



Long Term Large Scale Project

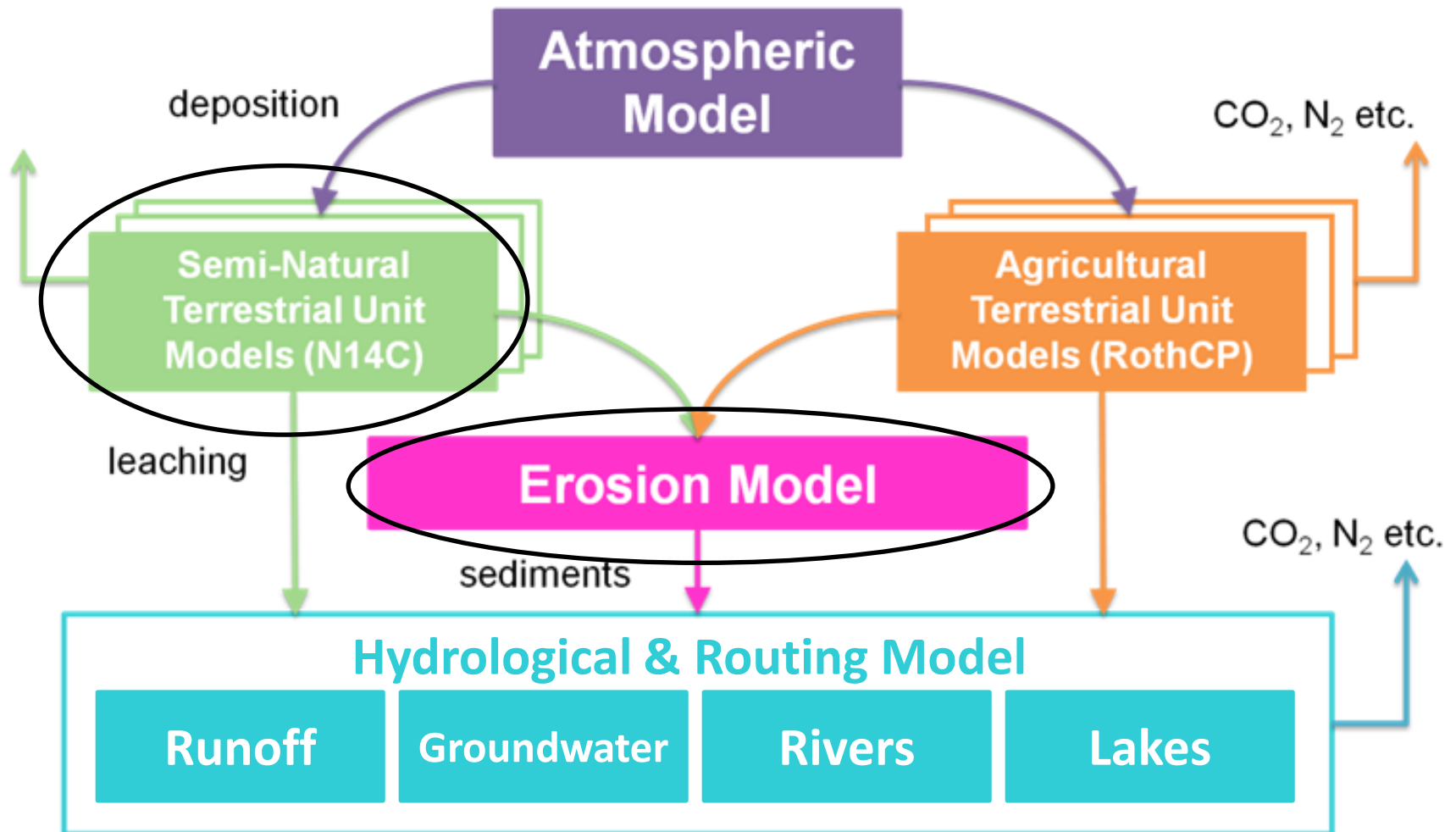
Semi-natural terrestrial modelling & erosion

Jess Davies^{1,2}, John Quinton¹, Ed Tipping²

¹Lancaster University

²Centre for Ecology and Hydrology, Lancaster

LTLS - Integrated Model



Terrestrial Modelling

~10,000 5 x 5 km grid cells...

