CTBE Laboratório Nacional de Ciência e Tecnologia do Bioetanol

ABTLuS CNPEM

Ministério da Ciência e Tecnologia

GOVERNO FEDERAL BRASIL PAÍS RICO É PAÍS SEM POBREZA

BBEST

Integrated assessment of sustainability

Parallel Session 15 BE-BASIC Sustainability

1st Brazilian BioEnergy Science and Technology Conference

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Integrated assessment of sustainability

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Outline

- An overview about the subject;
- CTBE's Research Program on Sustainability;
- Our aims on Integrated Sustainability Assessment;
- Invitations;
- Final remarks.

An overview about Integrated Sustainability Assessment

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Sustainability assessment

Based on: Pope, Annandale & Morrison-Saunders (2004)

- **Sustainability assessment** is often described as **a process by which the implications of an initiative on sustainability are evaluated** (*from a sustainability point of view*).
- Many approaches are actually examples of “integrated assessment”, derived from environmental impact assessment (EIA) and strategic environmental assessment (SEA), taking into account also social and economic considerations.

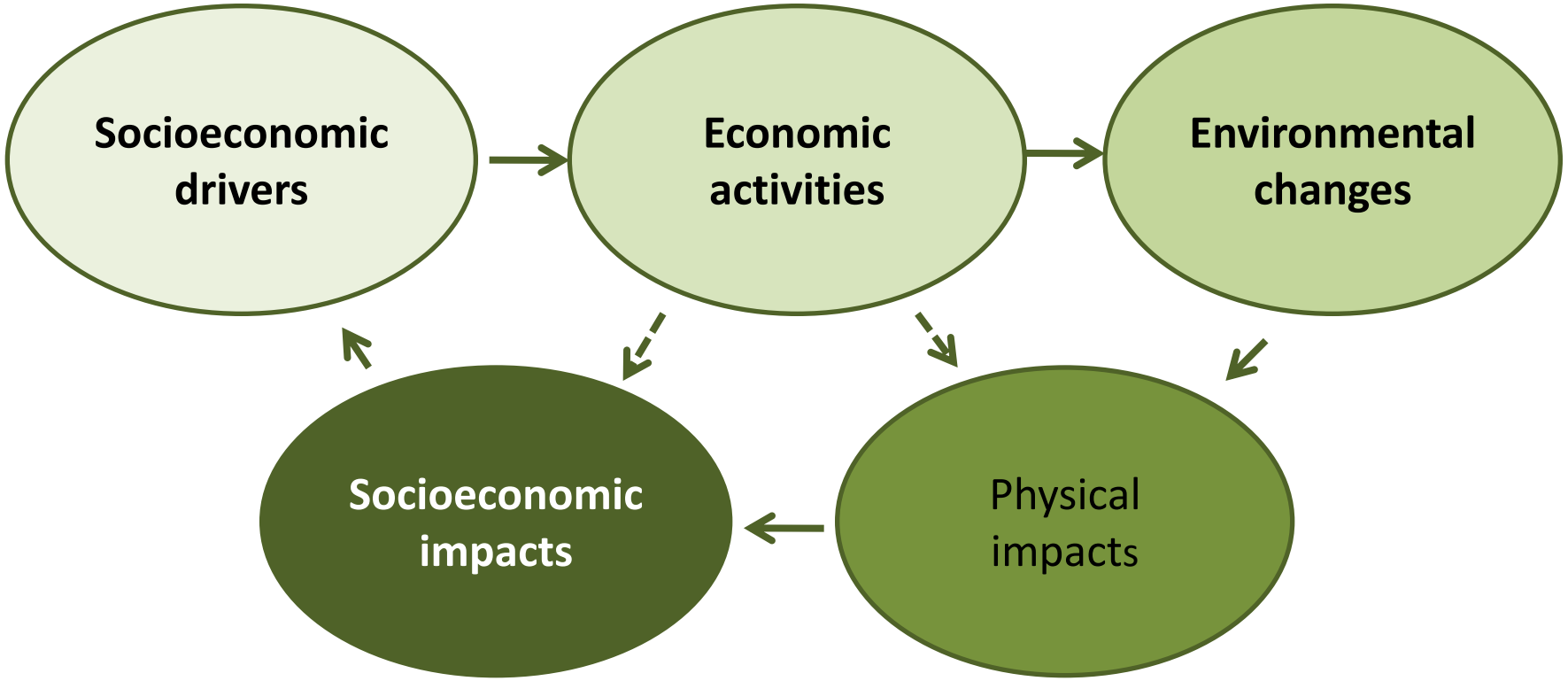
Integrated assessment

Based on van der Sluijs (2002)

