

REDUCING GREENHOUSE GAS EMISSIONS IN AGRICULTURE: CHALLENGES AND POSSIBILITIES

Biljana Balabanova, Verica Ilieva, Sasa Mitrev

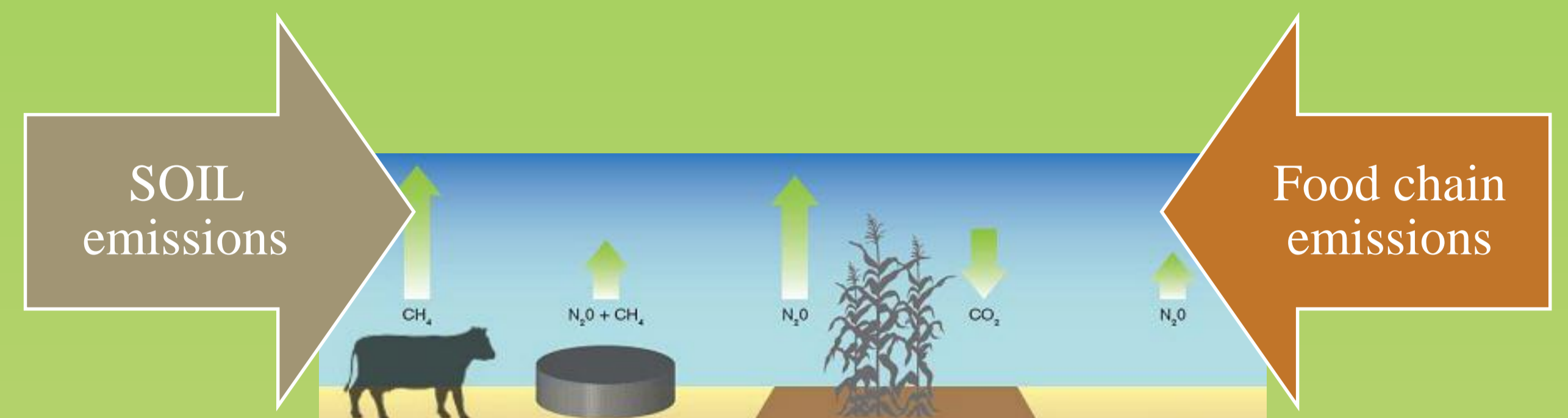
Faculty of Agriculture, Goce Delchev University, Stip, Krste Misirkov, 10A, 2000 Stip, Republic of North Macedonia

