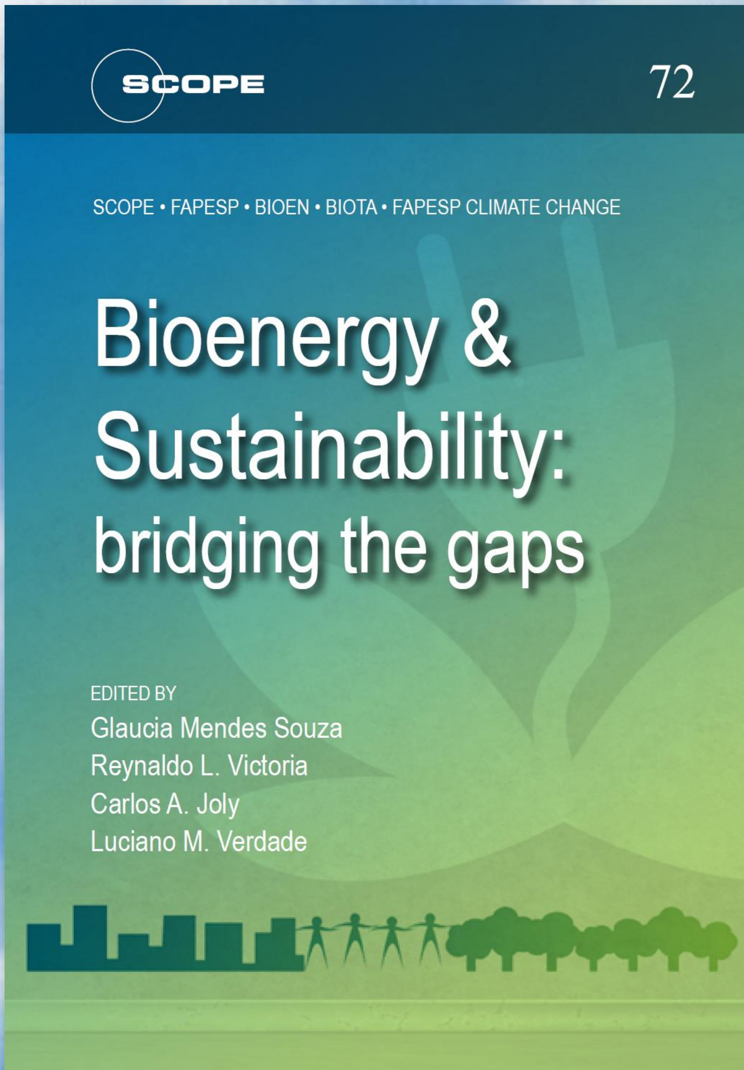

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SCOPE SCIENTIFIC COMMITTEE ON PROBLEMS OF THE ENVIRONMENT of the INTERNATIONAL COUNCIL FOR SCIENCE (ICSU-SCOPE)