- Integrated assessment (IA) can be defined as **an interdisciplinary process of combining, interpreting and communicating knowledge from diverse scientific disciplines** in order to evaluate the whole cause–effect chain of a problem.
- The cause–effect chains start with socioeconomic drivers leading to economic activity, leading to stresses on the environment, leading to environmental changes, leading to physical impacts on societies and ecosystems, leading to socioeconomic impacts, eventually returning to cause changes in the socioeconomic drivers.

Integrated assessment

Based on van der Sluijs (2002)



The cause–effect chain

Integrated Sustainability Assessment (ISA)

Based on: Brinsmead (2005)

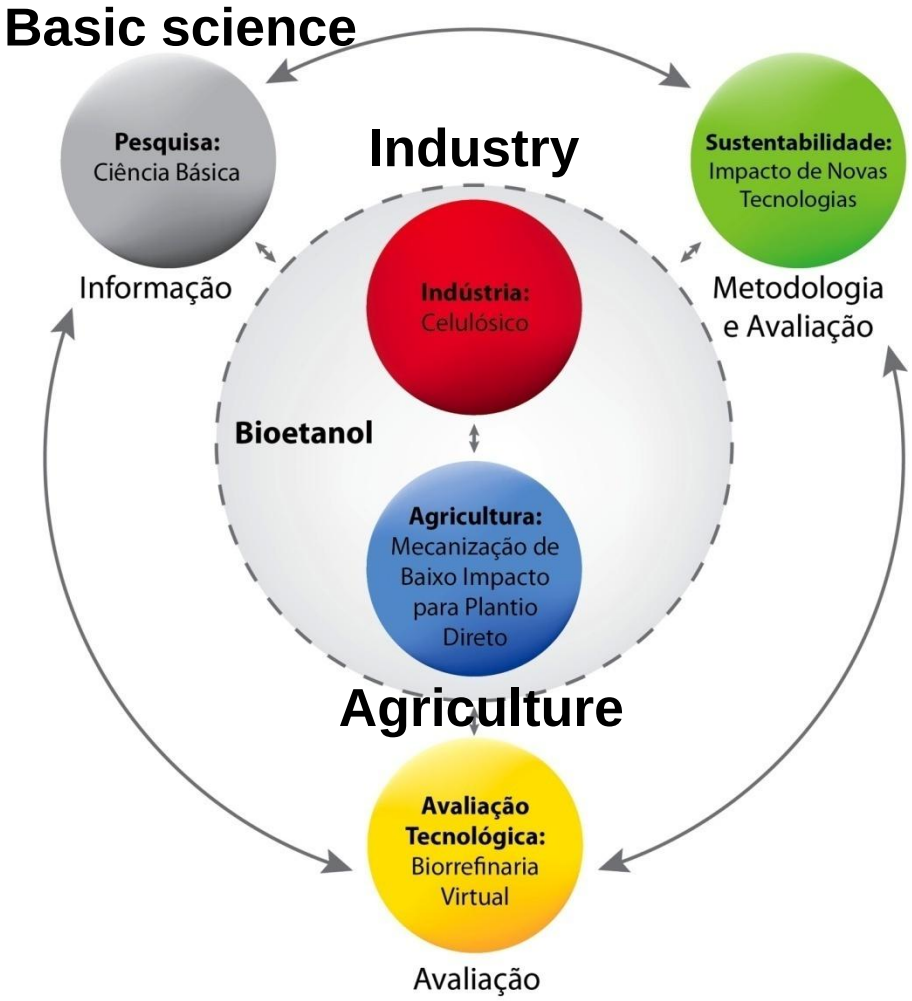
- As an immature field of research, **Integrated Sustainability Assessment is not precisely defined theoretically**, **nor there are well developed**, well-documented, **standard methods**.
- Some general methodological principles for Integrated Sustainability Assessment have begun to emerge. These principles refer to criteria for **satisfactorily integrated descriptions of different aspects, broader evaluations and definition of approach strategies**.

