Synthesis of the potential effects of current and anticipated future land-use and -mitigation policy on the climate system

An analytic and model-based exploration of land system change as a mitigation option, also including adaptation

Quantification of the impact of changing methodology to incorporate LULCC on the modelled carbon cycle and climate

Develop scenarios for land-based climate change mitigation, based on SSPs

Identify indirect effects and trade-offs of land-use-based mitigation options

Good practice guidance on MRV incorporating LUC4C

LUC4C SDWG-Boulder, February 2014
Project

• EU FP7 Integrated project: 603542 – LUC4C
• Duration 4 years, 01/11/2013 – 31/10/2017
• 15 Partners from 11 EU and 4 non-EU countries; total ca. 8 Mio € (6 Mio € from EU)
Challenges

1. Key aspects of land use with the largest effect on climate, including their dependencies across time and space

2. Innovative methods to better quantify the dynamic interactions between land use and the climate system

3. Synthesis products and best practice guidelines for identification of benefits or adverse effects of land-based mitigation options & adaptation strategies
Some of the issues to be addressed
Biophysical and biogeochemical climate effects of afforestation (and hence also deforestation) have regionally different magnitude and signs.

Arora & Montenegro, Nat. Geosc. 2011
Uncertainties are large...e.g., attribution of the inter-model differences in $Q_{LE}$ to:

VEG : Vegetation distribution. PAR : Land-Surface Parameters & parameterizations
REF : combines VEG & PAR. ALL & MOD = REF + remaining influences

De Noblet et al., GAP 2014
Different decisions on land-transitions

De Noblet et al., GAP 2014
Different estimates on LUC-CO$_2$ emissions

Global C budget (2000-09: PgC a-1)

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil fuel combustion and cement production</td>
<td>7.8±0.4</td>
</tr>
<tr>
<td>Land-use change</td>
<td>1.0±0.5</td>
</tr>
<tr>
<td>Atmospheric growth rate</td>
<td>4.0±0.1</td>
</tr>
<tr>
<td>Ocean sink</td>
<td>2.3±0.5</td>
</tr>
<tr>
<td>Residual terrestrial sink</td>
<td>2.5±0.8</td>
</tr>
</tbody>
</table>

Houghton et al., 2013; Le quéré et al., 2009
From land cover to land use: Influence of crop representation on LUC-CO2 emissions

• AR5 ESMs represented croplands as grasslands.

• Does it make a difference when attempting to account for crop-specific processes?
Develop scenarios for land-based climate change mitigation, based on SSPs.

Identify indirect effects and trade-offs of land-use-based mitigation options.

Good practice guidance on MRV incorporating LUC4C.
Focal regions

1. Globe
2. Continental Europe (EU and European Russia)
3. Sub-Saharan Africa
4. South/southeast Asia
Land-use change model intercomparison

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Methodology to incorporate land-use changes provided by IAMs and/or land-use models into ESMs

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Performance of DGVMs in assessing LULCC-mediated climate impacts; assess ESM capacity in detecting observed changes in land properties

LUC4C
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Performance of DGVMs in assessing LUC-mediated climate impacts; assess ESM capacity in detecting observed changes in \( bph \) and \( bgc \) land properties

LUC-model intercomparison

Impact of changing methodology to incorporate LUC on the modelled carbon cycle and climate

Methodology to incorporate land-use changes provided by IAMs and/or land-use models into ESMs