ASSESSING IMPACTS OF LAND USE CHANGE USING PREDICTIVE, SPATIAL MODELLING

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LAND USE CHANGE IMPROVED (LUCI) LCA

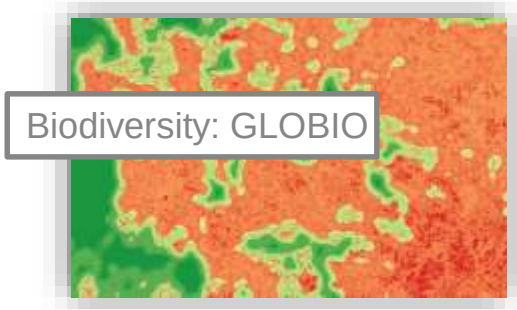
- Collaboration with the Natural Capital Project at Stanford University

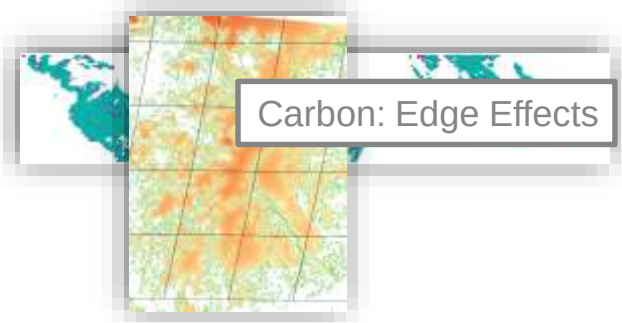
- Aim: *Develop and demonstrate a new approach to assess the impacts of increasing demand for bio-based materials on biodiversity & ecosystem services (BES) in a spatially resolved and predictive way.*