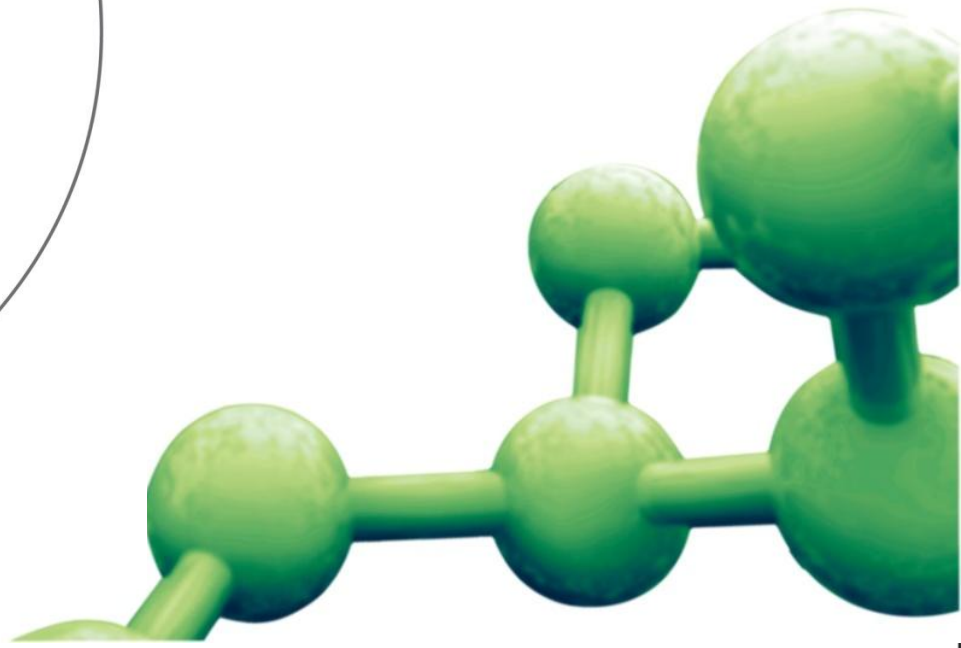
Integrated Sustainability Assessment (ISA)

- Integrated assessment is usually used for *ex-ante* evaluation of the potential impacts of a given action. Many cases described in the literature are related with policy definitions and policy-review process.
- Scenarios must considered. Vulnerability and risks should be clearly evaluated.
- **ISA is useful for evaluating problems with a large degree of complexity, mainly those with consequential effects along the time and the space**.