e-mail: biljana.balabanova@ugd.edu.mk

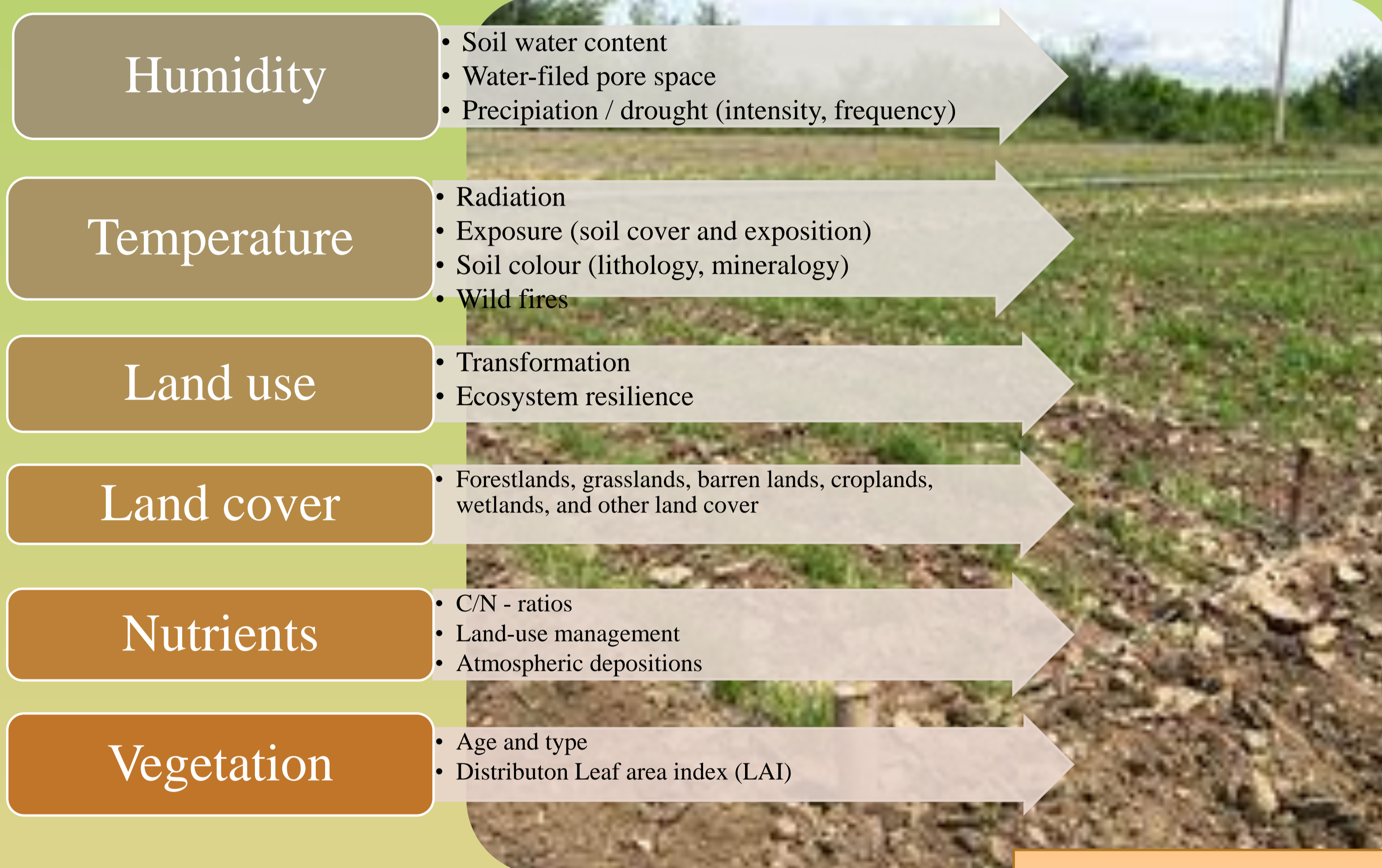
INTRODUCTION

Global agriculture is affected by climate change that could significantly impact productivity. Large-scale afforestation and biomass for energy production as well as population and income growth will exacerbate the competition for land.

Agriculture is an important contributor to climate change, accounting directly for 10%–12% of anthropogenic greenhouse gas (GHG) emissions and also for around 70% of land use change emissions, mainly through deforestation.