- *Combines InVEST (ecosystem assessment tool) with LCA*

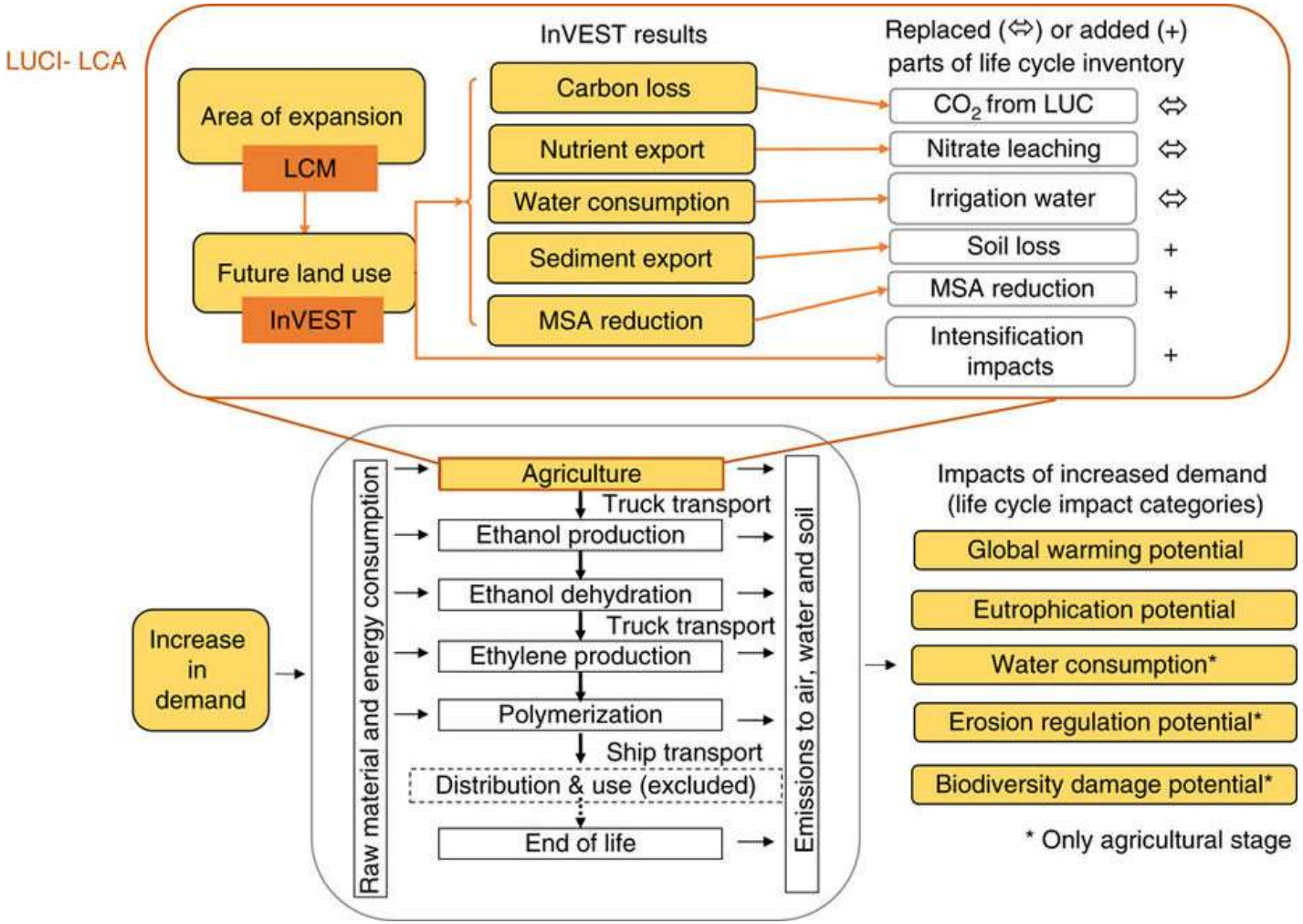
INVEST

- Site-specific ecosystem service assessment tool
- Using globally available, spatially resolved data
- We adapted the tool for predictive modelling of land use change impacts





THE APPROACH



Source: Chaplin-Kramer et al (2017) Nature Communications

BIO-PLASTIC CASE STUDY

BIO-PLASTICS USE CASE

Research Question:
"How does the combination of feedstock & location influence the environmental impacts of bio-HDPE plastic?"

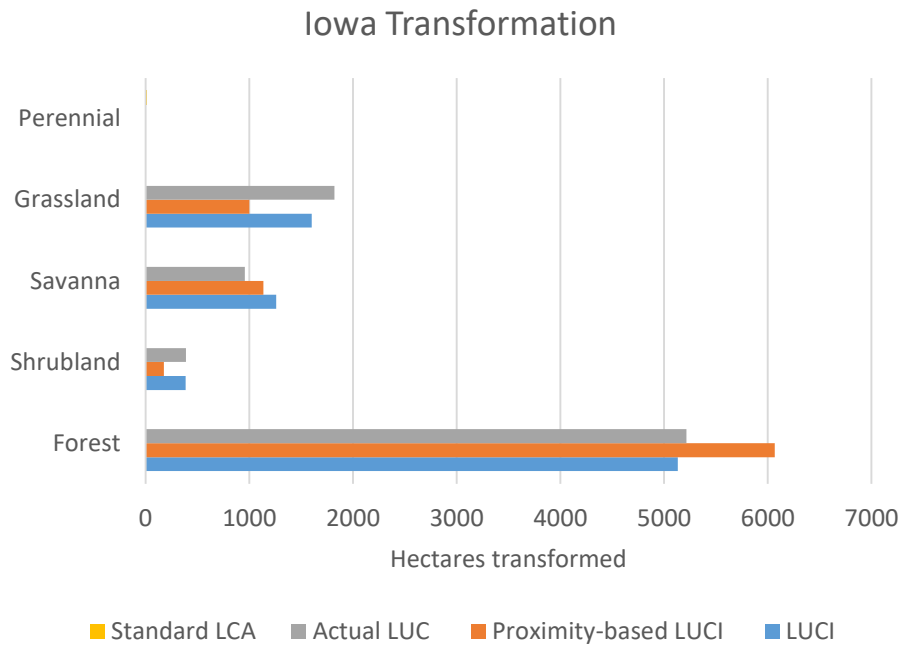
Scope:

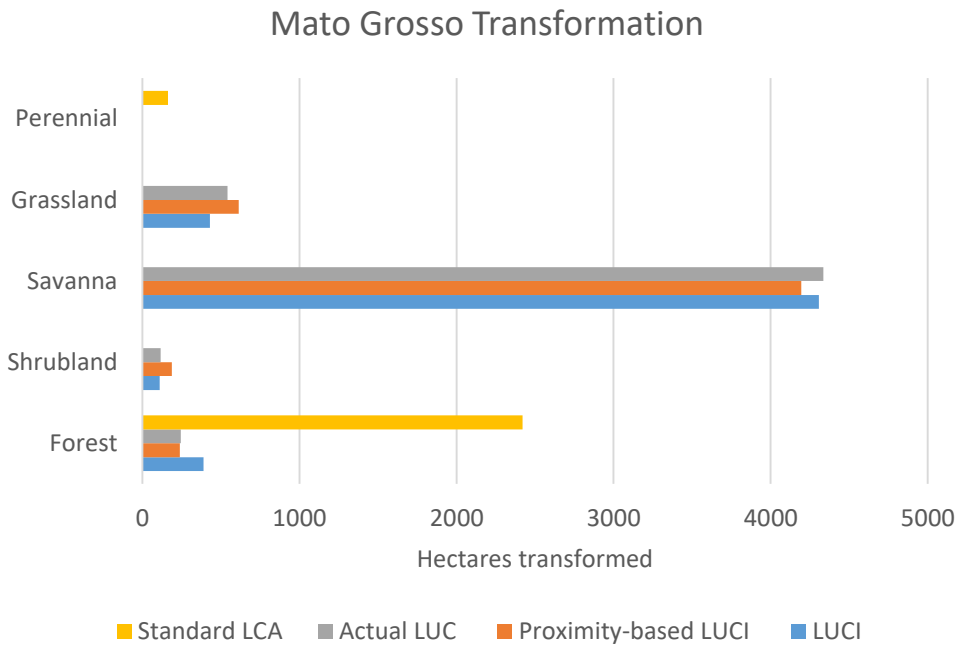
- 3 High-Density PolyEthylene (HDPE) volume (tonnage) scenarios