CTBE's Research Program on Sustainability

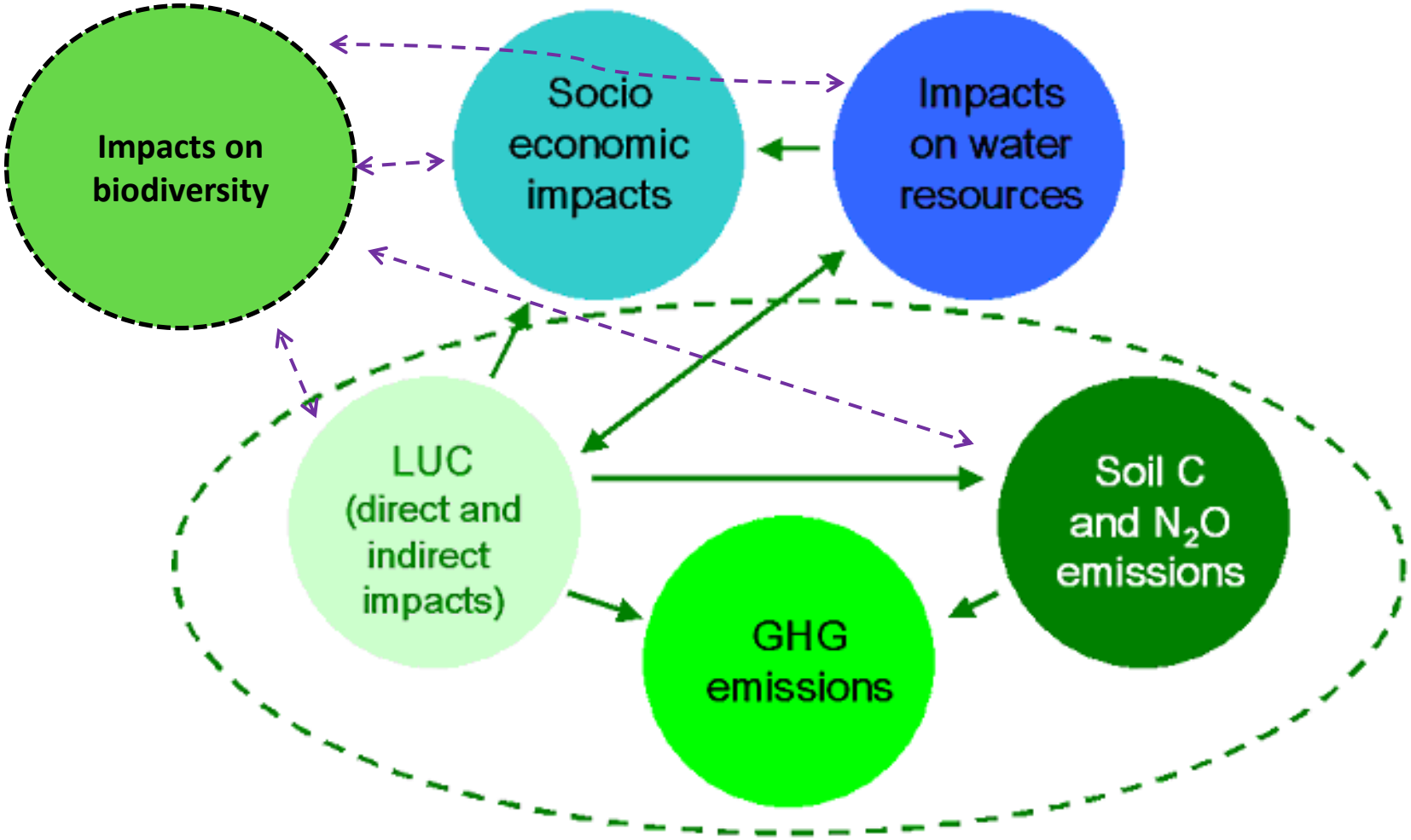
Research Programs





Sustainability Assessment of sugarcane ethanol

- On short-term, **the aim is evaluating the sustainability of bioethanol production from sugarcane, considering current technology and all changes that can be implemented in the years to come**.
- The mid-term aim is on **evaluating the bioethanol production from a sustainability point of view, taking into account all science and technology innovations that shall be incorporated to the production chain**, and that will be developed by the CTBE in its Research Programs (e.g., low impact mechanization in the agricultural side, ethanol production through hydrolysis of the bagasse, diversification of products, etc.).



Sustainability Research Program

Socio-economic impacts

- **CTBE's priority has been on evaluating the impacts at the level the production activity takes place**.
- Currently, research **activities** are **focused on defining indicators**, **doing assessments and on applying models** (e.g., input-output matrix) at the lowest aggregated level (e.g., municipalities).
- **The necessity of understanding the socio-economic impacts** of land use change, water consumption for biomass production, biodiversity impacts, etc.

GHG emissions

- Methodologies/models are well known.
- The **lack of proper information** about:

1. **Carbon stocks on soil**, considering different soils, different agricultural practices, different land use changes, …;
2. **Emissions along the life cycle of fossil fuels produced in Brazil**;
3. **The production and use of fertilizers** (and their substitutes);
4. **The impact of new agricultural practices**, including mechanical harvesting and trash disposal in the soil.