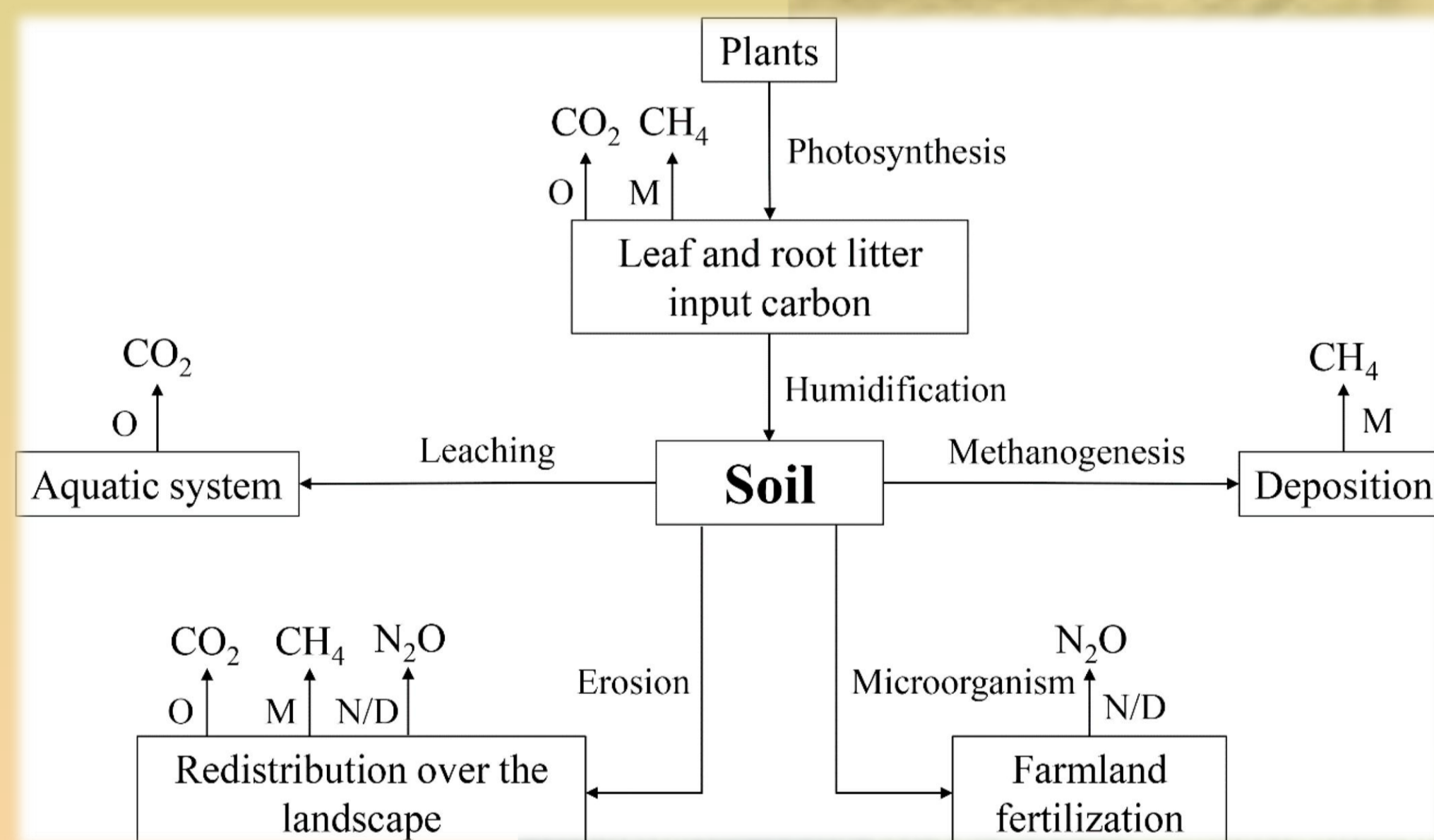
- The food chain produces greenhouse gas (GHG) emissions at all stages in its life cycle, from the farming process and its inputs, through to manufacture, distribution, refrigeration, retailing, food preparation in the home and waste disposal.
- Carbon dioxide (CO₂) emissions arising from fossil fuel combustion to power machinery, for the manufacture of synthetic fertilizers and from the burning of biomass also contribute, albeit to a lesser extent.
- At the farm stage, the dominant GHGs are nitrous oxide (N₂O) from soil and livestock processes (manure, urine and applications of nitrogen fertilizers) and methane (CH₄) from ruminant digestion, rice cultivation and anaerobic soils. However, CO₂ resulting from agriculturally induced land use change can add considerably to farm-stage impacts. Beyond the farm gate, CO₂ from fossil fuel use dominates, with a supporting role played by refrigerant gases.



The increase in production is mostly attributable to a combination of factors such as:

