

# Comparative evaluation of C and N models for global scale GHG mitigation

Renáta Sándor, Gianni Bellocchi and the JPI-FACCE CN-MIP team





# Current state of climate change

## September 2018

Australia

The New York Times

Drought Relief Is Coming. Australia's Farmers Say It's Nowhere Near Enough.



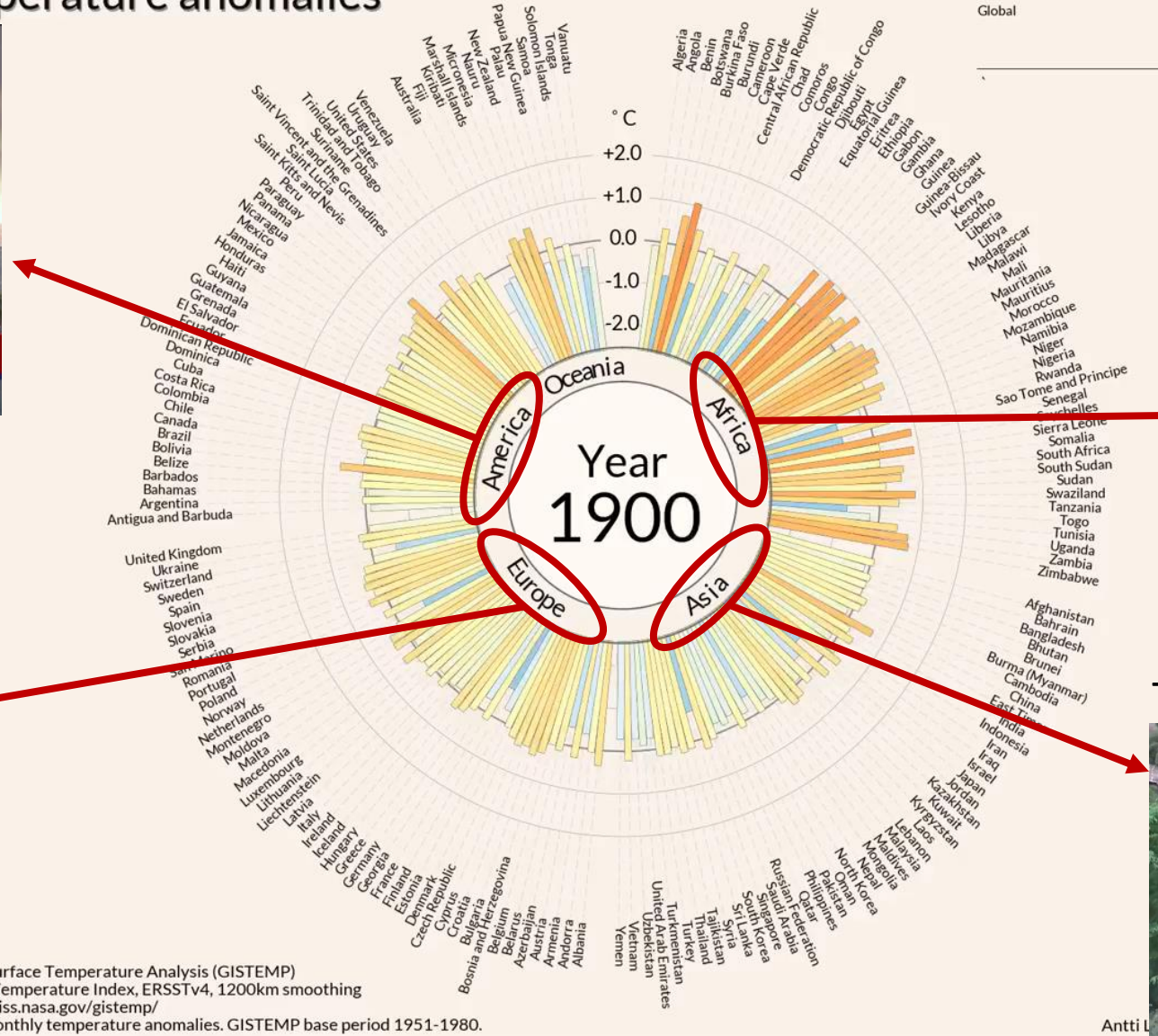
South Africa



Thailand



Temperature anomalies



California, US



Budapest

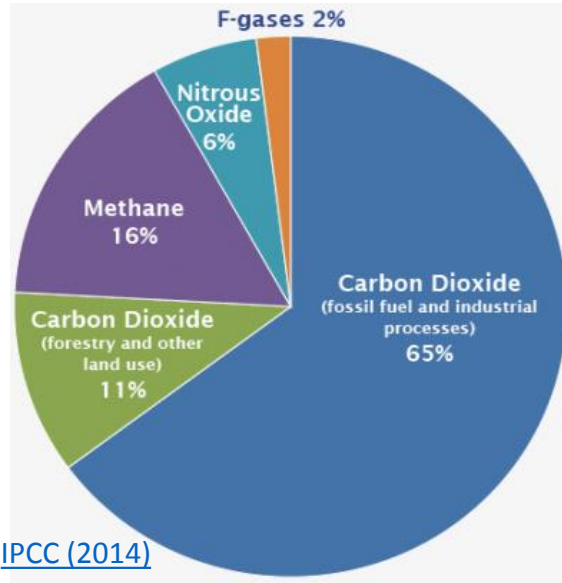


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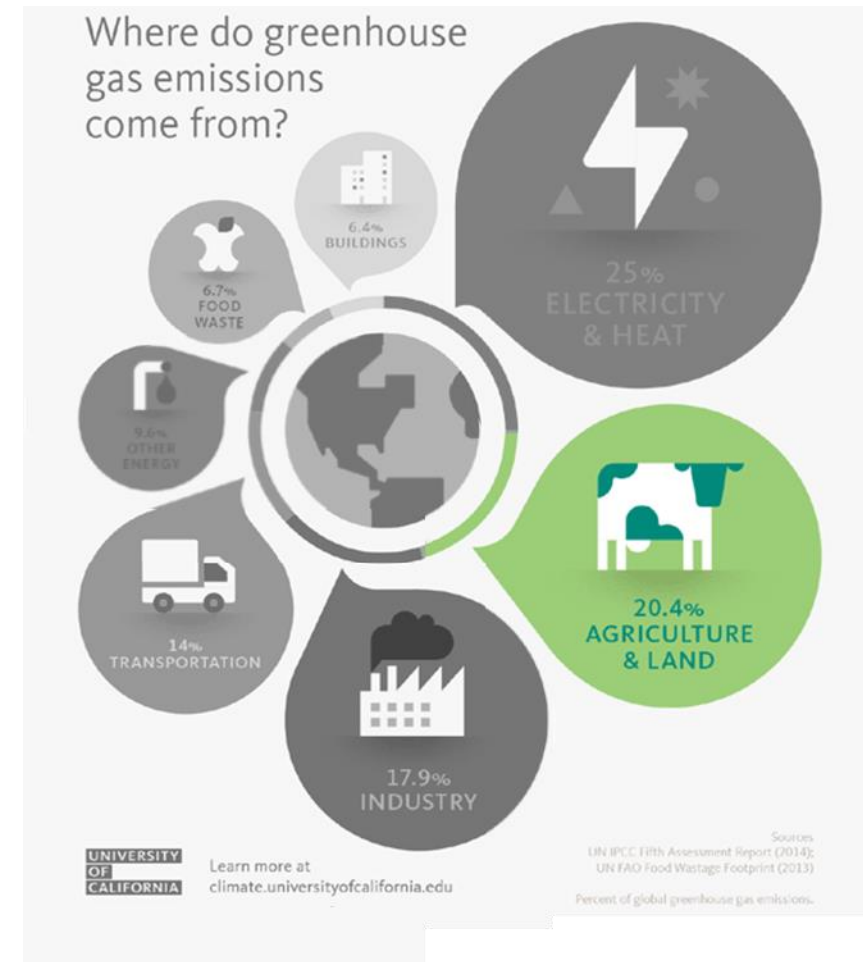