...each with up to 7
current land use
types...



... and their own land
use history...

12000 BC

2000 AD



... all of which were originally semi-
natural

~45,000 Terrestrial simulations



Semi-Natural Terrestrial Model: N14C

Above ground:

- 4 Plant Functional Types
- Coarse and soft plant components
- 2 vegetation types high/low C:N

N14C
Model

Now with more P!
P cycling P weathering
and pH

Below ground:

- SOM pools: fast, slow, passive constrained by 14C
- Sorbed P pool
- Weatherable P and BC pools

Simulates on a seasonal time step:

- NPP
- pH
- Plant & Soil C, N, P
- Denitrification
- DOC/DON/DOP Inorg. N & P

Semi-Natural Terrestrial Model: N14C Inputs/Outputs



Atmospheric Inputs:
N, S and P deposition
14C in atmosphere

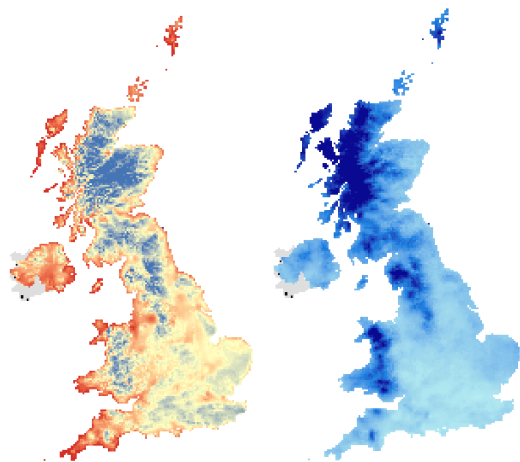
Geology: Determines
weatherable P and
base cations

Fine Sediment

Climate Inputs:
Gridded seasonal temp
& precip 1914-2010
Long-term averages used
pre 1914 with temp anomaly

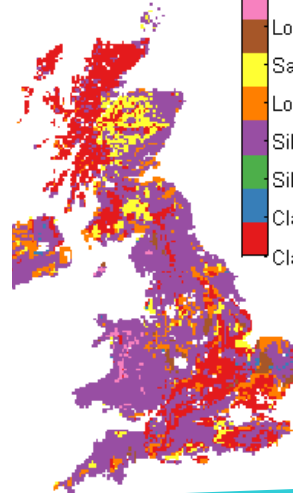
N14C
Model

Erosion
Model

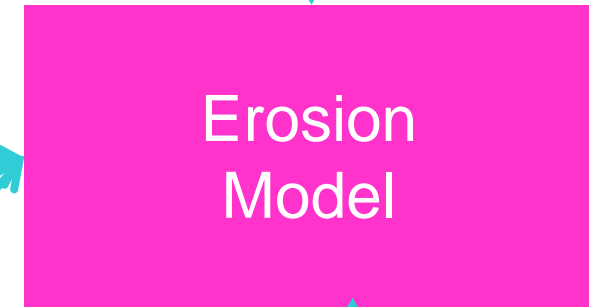
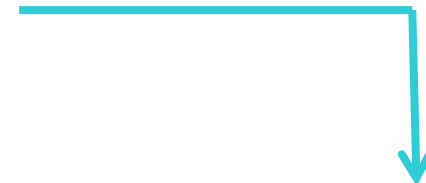