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FAPESP CLIMATE CHANGE

Environmental and Climate Security

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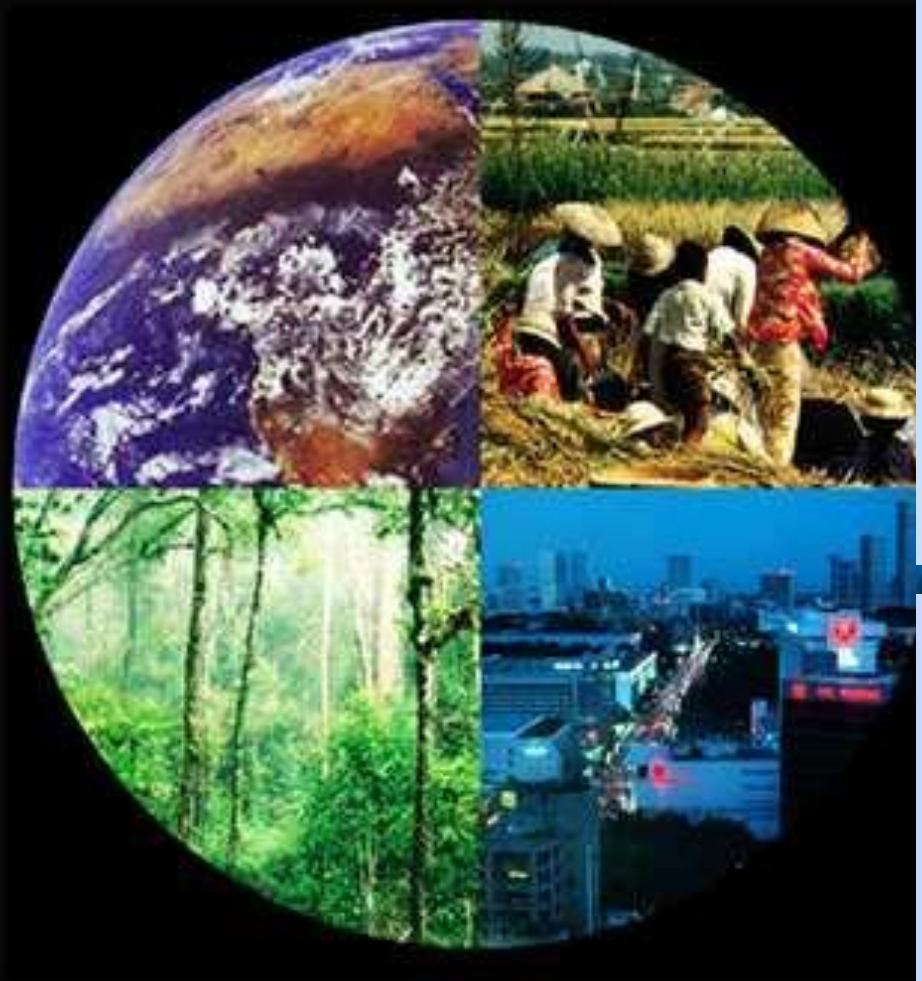
The fundamental question of our time



By 2050...

8,5 billion people: 6 billion tons of GHG and 60 million tons of urban pollutants.

Resource-hungry: We will withdraw 30% of available fresh water.

How is the Earth’s environment changing, and what are the consequences for human civilization? **What should we do about it?**

Highlights

●● Bioenergy is critical for environmental security and climate change mitigation. Global warming levels greater than 2°C will lead to significant adverse impacts on biodiversity, natural ecosystems, water supply, food production and health. Any potential impacts of bioenergy should be viewed in this context.

●● In general, environmental security deals with local to regional issues, while climate security deals with global issues. The impact in local activities such as biofuels production will be singular, demanding specific engagements of regional governments and regulatory constraints.

●● Environmental impacts need to be considered at appropriate scales, across the whole feedstock production and bioenergy processing chain and across landscapes, catchment basins, functioning ecosystems and where migratory species are affected, dispersion areas.

●●Bioenergy projects can be economically beneficial, e.g., by raising and diversifying farm incomes and increasing rural employment through the production of biofuels for domestic use (Gohin, 2008) or export markets (Wicke et al., 2009; Arndt et al., 2011)..