# Source of GHG

- Agricultural GHGs are related with **C and N cycling**



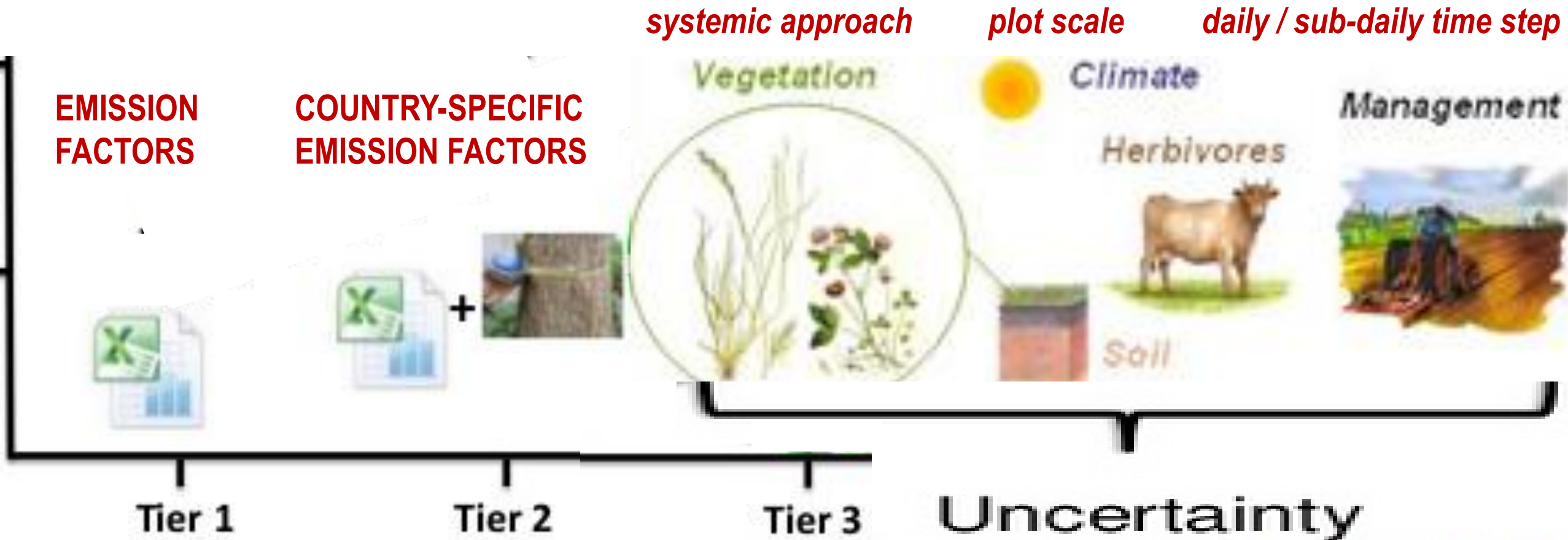
Source: [IPCC \(2014\)](#)



- The **increase of soil organic carbon (SOC)** stocks improves soil quality and structure
- **Human activities** could lead to either losses or gains of SOC and SON in croplands and grasslands



- The need to mitigate climate change requires the **abatement of GHG emissions** and the **sequestration of organic C** in cropland and grassland soils
- This must be accomplished while **increasing agricultural productivity** under climate change to keep up with **global increasing demand and improve food and nutritional security**



*“It would be premature to fully trust model outputs as representing reality” (Oertel et al., 2016)*

There is a need for **greater confidence in the biophysical models** to assess C balances in agricultural systems are required in order for policy makers and stakeholders to use the information for policy and mitigation options

The initiative **Model intercomparison for agricultural GHG emissions** was established in 2014, with the support of projects funded by a multi-partner call on agricultural GHGs (FACCE JPI)



Paris, France - March 2014



Fort Collins CO, USA, March 2015



Rome, Italy - March 2016

- ◇ ~40 scientists (modellers, data providers, statisticians) from 30 institutions
- ◇ >20 simulation models from 11 countries



## Crop sites:

- Australia (C4)
- Brazil (C5)
- Canada (C1)
- France (C2)
- India (C3)