Semi-Natural Terrestrial Model: Erosion

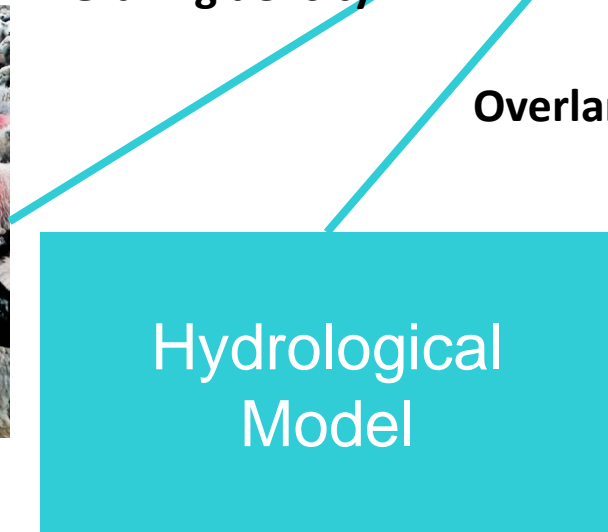
Distribution of slopes
From HWSD



Erodability
From HWSD



Grazing density



Overland flow

Connectivity
From drainage
density



Semi-Natural Terrestrial Model: N14C Inputs/Outputs



Atmospheric Inputs:
N, S and P deposition
14C in atmosphere

Geology: Determines
weatherable P and
base cations

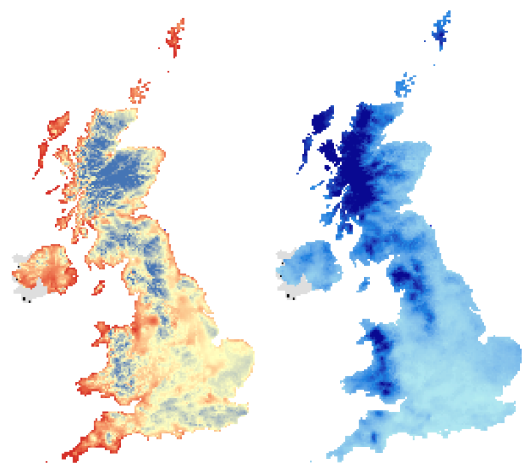
Fine Sediment

Climate Inputs:
Gridded seasonal temp
& precip 1914-2010
Long-term averages used
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N14C
Model

Erosion
Model

Outputs:
DIC, DO14C, DOC, DON, TDP, NO3-N, Ca,
SO4S Labile/Non-Labile POC, PON, POP,
PO14C PADS, PIP



Hydrological
Model

Prototype agriculture



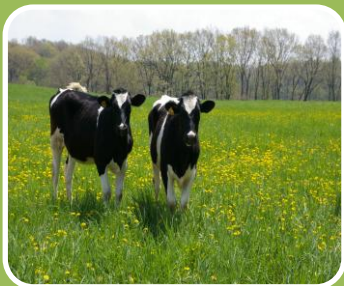
Low intensity (pre-1800) arable assumptions:

- Remove half of biomass at beginning of autumn
- Double the soil process turnover rates to simulate ploughing



Intense arable assumptions:

- Add fertilizer at start of spring (values from Johnston & Dawson 2005)
- Remove 50-80% of biomass at beginning of autumn
- Double the soil process turnover rates to simulate ploughing



