

Brief 2017 Update from The Landscape Management of Agricultural Systems Network (LMAS)

Xunhua Zheng

(corresponding to: Xunhua.zheng@post.iap.ac.cn)

Croplands Research Group Annual Meeting, September 8, 2017, Hatfield, UK

The LMAS Aims and Activities

The Network Aims

- To develop process-oriented carbon and nitrogen biogeochemical model(s), and to validate them at ecosystem, landscape and/or catchment scales.
- To design and promote application of process model-based tool(s) to enable virtual science experiments and/or management decision support for reducing greenhouse gas emissions at the landscape level.

The Network Activities

- Improve and validate model(s) at the aforementioned scales.
- Create a demonstration tool of virtual experiment or management decision support for a catchment scale.
- Develop project proposal(s) for cooperative researches aiming at the network goals.
- Align future activities with the Integrative Research Group.

GHGfom -- a LMAS research Project

- **GHGfom:** Effects of climate and management practices on yield and GHG footprint of maize cultivation
- **Five-year NSFC-UNEP joint project:** Jan. 2018 to Dec. 2022
- **Participants:** X. Zheng¹, N. Raut², K. Butterbach-Bahl³, R. Sommer⁴
Z. Yao¹, S. Han¹, W. Zhang¹, S. Li¹, C. Fu⁵
- **Institutions:** ¹ Institute of Atmospheric Physics, CAS, China
² International Ecosystem Management Partnership, UNEP
³ International Livestock Research Institute (ILRI)/CGIAR, Kenya
⁴ International Center of Tropic Agriculture (CIAT)/CGIAR, Kenya
⁵ Institute of Geographic Sciences and Natural Resource Research, CAS, China
- **Target agricultural systems:** maize cultivation in tropic (Kenya) and warm temperate/cool temperate (China) climates
- **Models to be involved:** LandscapeDNDC, CropSys, CNMM-DNDC

GHGfom aims at tool development for decision support of climate-smart maize production

GHG footprint (I): a key index for assessment of the GHG mitigation

$$I = \text{GHG}_n / \text{CP}$$

Net GHG flux over the entire life cycle

Crop production

A fiscal tool using GHG footprint in to mitigate climate change (De Camillis & Goralczyk, 2013):

A green Value Added Tax in the k^{th} year

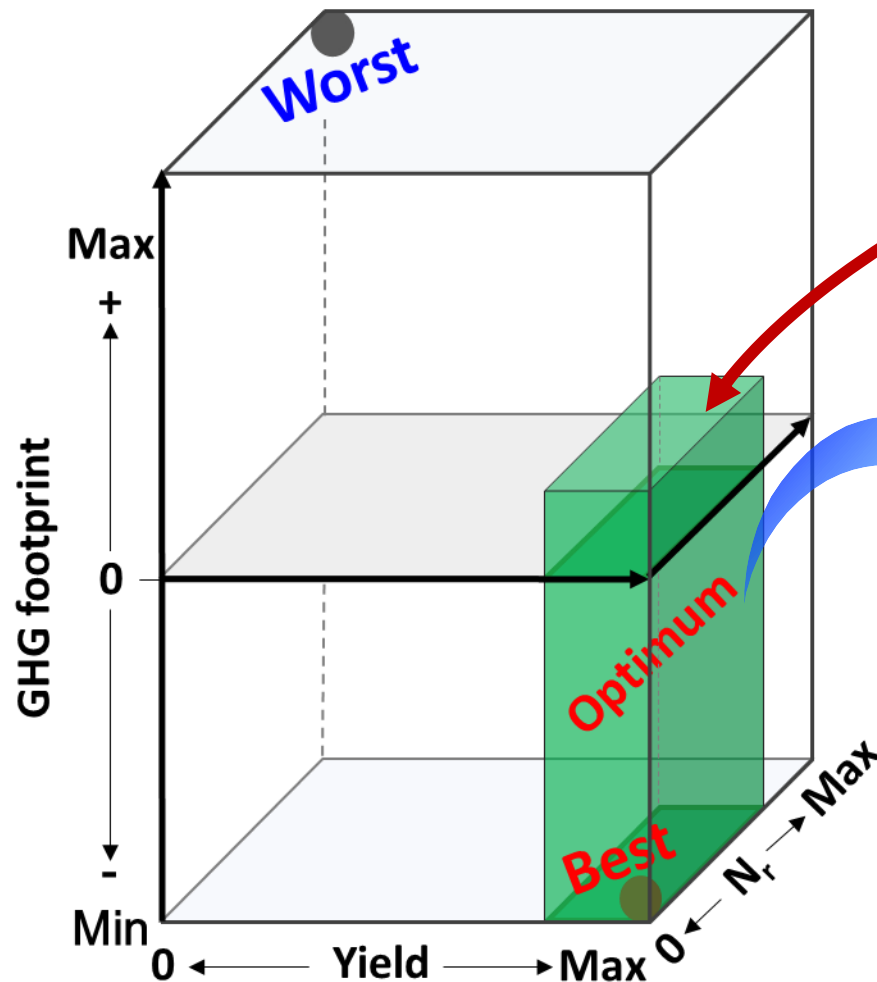
GHG footprint in the $(k-1)^{\text{th}}$ year