# Study sites

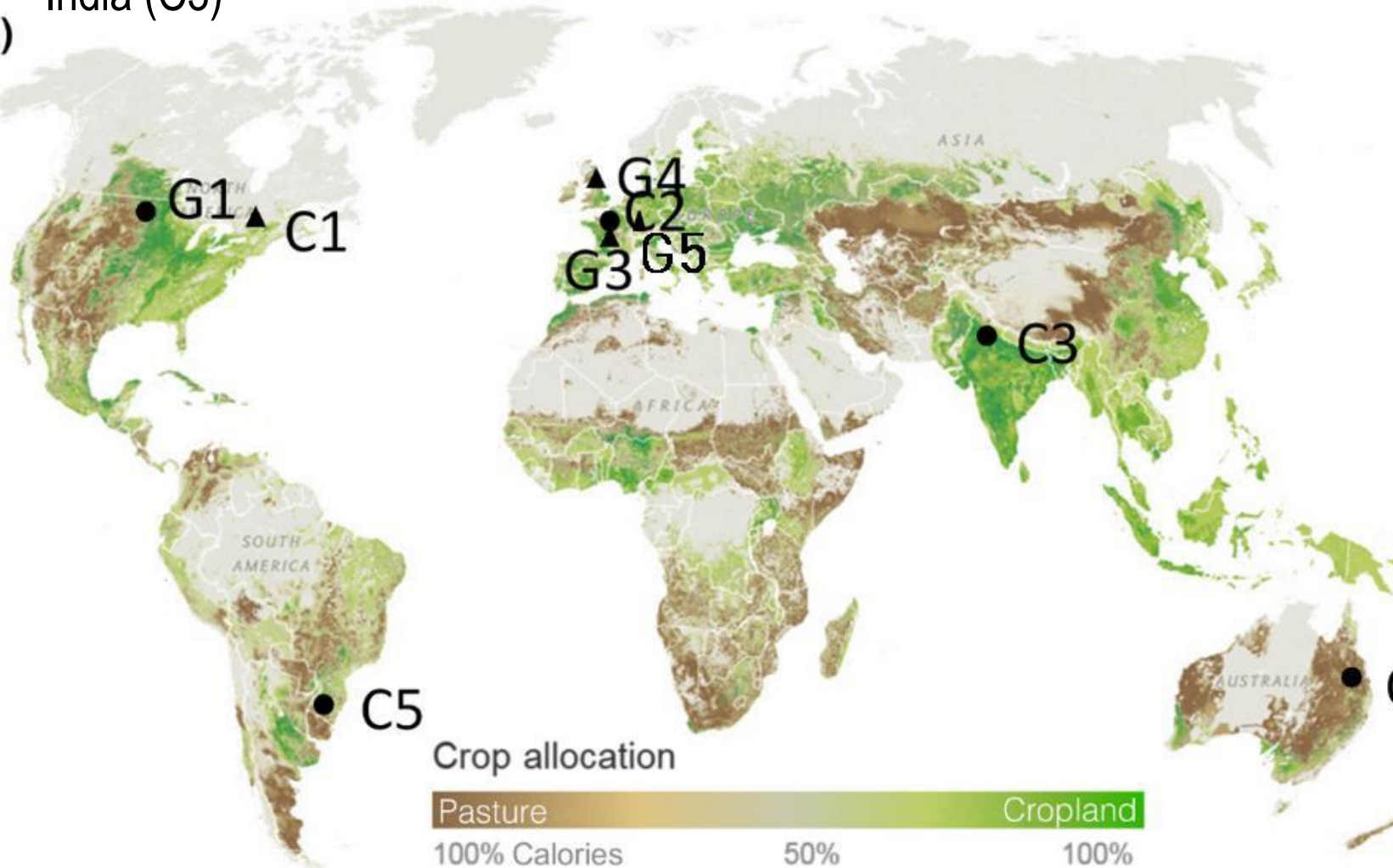
(Ten sites from nine countries)

Providing high-quality multi-year datasets for: climate, soil profile, agricultural practices, production, C cycle, N cycle