Highlights

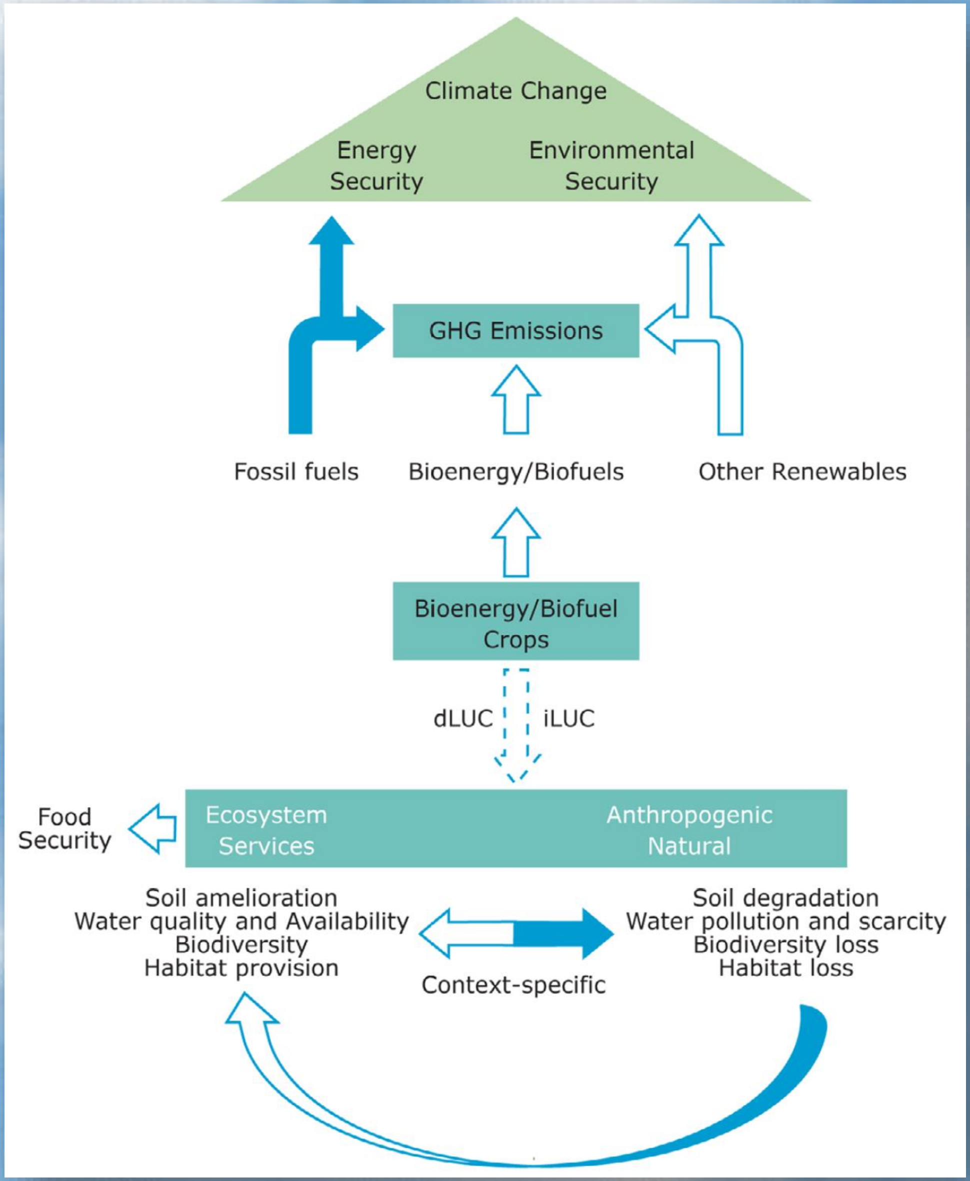
●● Water use in bioenergy production systems is highly variable and the impacts are site-specific. Wherever possible, full water budget analysis, rather than a reliance on water use efficiency metrics, should be conducted. Poorly managed bioenergy production may decrease water abundance and quality.

●● Mining nutrients from the soil with inadequate or insufficient fertilization, removing excessive amounts of plant material or improper disposing of residues may reduce soil fertility, cause loss of organic matter and predispose soil to erosion. However, properly managed bioenergy crops can help to maintain soil quality and even result in carbon accumulation, thus mitigating CO2 emission.

●● Governance policies are needed that are especially designed to avoid the implications of unsustainable exploitation of natural forests for biofuels, which frequently lead to “exporting” deforestation to other regions.

●● Sustainable biofuel production must be part of sustainable forest management and sustainable agriculture (food security) where both are needed as integral components of land use.

Schematic of the energy security - environmental security nexus. White arrows indicate positive impacts and blue arrows negative impacts.



- Harmonizing forestry and agriculture policies is fundamental for the sustainable production and supply of bioenergy through integration into cropland and forestland, and land currently classified as pasture, in ways that do not compromise food production or other ecosystems services.

- Rational and state-of-the-art agricultural practices can also lead to increased biomass productivity for bioenergy and spare land and sensitive ecosystems.

- Pasturelands are more abundant than croplands and have the potential to provide large amounts of land for bioenergy expansion;

A future <u>multifunctional landscape</u> for both environmental and energy security<u>. Strategic spatial integration of bioenergy crops on poorer land with food cropping on arable land can provide energy</u> and alleviate environmental problems associated with arable land use.