$$\text{VAT}_k = \text{VAT} - (I_{k-1} - I_k) / I_{k-1}$$

The Value Added Tax regardless of GHG footprint

GHG footprint in the k^{th} year

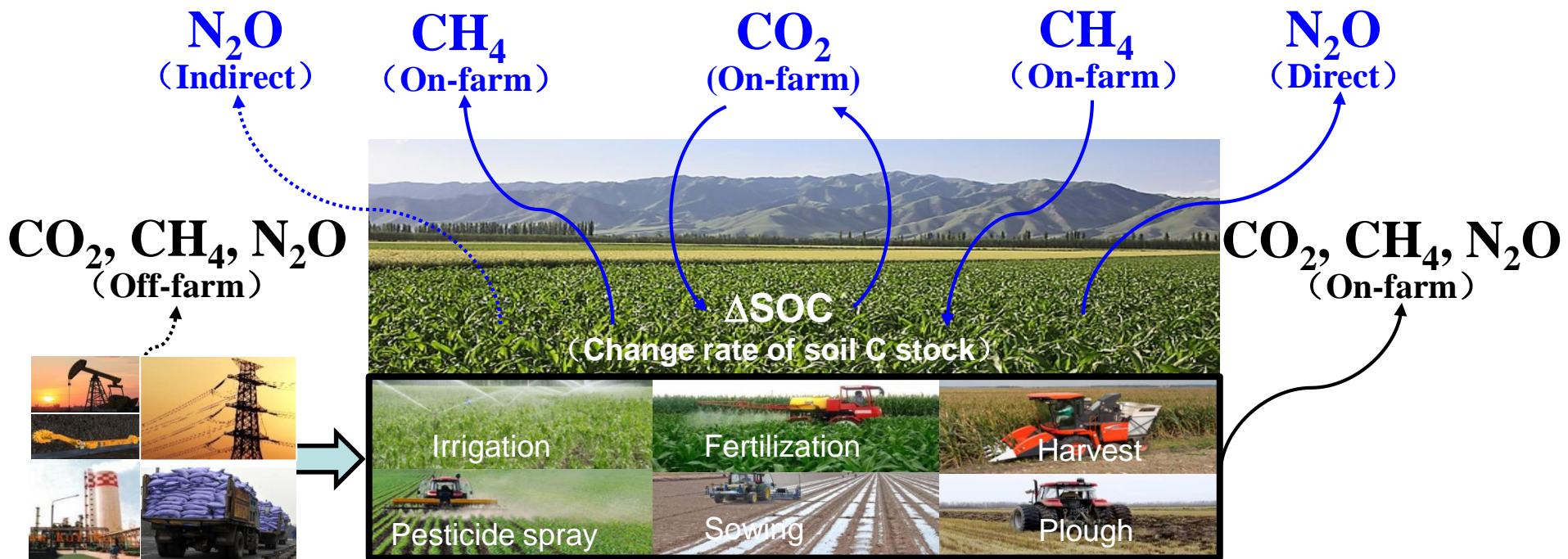
GHGfom aims at tool development for decision support of climate-smart maize production