Improved pasture assumptions

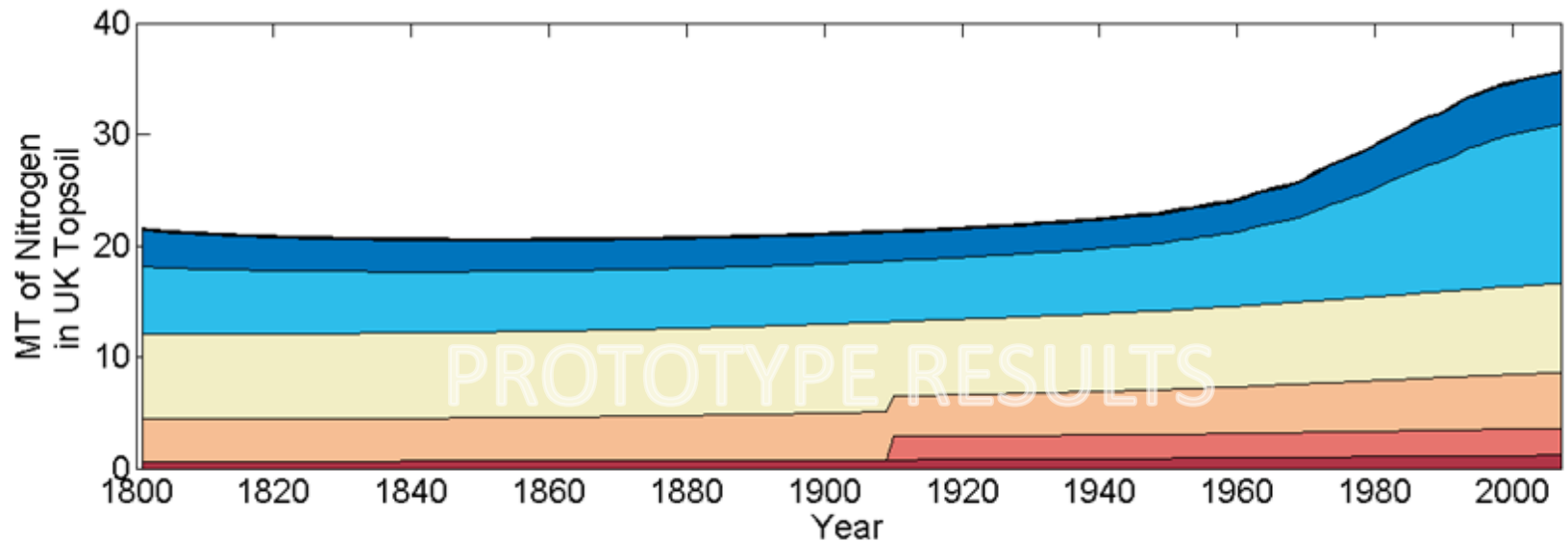
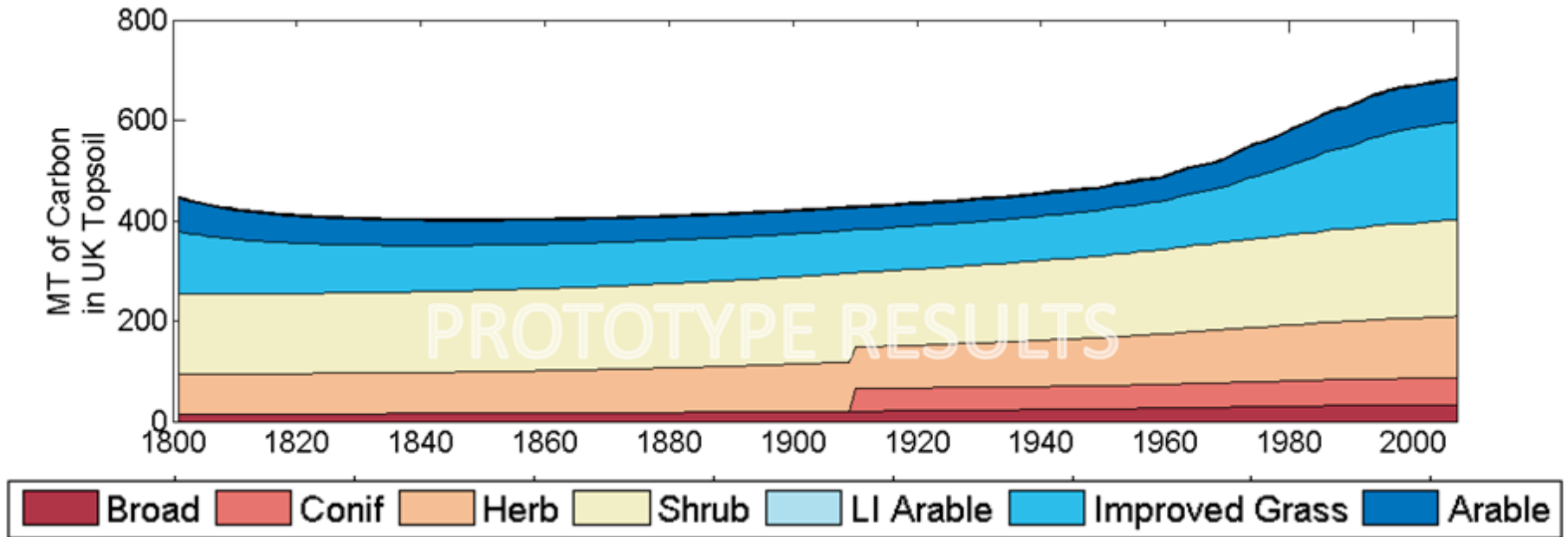
- Add fertilizer same as arable