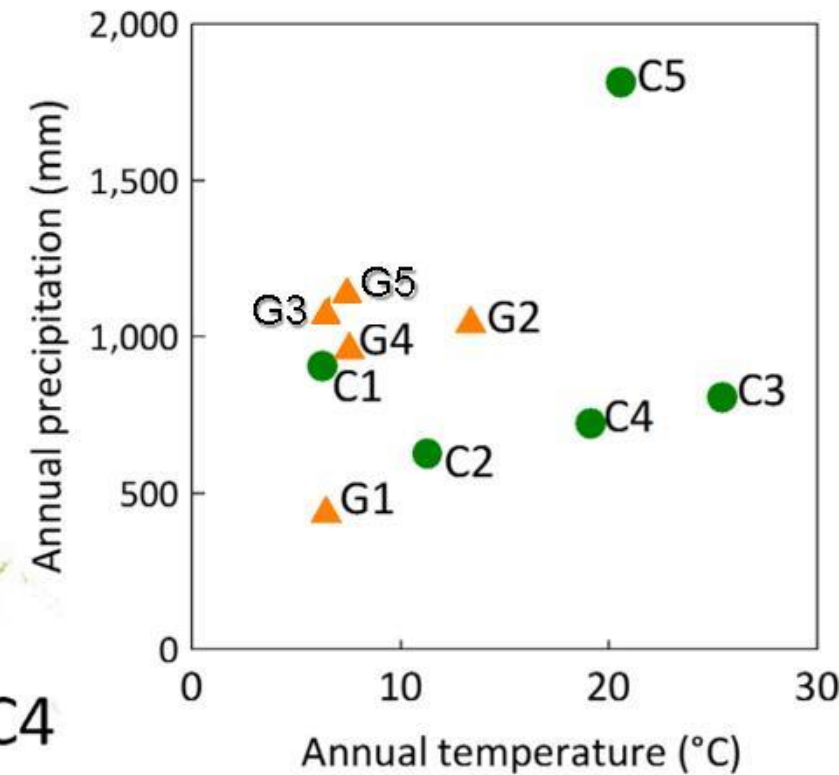
## Grassland sites:

- France (G3)
- New Zealand (G2)
- Switzerland (G5)
- UK (G4)
- USA (G1)

(a)



(b)