**Climate-smart
maize production**

- High maize yield
- Low new N_r input
- Low GHG footprint

GHGfom aims at tool development for decision support of climate-smart maize production

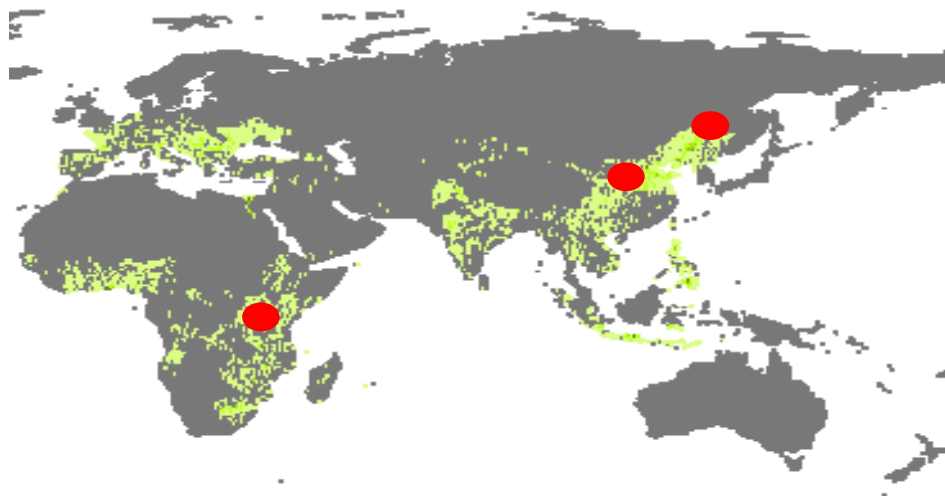


$$\text{GHG}_n = (\sum \text{C}_E - \Delta\text{SOC}) + (\sum \text{M}_E - \sum \text{M}_U) \cdot \text{GWP}_m + \sum \text{N}_E \cdot \text{GWP}_n$$

GHG_n , net life-cycle GHG emission (CO_2eq); C, CO_2 ; N: N_2O ; M, CH_4 ; E, emission; U, uptake; ΔSOC , change rate of soil C stock

GHGfom aims at tool development for decision support of climate-smart maize production