- 2 feedstock-location combinations:
  - Maize, US
  - Sugarcane, Brazil

RESULTS

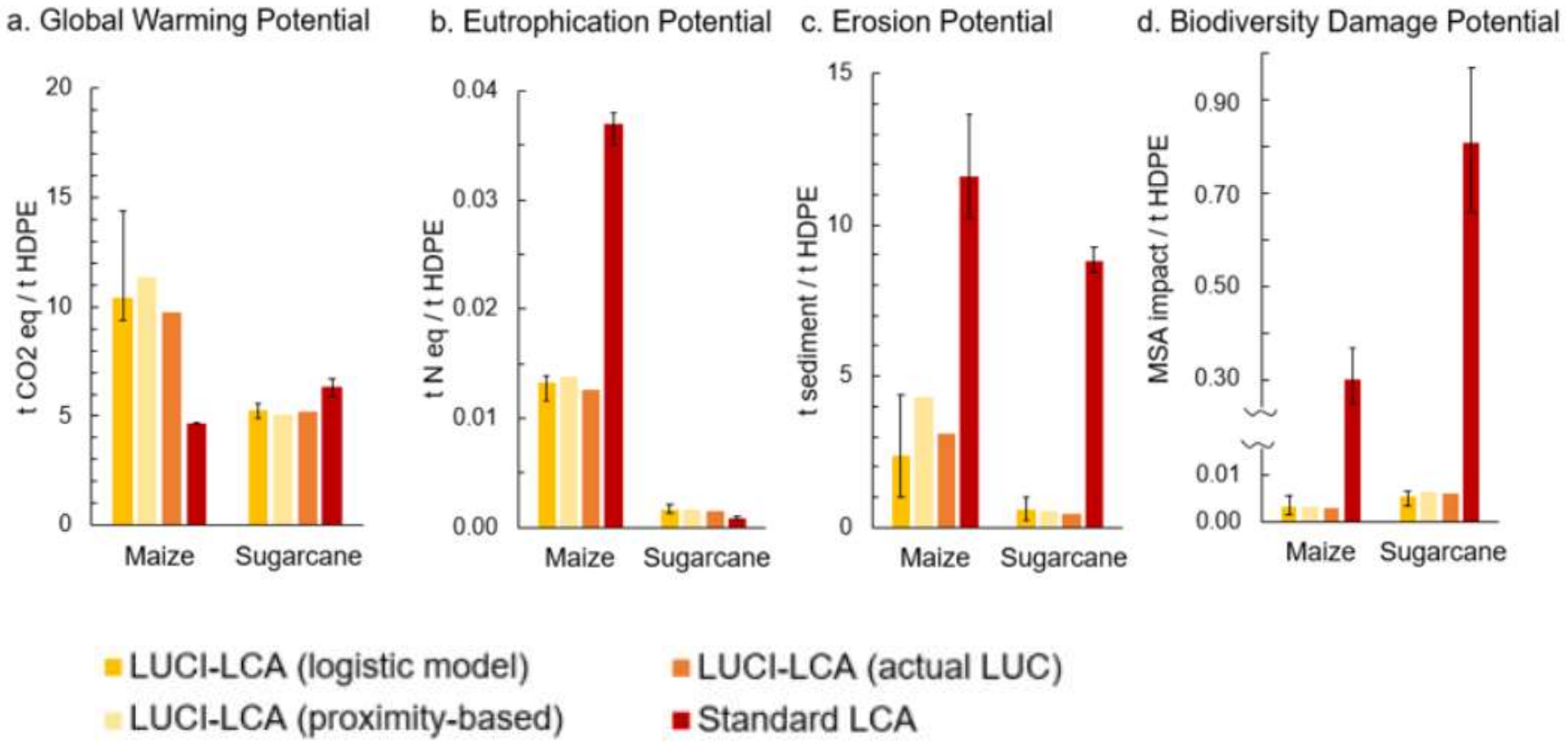
Predicted Land Use Change





Results shown for Scenario 3

RESULTS



Source: Chaplin-Kramer et al (2017) Nature Communications

SCIENTIFIC & BUSINESS BENEFITS

Advantages of LUCI-LCA

- Based on predictive land use changes
- Provides improved spatial resolution of land use change
- Incorporates ecosystem relevant impact assessment categories

Enable us to better inform bio-based innovation & sourcing strategies by:

- Choice of feedstock and location
- Evaluate impacts of scaling technologies
- Management of landscape development / configuration

CONTINUING RESEARCH INTERESTS

Land change modelling requirements:

- Econometric approaches
- Dynamic land change modelling – equilibrium approaches
- Accounting for feedbacks - impacts of climate change on future yields, growing regions and ecosystem impacts
- Local & regional thresholds / tipping points relating to Planetary Boundaries

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Related Publications:

Chaplin-Kramer, Rebecca, et al. "Life cycle assessment needs predictive spatial modelling for biodiversity and ecosystem services." Nature Communications 8 (2017).

Chaplin-Kramer et al. (2015) Degradation in carbon stocks near tropical forest edges, Nature Communications. 6:10158. DOI: 10.1038/ncomms10158

Chaplin-Kramer et al. (2015) Spatial patterns of agricultural expansion determine impacts on biodiversity and carbon storage. PNAS 112 (24) 7402-7407; 2015,doi:10.1073/pnas.1406485112