LUC/iLUC impacts

- **Modeling is a new issue** in Brazil (and also worldwide) and models should be developed/adapted/improved.
- **The lack of proper data**/information regarding:

1. **Dynamics of land use change**;
2. Inaccurate evaluations due **poor information** (e.g., elasticities);
3. The necessity of taking advantage of **satellite images**;
4. The **impacts of increasing yields**;
5. The necessity of understanding (and also proper evaluating) the impacts of **new technologies and new agricultural practices**.

Impacts on water resources

- There is **lack of specific knowledge** concerned to the impacts of sugarcane cropping on water resources.
- It is (still) unknown:

1. **The real impact of sugarcane cropping** (even in traditional areas) **on water resources**, considering availability and quality;
2. There is even less knowledge on **the impacts of sugarcane cropping over water resources in new producing areas**;
3. The **impacts of new agricultural practices** on water resources is unknown;
4. **Is there potential advantage of irrigation in some specific cases**?
5. How water resources could be managed in the context of sugarcane expansion?
6. What are **the impacts of new industrial technologies** on water demand?

Impacts on biodiversity

- The issue in (relatively) new regarding sugarcane production. **What is known regarding biodiversity in traditional sugarcane areas and what is necessary to know in order to avoid problems in new producing areas**?
- What are **the actual impacts of extensive monoculture of sugarcane**?
- What are **the synergies between biodiversity and social aspects**?
- What are **the synergies between biodiversity and water use in large-scale**?
- What are **the impacts of new agricultural practices**?

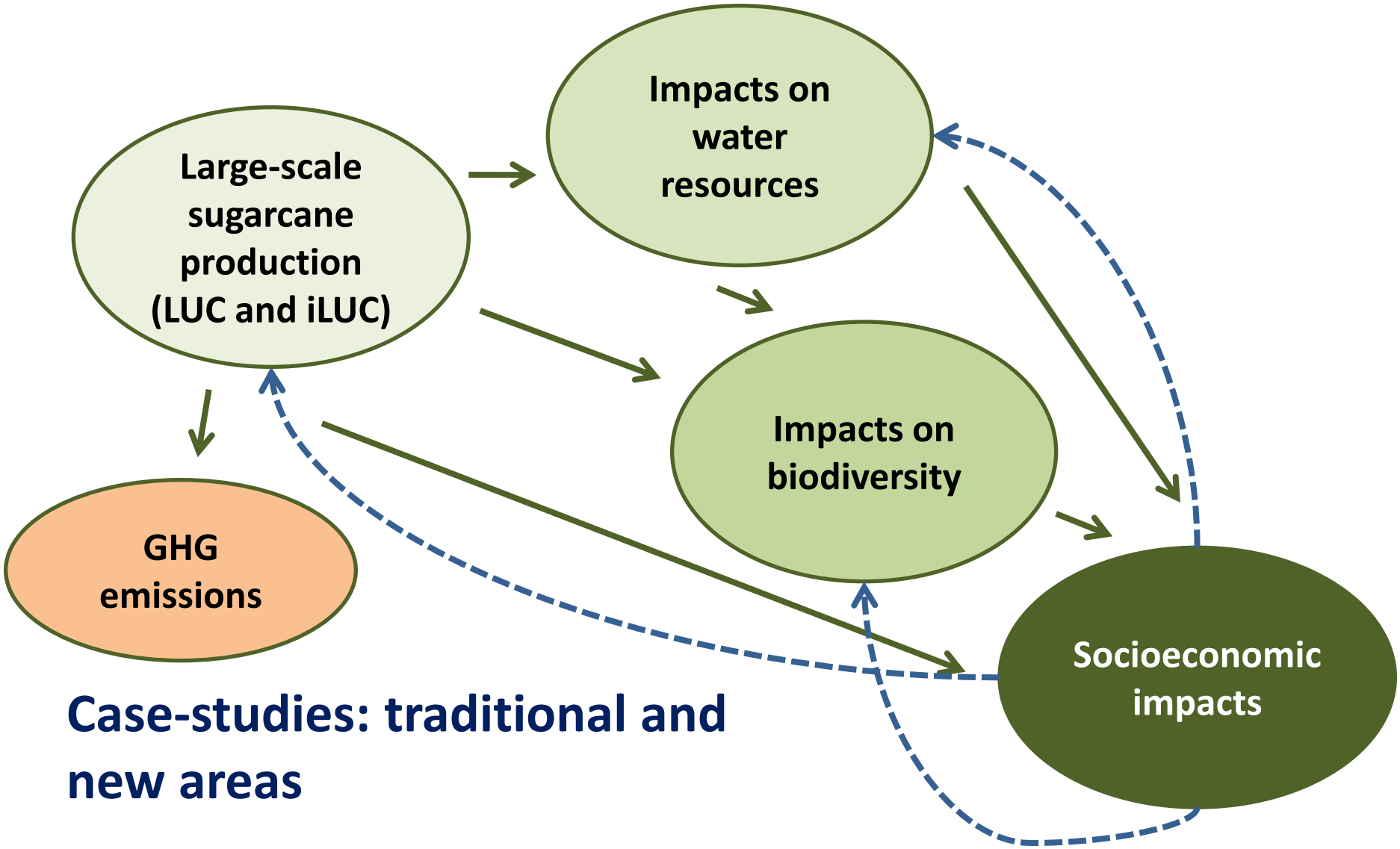
Our aims on Integrated Sustainability Assessment