Prototype results

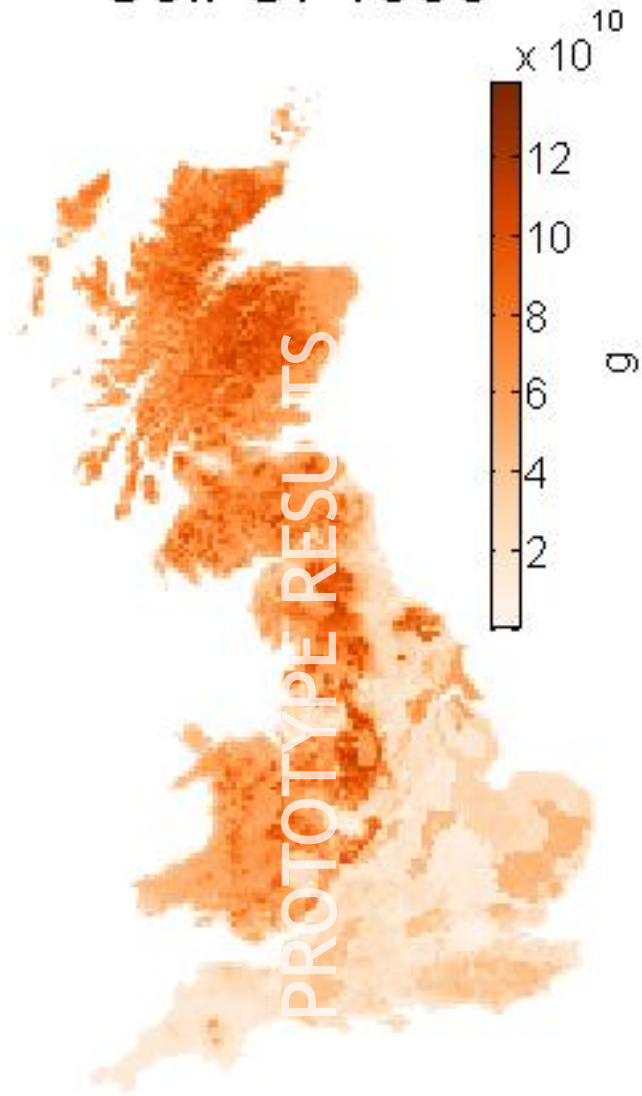
- Nutrient Stores
- Fluxes in:
 - NPP
- Fluxes out:
 - Water phase
 - Sediment phase

WARNING- THESE ARE PROTOTYPE RESULTS!

