Implementation of land cover changes..

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CarboEurope-IP

www.carboeurope.org/

• Inter-comparison of simulations of European carbon balance.

• 9 different land surface models (including LPJ and ORCHIDEE)

  1. site level simulations

  2. climate and CO₂ effects

  3. climate, CO₂, and land use.
CarboEurope-IP

- Common meteorology data
- Common land use data
- Common modelling protocol

Meteorology prior to 1861 is 1900-1930 repeated.

[Graphs showing land use changes and temperature and precipitation patterns over time.]
Stage 3 simulations

Using the standard release of JULES 2.0 as starting point.

This is also an ideal test case for developing a basic representation of land use change for inclusion in HadGEM2-ES GCM (but places constraints on development).
Constraints

However the dual goal placed constraints on what we could do.

The deadlines of CarboEurope meant that we couldn’t do anything too complex or rather wait for other groups to finish development of better models. But also its use in HadGEm2-ES meant:

- No extra PFTs

- Also, in GCM only interested in large scale feedbacks – assume can do this without complicated (or computationally expensive) modelling
European Simulations

- All forcings (1/4°)
- CLIM, CO₂, LU (1°)
- 30-ensemble, All, (3°)
  c-cycle uncertainty
Implementing harvesting

$H_a$ is proportional to $\text{frac}_\text{ag}$, above ground carbon ratio and NPP.

$H_a$ is saved out as a new output diagnostic for offline processing (pool allocation or spatial redistribution).
Forest clearance

- Correct accounting for when land use expands into regions of previously forested – redirection of above ground and below ground carbon.

**Standard scheme**

**Updated scheme**

* Reduced frac cover

* When due to land use expansion
Dynamic $frac\_ag$

Single point JULES run (equilibrium = forest), simple 0-90%-0 forcing, 150 years.
Time templating implemented

Standard INIT_AGRIC

******************************************************************************
## Agricultural fraction.
>INIT_AGRIC

F, 'asc'
'input/agr.dat'
0, 0
1, 'frac_agr'
1 'Land'

# Data fields to be read from this file should appear
>DATA
60000*0.0 ' frac_agr

******************************************************************************

Updated INIT_AGRIC

******************************************************************************
## Agricultural fraction
>INIT_AGRIC

T 'asc'
'input/agr.dat'
0, 0
1, 'frac_agr'
2 'Land'

# Data fields to be read from this file should appear
>DATA
1700010L, '00:00:00'
0.0 0.0 0.4 0.4 0.0

>ASCBIN
0.0 ' nheaderFile.nheaderFile
1

# Data fields to be read from this file should appear
>DATA
10000*0.0 ' frac_agr

******************************************************************************
(some) Limitations

- Nitrogen limitation not included.
- Management not included
- Crop yield carbon pool not included
- Spatial redistribution of carbon not included
Results

- Different effects
Results

- Sensitivity to harvesting parameters
NEP uncertainty

Area total NEP [TgC/year]