# Carbon fluxes (net ecosystem exchange)



Fallow



Winter wheat



Spring wheat



Triticale



Maize



Soybean



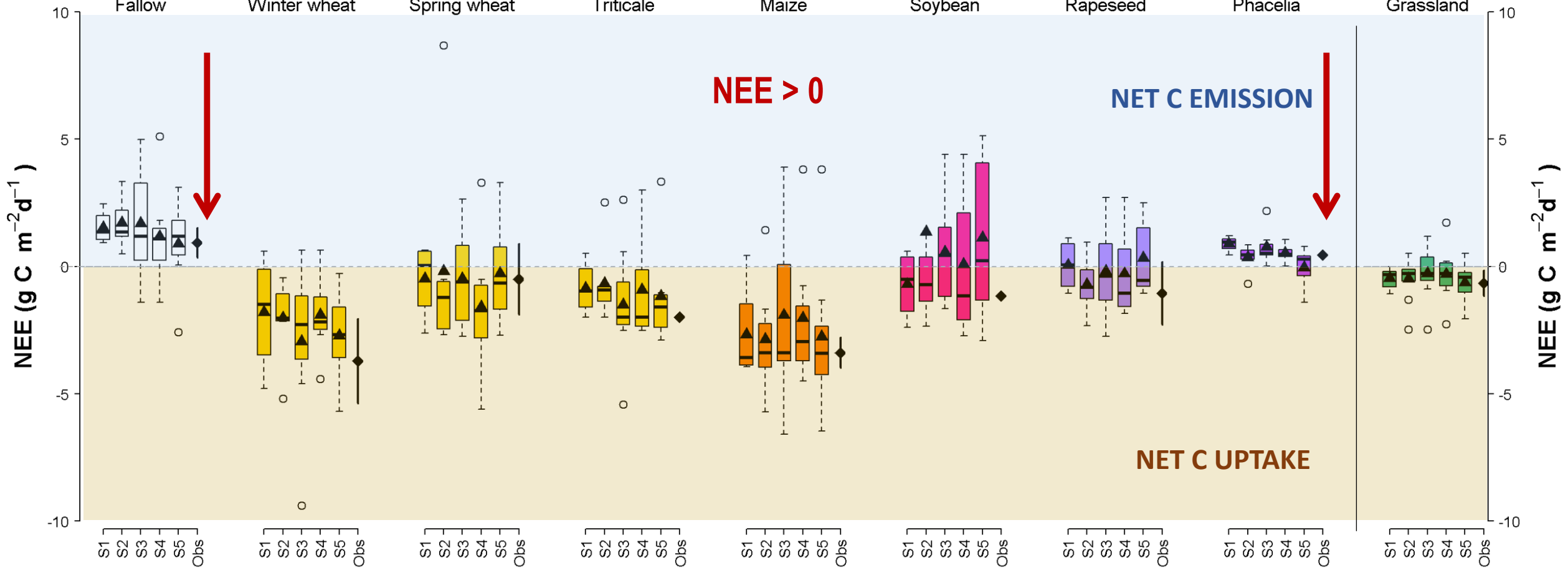
Rapeseed



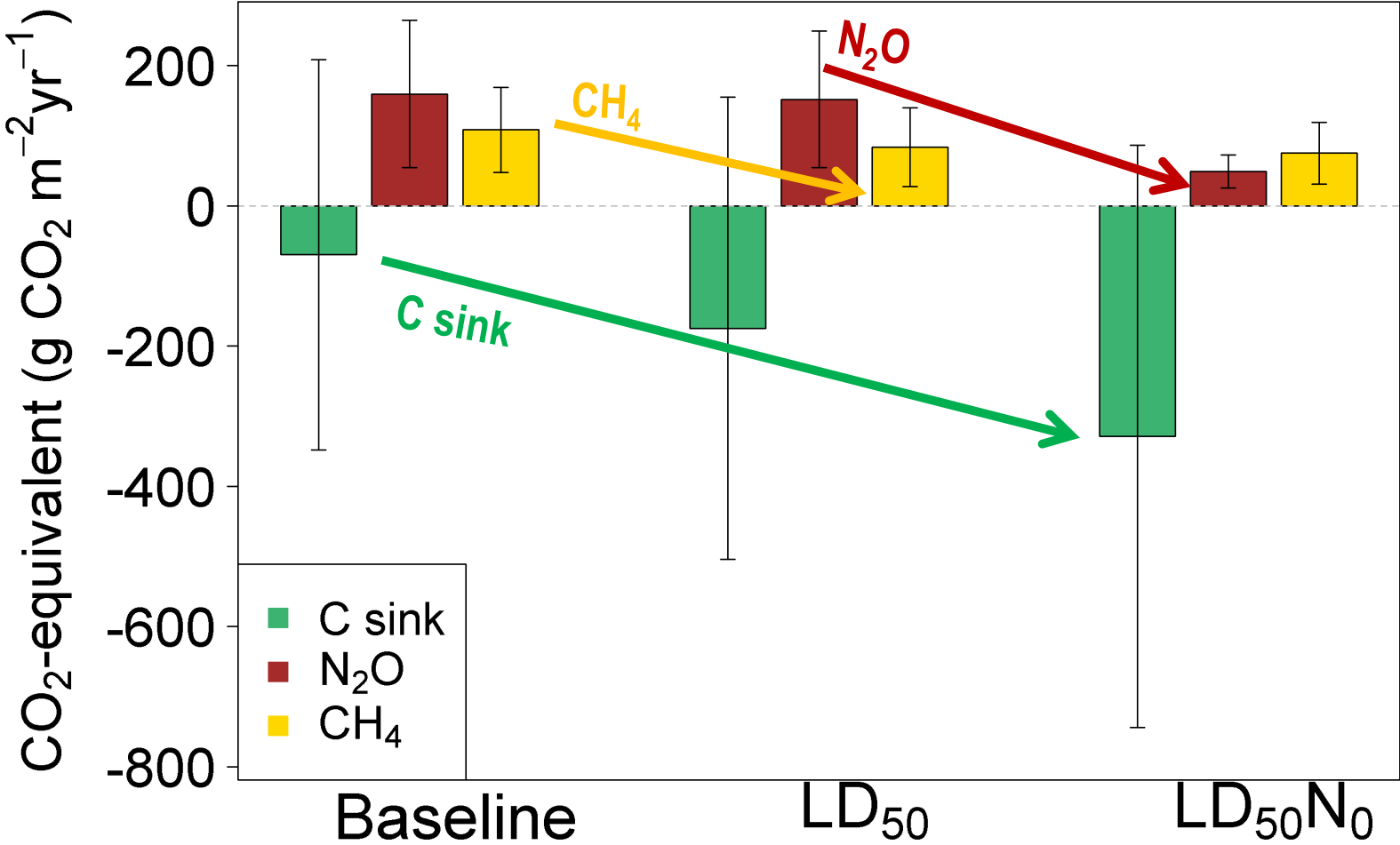
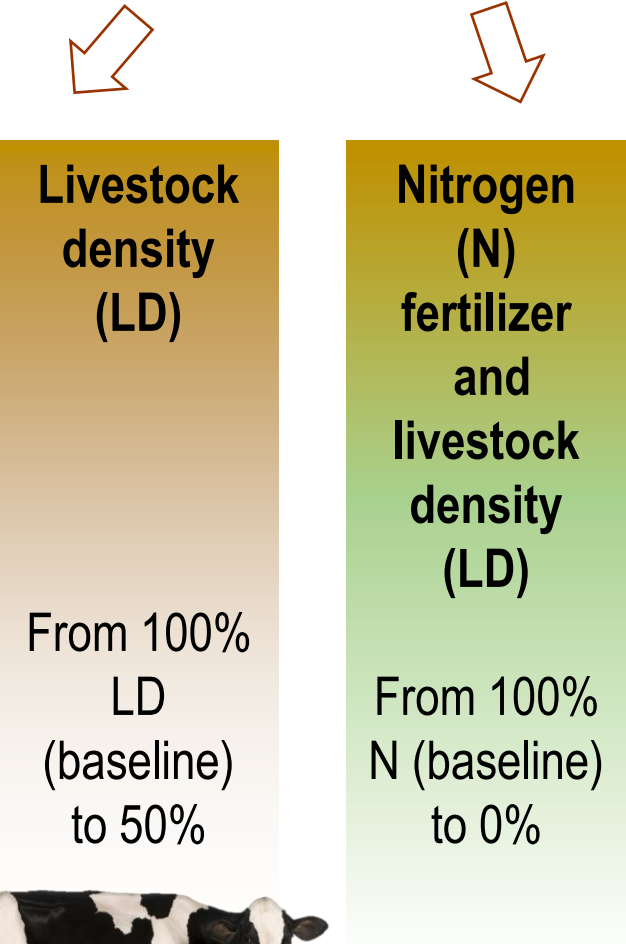
Phacelia