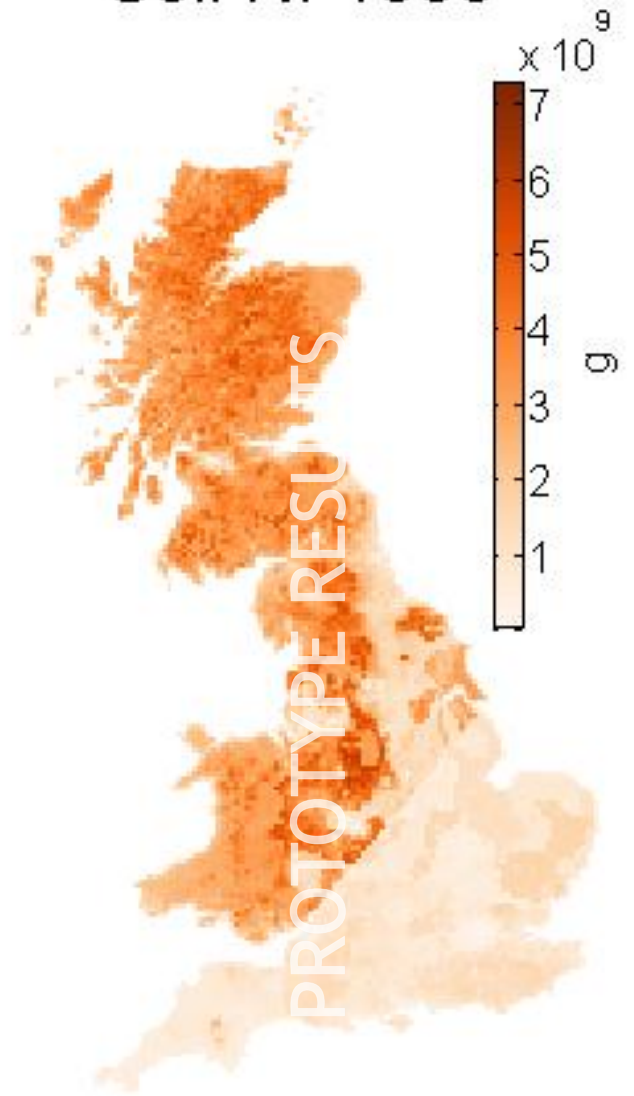
Total UK Topsoil C and N 1800 to 2007



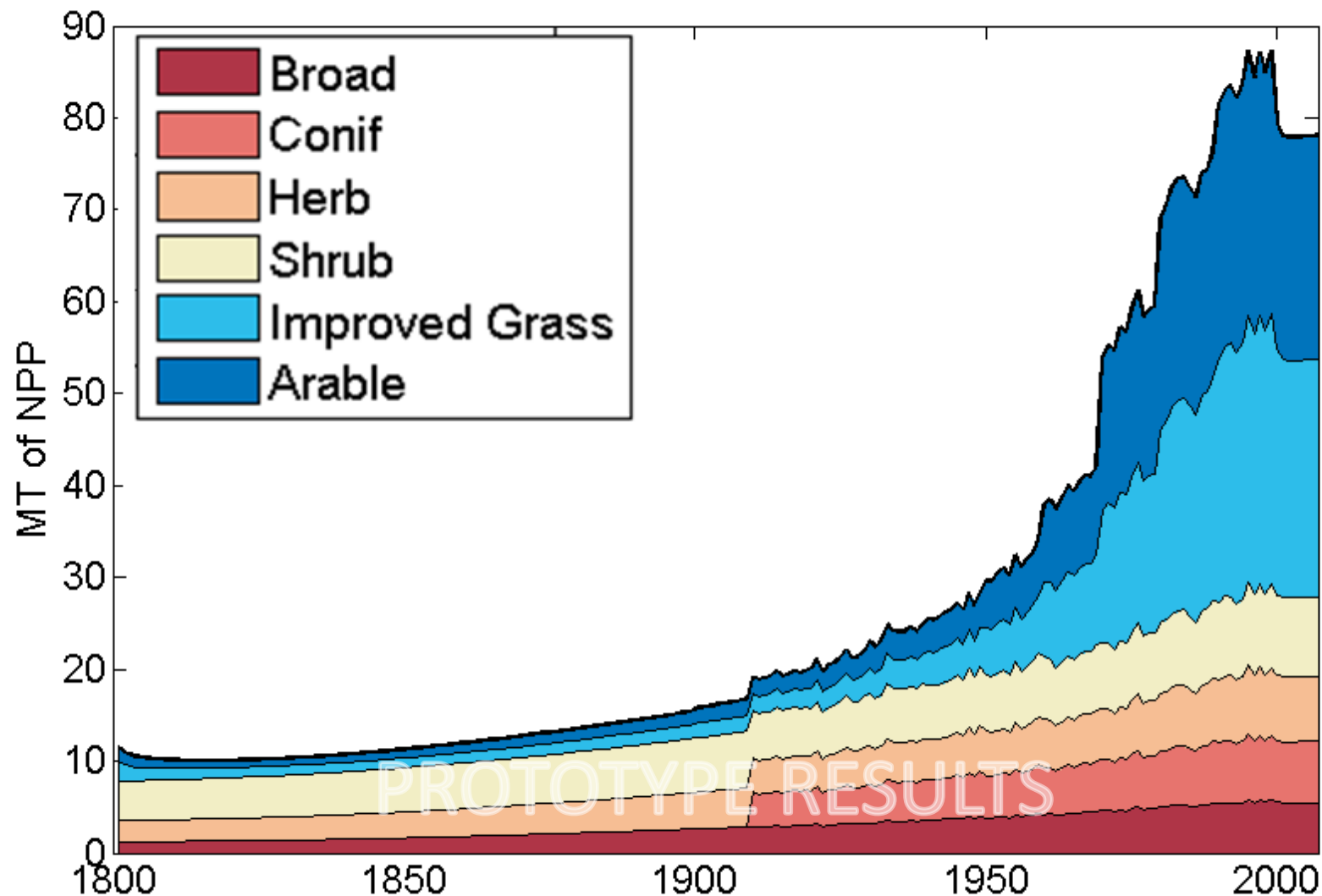
Soil C: 1800



Soil N: 1800



Total UK NPP 1800 to 2007



