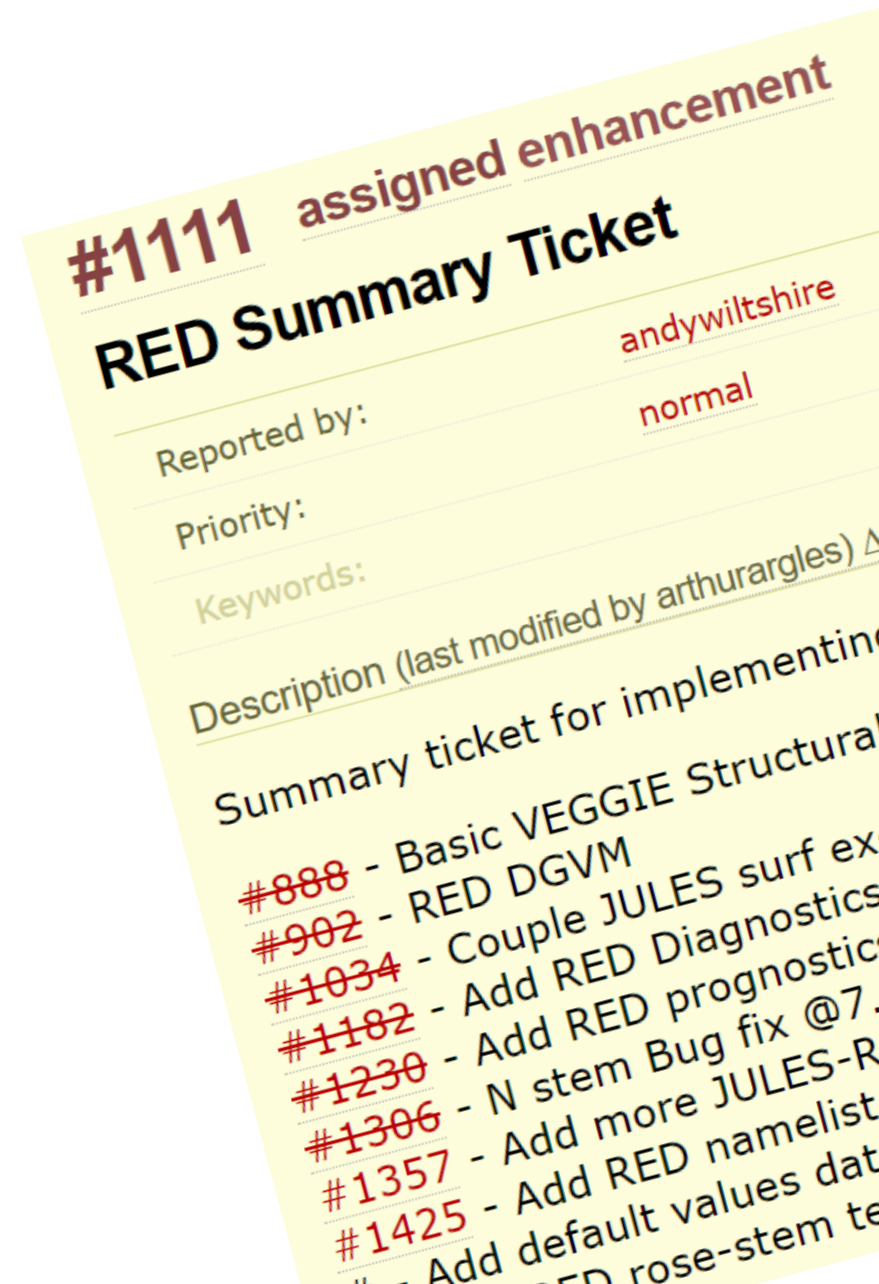
Arthur Argles[1] and Andy Wiltshire[1]

[1]UK Met Office

Contact: arthur.argles@metoffice.gov.uk

Developments

Overall Development ticket is #1111:

1. ~~Prognostics to dump (#1230):~~
   a. "PlantNumDensity", npft x nmclass (~9-13 x 30).

2. Science developments (#1357):
   a. Coupled to JULES phenology.
   b. Coupled to JULES soil models.
   c. Canopy closure (plants can have overlapping crowns).