Grassland



# Grassland mitigation options





# Concluding remarks



Testing different crops and mitigation options:

- Extensification would increase the amount of soil organic carbon
- Reduced nitrogen fertilizer would contribute to the abatement of N<sub>2</sub>O emission
- Fallow stage of the soil tends to release carbon

The **accuracy in the modelling of C fluxes** was improved with more detailed site information

Model simulations contribute to **climate smart agriculture** and to **increase food security**



Contents lists available at ScienceDirect

Science of the Total Environment

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The use of biogeochemical models to evaluate mitigation of greenhouse gas emissions from managed grasslands



Renáta Sándor<sup>a,b</sup>, Fiona Ehrhardt<sup>c</sup>, Lorenzo Brilli<sup>d,e</sup>, Marco Carozzi<sup>f</sup>, Sylvie Recous<sup>g</sup>, Pete Smith<sup>h</sup>, Val Snow<sup>i</sup>, Jean-François Soussana<sup>c</sup>, Christopher D. Dorich<sup>j</sup>, Kathrin Fuchs<sup>k</sup>, Nuala Fitton<sup>h</sup>, Kate Gongadze<sup>l</sup>, Katja Klumpp<sup>a</sup>, Mark Liebig<sup>m</sup>, Raphaël Martin<sup>a</sup>, Lutz Merbold<sup>k,n</sup>, Paul C.D. Newton<sup>o</sup>, Robert M. Rees<sup>p</sup>, Susanne Rolinski<sup>q</sup>, Gianni Bellocchi<sup>a,\*</sup>

## Global Change Biology

PRIMARY RESEARCH ARTICLE

### Assessing uncertainties in crop and pasture ensemble model simulations of productivity and N<sub>2</sub>O emissions

Fiona Ehrhardt, Jean-François Soussana ✉, Gianni Bellocchi, Peter Grace, Russel McAuliffe, Sylvie Recous, Renáta Sándor, Pete Smith, Val Snow, ... See all authors ▾

International Conference on Agricultural GHG Emissions and Food Security –  
Connecting research to policy and practice

#AgriGHG

10. - 13. September 2018 in Berlin

### Further plans:

- Submit a TÉT project proposal (2019)
- Publications under preparation



***Thank you for your attention!***