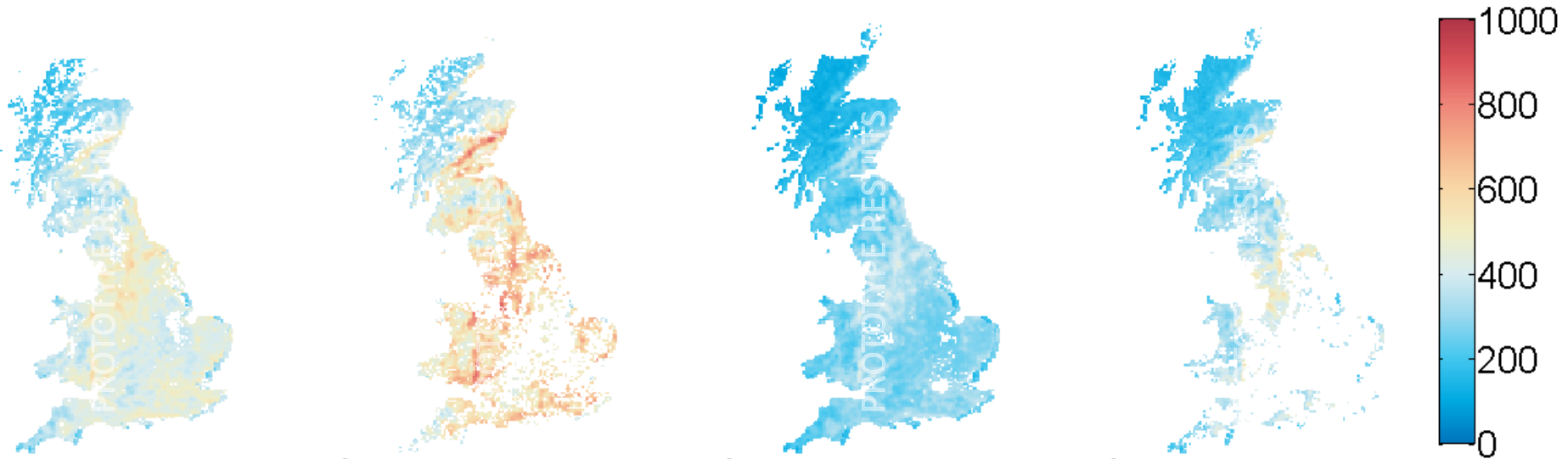
NPP 2007

Broad

Conifer

Rough Grasses

Heath



Prototype results

- Nutrient Stores
- Fluxes in
 - NPP
- Fluxes out:
 - Water phase
 - Sediment phase