3. In progress:
   a. A new [jules_red]: namelist (#1425).
   b. JULES-RED Land Use Change (October 2024).

4. Planned:
   a. Coupled fire (March 2025).
   b. rose-stem test.
   c. Nitrogen cycle.
   d. Drought and windthrow mortality.
   e. Forestry management.

#1111   assigned enhancement

RED Summary Ticket

andywiltshire

Reported by:

Priority: normal

Keywords:

Description (last modified by arthurargles)

Summary ticket for implementin

~~#888~~ - Basic VEGGIE Structura
~~#902~~ - RED DGVM
~~#1034~~ - Couple JULES surf ex
~~#1182~~ - Add RED Diagnostics
~~#1230~~ - Add RED prognostic
~~#1306~~ - N stem Bug fix @7.
#1357 - Add more JULES-R
#1425 - Add RED namelist
      - Add default values dat
   - D rose-stem te

Publications

Published

Argles, Arthur PK, et al. "Modelling the impact of forest management and CO2-fertilisation on growth and demography in a Sitka spruce plantation." *Scientific Reports* 13.1 (2023): 13487.

Moore, Jon, Arthur Argles, and Peter Cox. "A theory of demographic optimality in forests." *Scientific Reports* 13.1 (2023): 18712.

in review, submitted or in prep

Chou, Hsi-Kai, et al. "An evaluation of national Greenhouse Gas Removal potential using a process-based Land Surface Model." *Under review at New Phytologist*
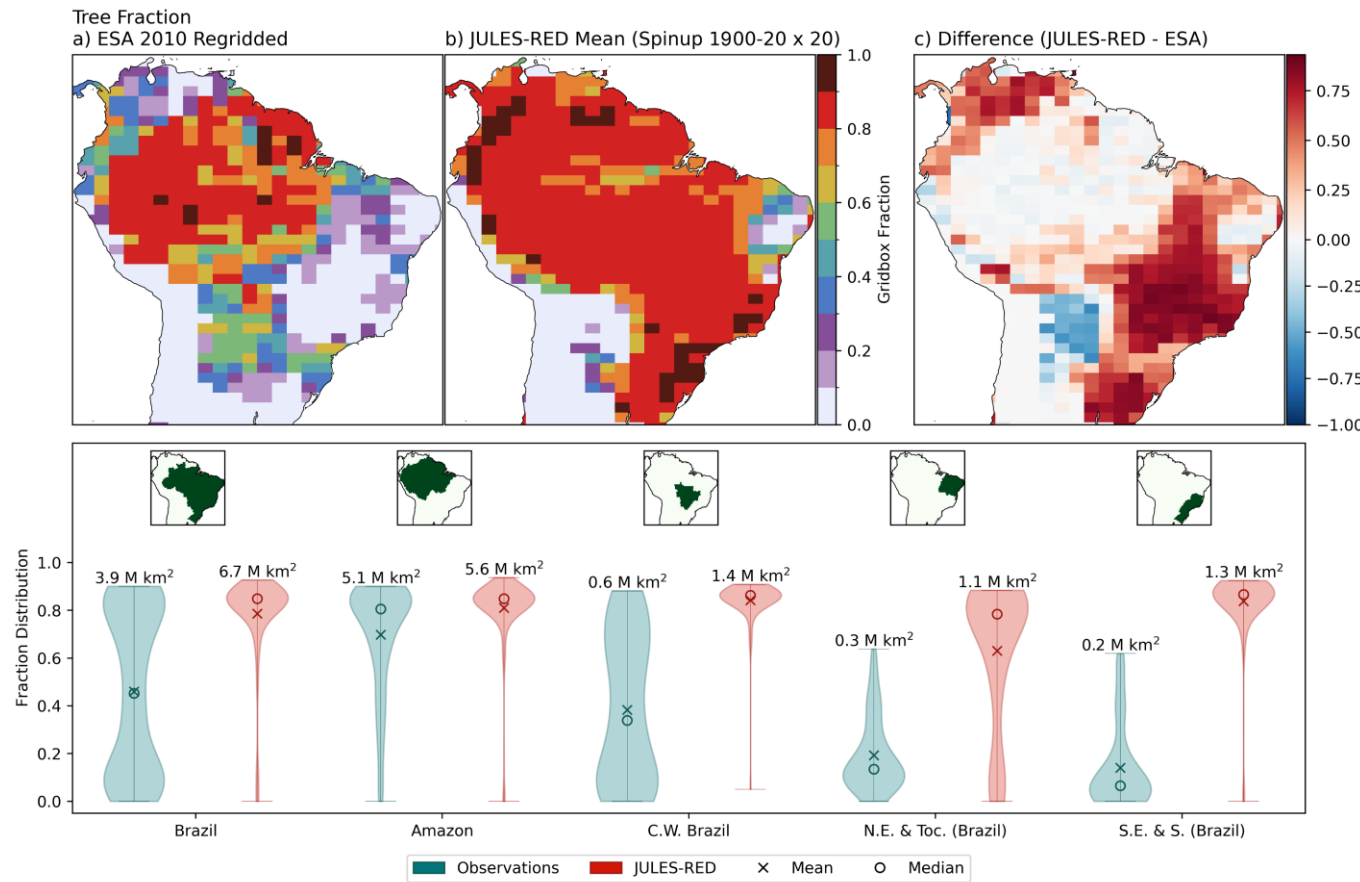
Harper, Anna, et al., "A modified process-based model to represent high resolution carbon cycle impacts of tree planting and management." *In prep.*
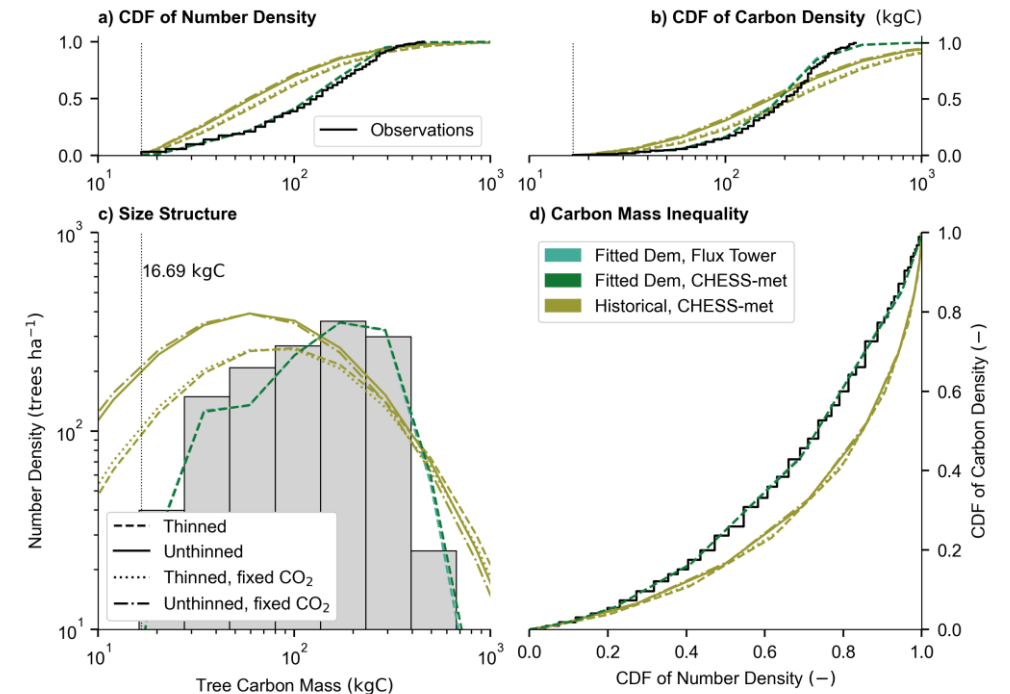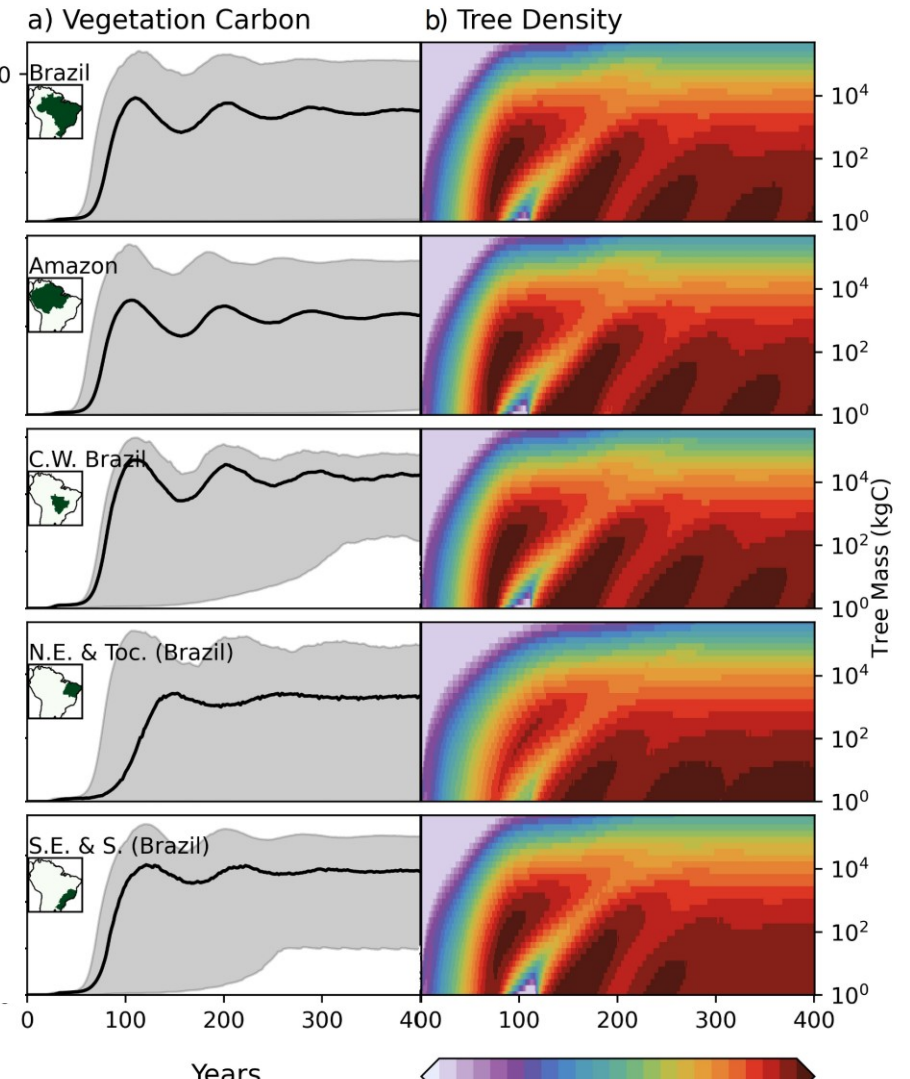
Results – Global Simulations