Sustainability Assessment of sugarcane ethanol

- **Current research projects will allow the understanding of socio and environmental impacts** (GHG, water and biodiversity) due to large-scale sugarcane and ethanol production.
- **Focus on data gathering, on doing assessments and on disseminating information**.
- Next step: **integrated sustainability assessment**, **first understanding the complexity and the cause-effect chain**. An open data basis is required, and all possible synergies must be considered. Lower priority on modeling development.
- Cases to be considered: **production in traditional areas and the expansion of sugarcane**; **the impacts of new technologies of sugarcane and ethanol production**.

Integrated assessment (1)

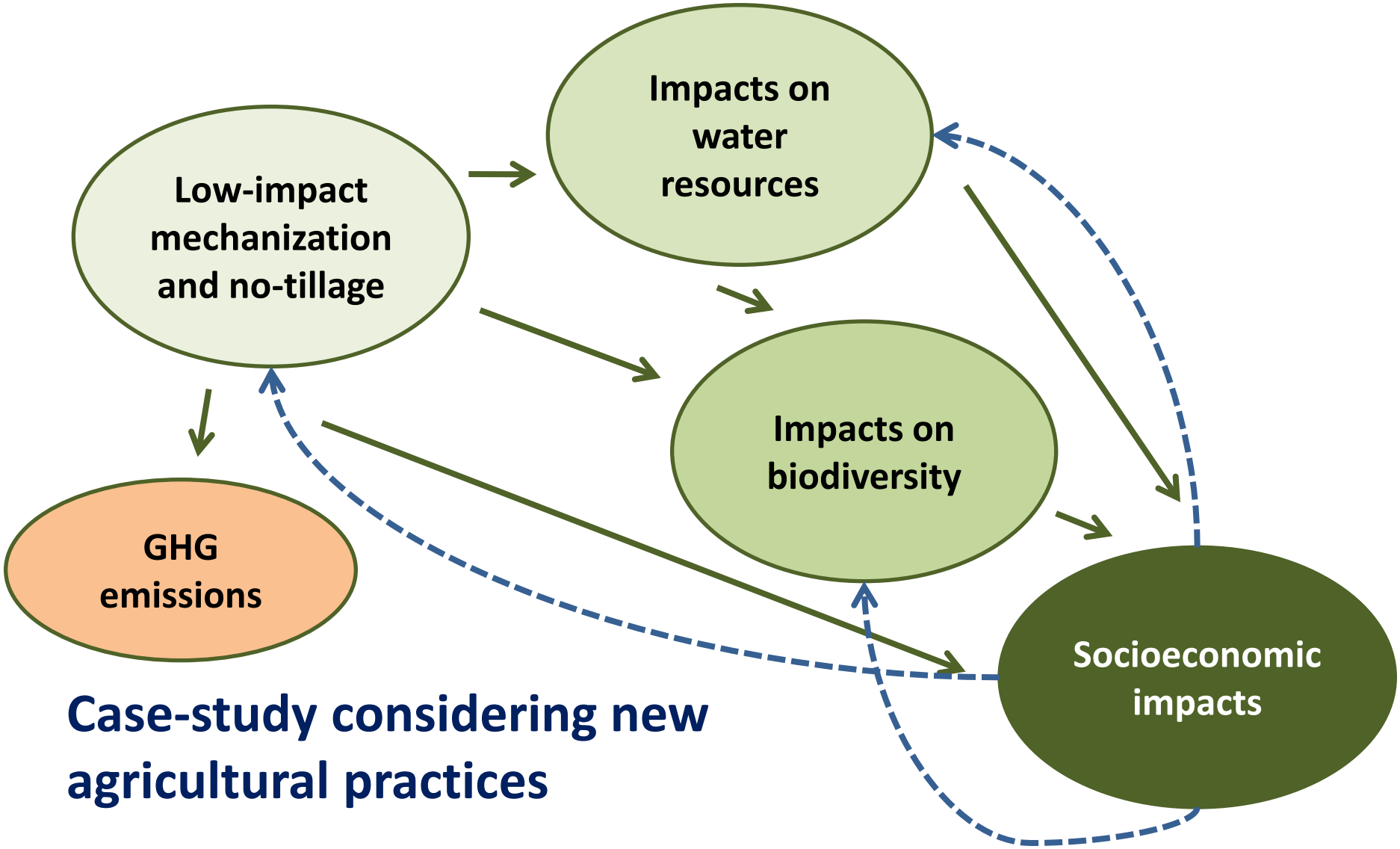
The cause–effect chain



Case-studies: traditional and new areas

Integrated assessment (2)

The cause–effect chain



Case-study considering new agricultural practices

Two invitations

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First invitation

- CTBE's Sustainability Research Program has been developed with close collaboration of partners, from Brazil and abroad.
- All researchers and research groups interested on different aspects of sugarcane and ethanol sustainability are welcome to be in touch and to discuss proposals.

Second invitation

- The submission of a proposal in the context of the "FAPESP/BE-BASIC – BIOEN Program".
- Proposals concerned to biofuels sustainability are eligible. The scope includes the following aspects:

a) **Land use change**;

