Some land management information is crucial to represent spatial variability of above-ground productivity in a land surface model.

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5th iLEAPS Science Conference, Oxford, UK
11th September 2017
“The multi-scale response of water quality, biodiversity and carbon sequestration to coupled macronutrient cycling from source to sea”


Smart et al, Funct Ecol (2017)
Soil-plant observations in the Conwy

Key relationships between MNC and above-ground net primary productivity

Datasets available online:
The Macronutrients Turf2Surf project. https://catalogue.ceh.ac.uk/documents/f63d537b-eea3-4203-89bf-d5ab4e14b58d

\[ R^2 = 0.93 \]
Developments in JULES

ECOSSE
Soil C and N

FUN
Plant uptake of N

JULES CORE
Energy, water, photosynthesis

TRIFFID
Dynamic vegetation

Nitrogen
Heat
Evaporation
CO₂
CH₄
Momentum

Precipitation
Radiation
N deposition


Best et al, GMD (2011)
Clark et al, GMD (2011)
JULES + C/N model summary

Observations inform model parameters

Meteorology
Air temperature, pressure and humidity
Wind speed
Down-welling radiation
Precipitation

Soil properties
Hydrological
Thermal

Atmospheric CO₂

N deposition

FUND
Plant uptake of N

TRIFFID
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Evaluate against observations

aNPP

NO₃ and NH₄
Without N limitation all sites are highly over-productive.
JULES-CN

- N limitation reduces productivity for all sites
JULES-CN-OBS

- Observed parameters (leaf mass area, leaf N content, soil pH)

![Graphs showing modeled vs. observed aNPP and aNPP vs. NO3 concentration.](image)

[CEH Logo]

[NERC Logo]
Fertiliser N inputs

- Four of the sites are managed, with significant fertiliser inputs
  a) Improved grassland
  b) Arable (barley)
- Known mineral application
- Estimated from slurry application, Defra fertilizer manual (RB209)
Knowledge of input (fertiliser) improves productivity gradient.
Investigating processes

Graph 1: aNPP (gC m$^{-2}$ yr$^{-1}$) vs. Soil pH

Graph 2: NO$_3^-$ (gN m$^{-2}$ in top 1m soil) vs. Soil pH

Legend:
- Peat
- Rough grass
- Conifer
- Broadleaf tree
- Improved grass
- Arable
- Heath
- Observations
- Model

Centre for Ecology & Hydrology
Natural Environment Research Council
Turf2Surf
NERC Science of the Environment
Summary

• N cycle is necessary for better representation of vegetation in LSM
• Comprehensive observation campaign allows detailed assessment of LSM
• Knowledge of inputs is key to representing productivity gradient
• Further investigation and improvement of modelled processes is ongoing


• Smart, S. M. et al. (2017), Leaf dry matter content is better at predicting above-ground net primary production than specific leaf area. Funct Ecol, 31: 1336–1344. doi:10.1111/1365-2435.12832

• The Macronutrients Turf2Surf project, https://catalogue.ceh.ac.uk/documents/f63d537b-eeaa-4203-89bf-d5ab4e14b58d