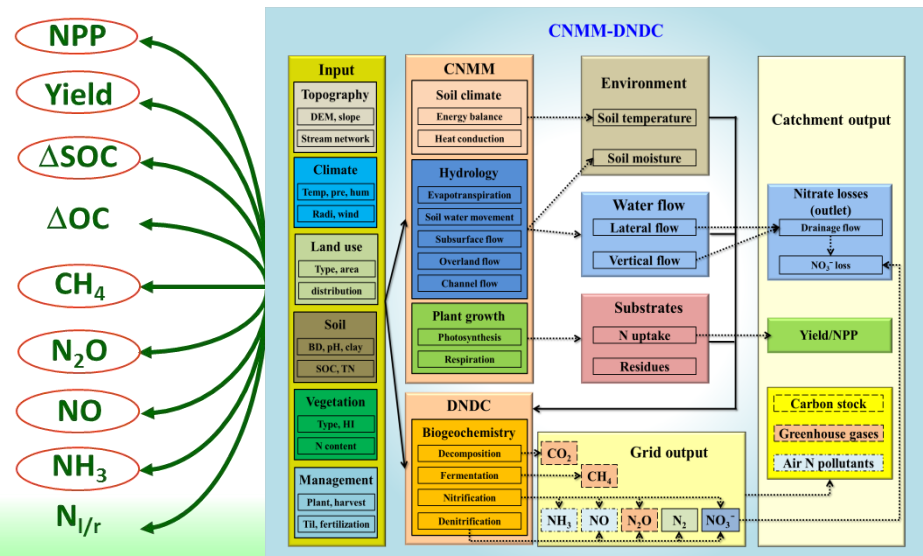
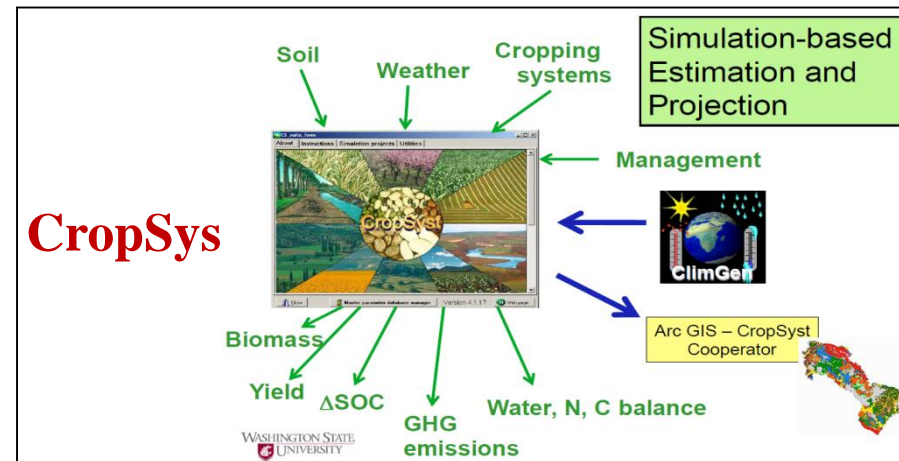
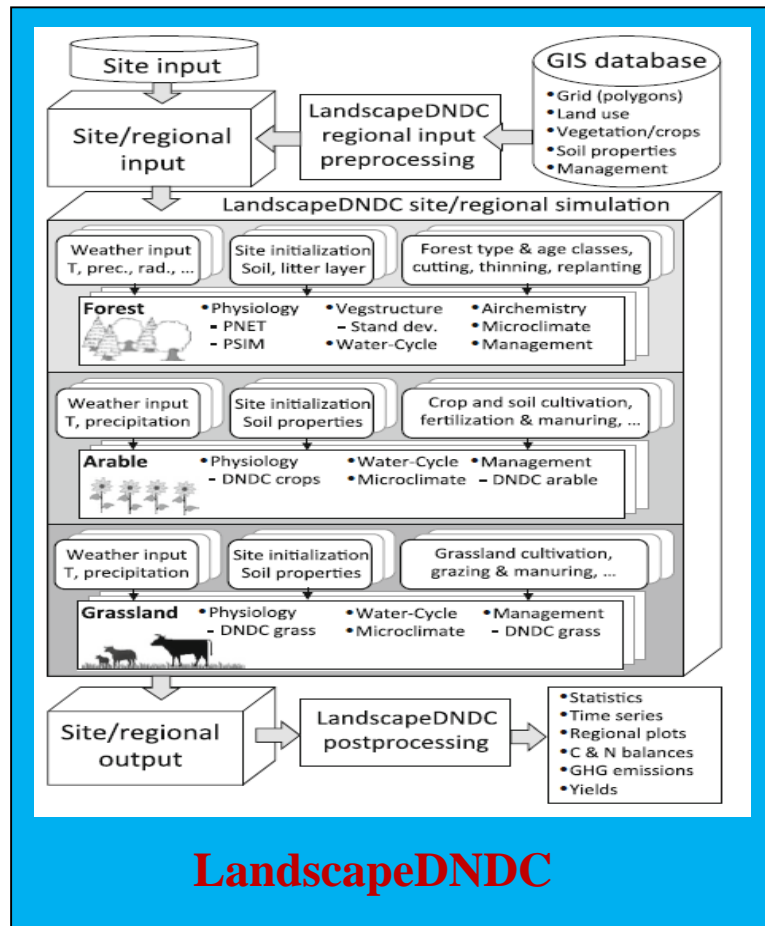
- Climatic zone: **tropical, warm temperate and the transition of the typical and the cool temperate;**
- Management practice: **fertilization, tillage, cropping system, crop residue and other field operations;**
- Direct measurement of the **yield, CH₄ and N₂O fluxes and/or Δ SOC:** **climate and management effects**