b) **GHG emissions**;

c) **Carbon stocks on soil and on vegetation**;

d) **Water use**;

e) GMOs (impacts and public perception);

f) **Biodiversity** and ecosystems services;

g) **Regional economic impacts**;

h) Labor and migration;

i) **Socio-economic impacts**;

j) **Integrated impact assessment**;

k) Governance.

BE-BASIC - BIOEN

- The proposal/project aims at an **integrated sustainability assessment of large-scale production of biofuels**, with focus on the use of sugarcane for biofuels and materials production, in Brazil.
- Different aspects of sustainability should be taken into account, considering **both the environmental and socio-economic dimensions**.
- The main aspects to be addressed include **greenhouse gas (GHG) emissions** (e.g., ways for reducing emissions into the biomass life-cycle and also opportunities for capturing carbon), **direct and indirect impacts of land use change**, **impacts on water resources and on biodiversity**, and **socio-economic impacts**, mainly at the level the production takes place.
- We already have the required partner in The Netherlands, engaged with the BE-BASIC Program.

Final remarks: challenges/problems to be addressed

Challenges

- For Brazilians: which should be our priorities regarding the sustainability of biofuels?
- For everybody: what we can do in short- to mid-term regarding Integrated Sustainability Assessment of Biofuels?

Thanks!

Also on behalf of my colleagues of the Sustainability Research Program

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