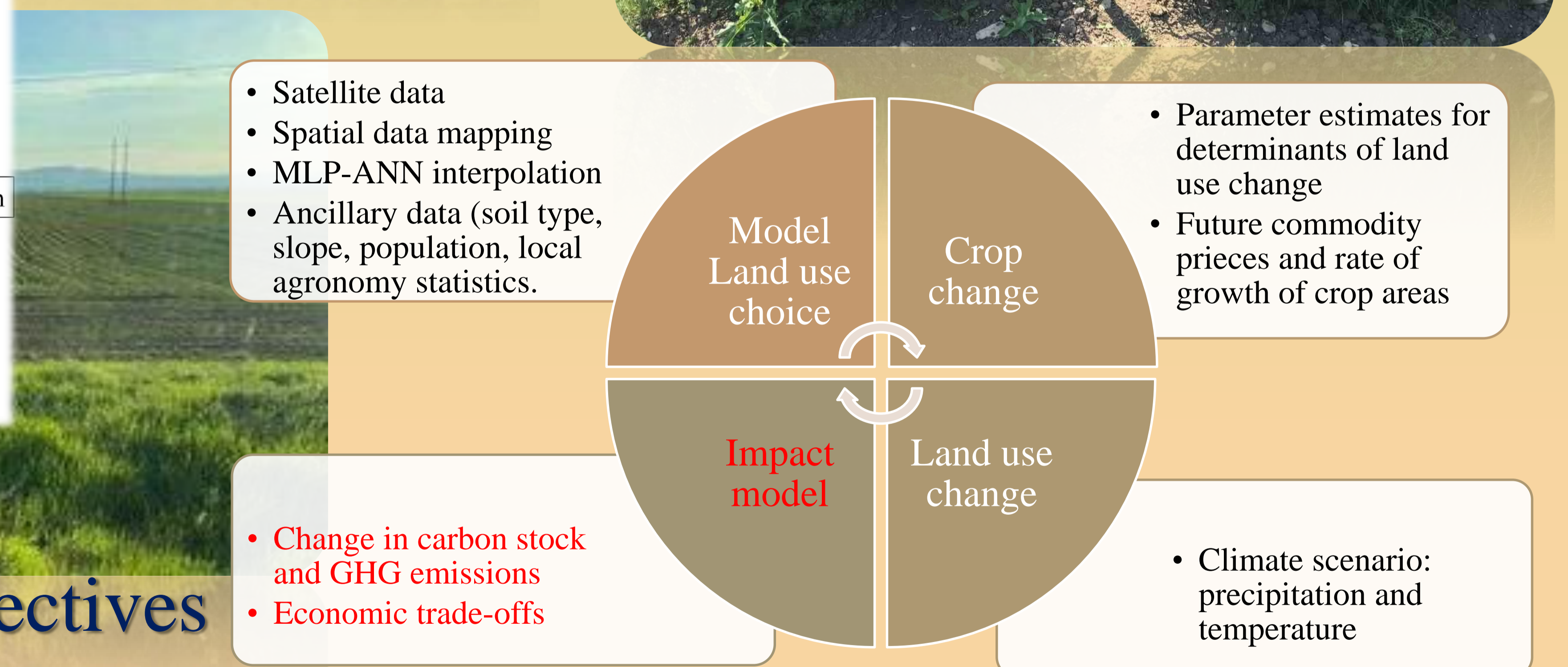
- increased use of irrigation, pesticides and fertilizers, and to a lesser extent a larger cultivated area;
- other factors such as better farming practices and the use of high yield crops also play a role.

SOIL (Safe Organic Irrigated Land)



Atmosphere 2019, 10(7), 377: <https://doi.org/10.3390/atmos10070377>

PLANT/planting (Planting Land Animal Nutrients Time)



General conclusions and perspectives

The following paragraphs summaries the measures that have been proposed for reducing GHG emissions at the agricultural and post-farm gate stages respectively and highlight some broader sustainability issues that these approaches raise. The potential for mitigation offered by both technological improvements and behavior change are examined. Here, we summarized most comprehensively and broadly falls into five sets of measures:

- Enhancing carbon removals: measures to restore degraded lands, afforestation, no or minimum tillage, the incorporation of organic matter.
- Optimising nutrient use: precise dosage and timing when applying organic and inorganic fertilizers; incorporating nitrogen-fixing legumes into rotations.
- Improving productivity: approaches that increase the yield of edible output per unit of emissions generated including: crop and animal breeding; feed optimization and dietary additives; pest and disease management.
- Managing and benefiting from the outputs: including manure and plant biomass: composting, and the use of anaerobic digestion.
- Reducing the carbon intensity of fuel inputs through energy efficiency improvements and the use of alternative fuels such as biomass, biogas, wind and solar power.