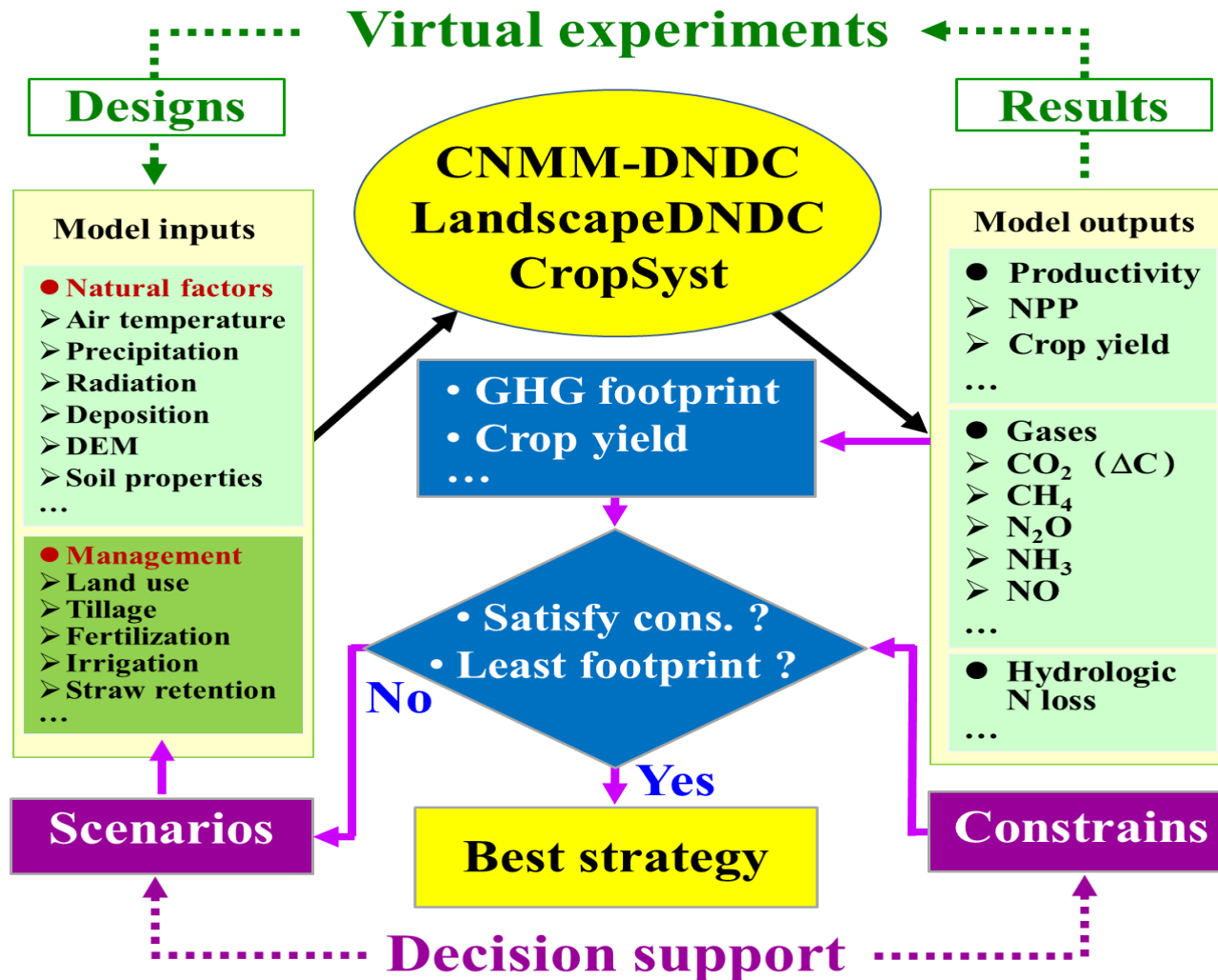
GHGfom aims at tool development for decision support of climate-smart maize production

GLOBAL
RESEARCH
ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES



GHGfom aims at tool development for decision support of climate-smart maize production



Questions GHGfom will attempt to answer in terms of maize cultivation

- How to accurately quantify GHG footprints?
- How can extreme climate events impact GHG footprint?
- How to maximize yields while minimizing the GHG footprints?
- Is it possible to solve the problems of N_r -deficit in Africa and N_r -surplus in China through cooperation in maize cultivation?

A scenic view of a park with a river, a red bridge, and a tall antenna tower in the background. The text "Thanks for your attention !" is overlaid in green.

Thanks for your attention !

Xunhua Zheng from

LAPC, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China

CNMM-DNDC