CSSP Brazil: Arthur Argles[1], Peter Cox[2], Carolina Duran Rojas[2], Andy Wiltshire[1,2], and Eddy Robertson[1]
[1]Met Office, [2]University of Exeter

Tree Fraction
a) ESA 2010 Regridded
b) JULES-RED Mean (Spinup 1900-20 x 20)
c) Difference (JULES-RED - ESA)

JULES-RED Spin-up - 400 years (1900-20 x 20 cycles)
a) Vegetation Carbon   b) Tree Density

Research – Afforestation in the UK

NetZeroPlus (NZ+): Anna Harper[1], Carolina Duran Rojas[2], Hsi-Kai Chou[2], Emma Littleton[2], and Peter Cox[2]
Land-Climate Programme: Arthur Argles[3] and Chris Huntingford[4]

[1]University of Georgia, [2]University of Exeter,
[3]Met Office, [4]Centre of Ecology and Hydrology

- Using a CHESS-scape forcing data to run JULES-RED under different climate scenarios up to 2080.

- Investigating the sensitivity of UK regions to afforestation.

- NZ+ Project is building an emulator to match different JULES-RED growth curves to the UK tree species.

- Land-Climate Project, results from NZ+ being used to inform UK government decisions.

Gridbox mean C_VEG, RCP60-RCP26, Ens 06, July in year 2080
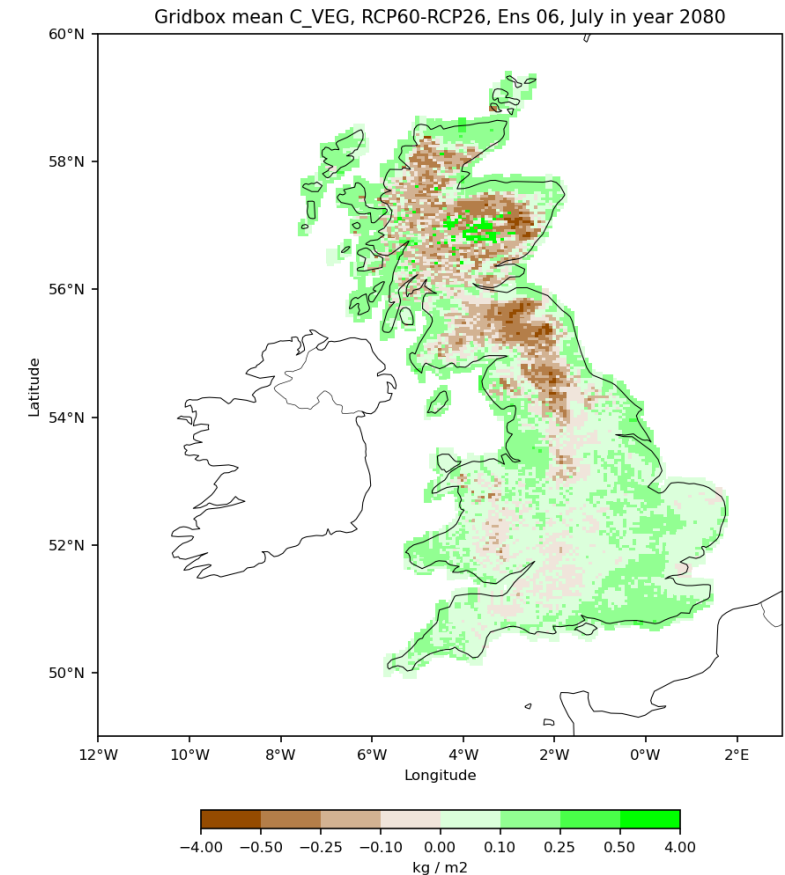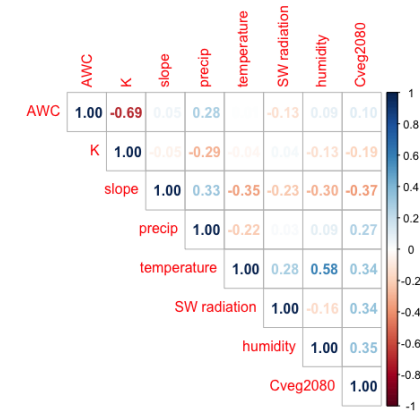
Funded Projects involving JULES-RED:

Nerc Amazon-SOS

Peter Cox, Hsi-Kai Chou, Mike O'Sullivan and Stephen Sitch

Improving modelled disturbances (2-3 involve JULES-RED):

1. Simulation of disturbances.

2. Vegetation immediate response to disturbances.

3. Recovery from disturbances.

Decrease Carbon Imbalance between Bookkeeping and Process based models in Global Carbon Project.

EU NextGenCarbon
Peter Cox, Stephen Sitch

Help develop a whole set of demographic DGVMs (JULES-RED, CLM-FATES, ORCHIDEE):

1. Combine a whole set of observations to improve demographic representation (EO, LiDaR, TLS) of forest size-structure.

2. Increase capacity of land surface models using demographic DGVMs and observations.

to "…*unprecedentedly well-informed understanding of terrestrial C stocks and fluxes to inform multiple emerging policy frontiers*":

JULES-RED versions:

Global test simulation (13 PFTs): r26886_vn7.3_test_add_red_sci_trendy

Test forestry management and other work in progress: r24142_add_red_sci_vn1.1

Use at your own risk! Contact: arthur.argles@metoffice.gov.uk if you have any questions.