Climate Security

According to IPCC (AR5, WGIII, 2014), bioenergy deployment offers significant potential for climate change mitigation but it depends on i) Technology used; ii) Land category used and carbon stock on land (Forest land, grassland, cropland or marginal land), iii) Scale of production and iv) Feedstock used and source of feedstock.

According to IPCC achieving high bioenergy deployment levels for mitigating climate change would require, "extensive use of agricultural residues and second generation biofuels to mitigate adverse impacts on land use and food production, and the co-processing of biomass with coal or natural gas with CCS to produce low net GHG-emitting transportation fuels and/or electricity".

Bioenergy can play a critical role for mitigation, but there are issues to consider, such as the sustainability of practices and the efficiency of bioenergy systems. Barriers to large-scale deployment of bioenergy include concerns about GHG emissions from land, food security, water resources, biodiversity conservation and livelihoods

Direct CO_2eq (GWP100) emissions from the process chain or land-use disturbances of major bioenergy product systems, not including impacts from LUC (Smith et al. 2014).

Key Messages:

- The share of bioenergy in the global primary energy supply will continue to increase even under Baseline scenario, thus it is necessary to ensure that bioenergy is produced sustainably with minimal adverse environmental and socio-economic impacts.

- The negative implications of land deployment for bioenergy can be minimized by: i) production and utilization of co-products, ii) increasing the share of bioenergy derived from forest, plantation, and crop wastes and residues, iii) integrating bioenergy production with crop production systems and in landscape planning, iv) increasing crop land productivity especially in developing countries, freeing up crop land for bioenergy crops, and v) deploying marginal or degraded lands.

- Achieving high level of deployment of bioenergy requires extensive use of agricultural residues and second-generation biofuels to mitigate the adverse impacts and land use and food production, and co-processing of biomass with CCS to produce low net GHG emitting transportation fuels and/or electricity.

The Much Needed Science

- Improved methodologies for the estimating, quantifying, and verifying of LUC;
- Methods for identifying win-win situations as well as trade-offs, e.g. land-sparing pasture intensification with bioenergy crops grown so that overall soil carbon storage and fertility are increased;
- Increased trials of bioenergy crops in environments where bioenergy expansion is anticipated, to provide much needed data on crop performance in target environments before wide spread expansion;
- Breeding of resource-use efficient and “future climate-resilient” bioenergy crops;
- Continued development of integrated, resource-efficient biomass conversion pathways;
- Long-term studies of perennial bioenergy crops and short-rotation forests in relation to ecosystem services, biodiversity, water quality and availability and soil carbon;
- Policy development to encourage sustainable bioenergy development and landscape-level planning.

The climate change issue is global by nature, but both mitigation and adaptation strategies are formulated on local, regional and global scale.

Bioenergy is critical for climate, food security and energy security. Challenge: where is the ideal balance point?

Read the full Report: You will learn a lot

Thanks for the attention !!!

Ecosystem Change

●● Rational and state-of-the-art agricultural practices can also lead to increased biomass productivity for bioenergy and spare land and sensitive ecosystems.

●● Pasturelands are more abundant than croplands and have the potential to provide large amounts of land for bioenergy expansion; both crop and pasture intensification can significantly increase biomass production, thus sparing land for other uses

●● In drawing up national and regional integrated forestry, agriculture and bioenergy policies it is imperative to address the underlying drivers of land conversion and unsustainable use of resources. Issues for such multi-sector policies include full valuation of forest goods and services, opportunity costs of forestland conversion and alternative cropping systems, governance and law enforcement, institutional capacities, safeguarding local user rights and land tenure arrangements.

●● Enabling conditions for effective land use policies include, *inter alia*, integrated land use mapping and planning, as well as eliminating perverse subsidies or regulatory barriers. There is also an urgent need to increase the coordination of objectives and planning within governments, as well as between governments and concerned international institutions, NGO’s and the private sector.

●● Incorporating initiatives such as REDD+ programs and Green Economy into national development strategies would constitute another venue to strengthen cross-sector forestry and agriculture policies and aligning implementation pertaining to bioenergy.