Sustainability Controversies of Biomass for Non-Food Purposes

- State of the art
- Best practices

A PLETHORA OF INTERNATIONAL INITIATIVES

INTERREG PROJECT

Regional circular economy models and best available technologies for biological streams

Project summary

BIOREGIO boosts bio-based circular economy through transfer of expertise about best available technologies and cooperation

INTERNATIONAL CONFERENCES

CÎrCLE 2018
Thursday 20-Saturday 22 September 2018
Chania, Crete

Challenges for the Islands in the era of the Circular Economy

CONFERENCE AGENDA

Under the auspices of

Part-financed by the European Union and the City of Vienna
Sustainable Agriculture, Forestry and Fisheries in the Bioeconomy

Environmental feedbacks e.g. water quality, GHGs, biodiversity

ENVIRONMENTAL DRIVERS
Changes in:
- Land cover & soils, Atmospheric Comp., Climate variability & means,
- Water availability & quality, Nutrient availability & cycling,
- Biodiversity, Sea level

‘Natural’ DRIVERS e.g. Soil

SOCIOECONOMIC DRIVERS
Changes in:
- Demographics, Economics, Socio-political context,
- Cultural context, Science & Technology

DRIVER Interactions

SCAR Principle 2 Sustainable Yields
SCAR Principle 5 Diversity
SCAR Principle 4 Circularity

SCAR Principle 3 Cascading Approach

Food Security

Food First

Food Utilisation
Food Access
Food Availability

Socioeconomic feedbacks e.g. nutrition, business,


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In Permaculture we see all the sectors as having usefulness. We use shaded areas for mixed forest growth and storage of resources such as water, semi-shaded areas for mixed plantings and protective of some plants during harsh summers. Full sun suits conventional vegetables and a variety of plants, annual and perennial provide protection for one another against the harsh sunlight and pests.

www.PermacultureVisions.com
REJUVENATING AGRICULTURAL PRACTICES – NO TILL AGRICULTURE

No-till Agriculture

**Definition:** Farming where the soil is left relatively undisturbed from harvest to planting.

**Explanation:** A narrow seedbed is prepared by drilling holes in the soil in which seeds are planted. It is a way of growing crops without disturbing the soil through tillage.

- **Crops:** great variety of vegetables such as cabbage and a great variety of beans
- **Most prevalent in America (Eastern)**

**Advantages:**
- Excellent erosion control.
- Soil moisture conservation.
- Minimum fuel and labor costs.
- Builds soil structure and health.

**Disadvantages:**
- No incorporation.
- Increased dependence on herbicides.
- Slow soil warming on poorly drained soils

Farmers use this technique as it causes no disturbance of the soil and enables greater soil retention and so less nutrients and fertilizers are used.
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REJUVENATING AGRICULTURAL PRACTICES – PRECISION AGRICULTURE

www.Farms.com/PrecisionAgriculture
A TYPICAL FLOW OF PRODUCTION WASTE TURN ON BIOFUEL

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Sustainability & Biomass

Sustainability issues in Agriculture & Forestry:

- Grow of world population;
- ¼ of agricultural land suffering degradation;
- Long term consequences of biodiversity loss;
- Increasing pressure on land & water resources due to food, feed & fiber demands;
- Prospect of climate change affecting availability & productivity in agriculture;
- Higher oil prices may trigger new non-energy demands on bio-resources;

Since mid 00’s: biomass appreciation for the development of sustainable energy & resource systems

New dynamics induced within agriculture & forestry sector for new growth prospects for non-food uses, both on domestic and international level.

The priority is valorizing agri-food sector’s wastes, which within a circular economy's framework holds some opportunities for producing energy or chemicals;

Determining which pathways (closed loop agriculture vs. wider bioeconomy utilization) are most effective for a sustainable agri-food system remains a priority for researchers & policy makers;
Controversies appear to which extent biomass holds the promise of sustainability and its role in implementing sustainable energy and production systems, the impacts and side effects of an offensive expansion of non-food biomass use.

Sustainability & Biomass

- Climate experts suggest a strong upscaling of renewables and sustainable biomass and reduction of fossil fuels, for the rapid & profound near-term decarbonisation of energy supply.

IPCC (2018). Global Warming of 1.5 °C. IPCC special report, p. 137 of 792
Sustainability & Biomass

- However, a number of potential environmental impacts from bioenergy production is recognized, f.i. indirect land-use change emissions from land conversion, nitrogen & water use for bioenergy production, depending largely on the governance of land use.

IPCC (2018). Global Warming of 1.5 °C. IPCC special report, p. 13 of 792
Sustainability & Biomass

- FAO recognizes that energy derived by sustainable biomass use as a flexible and competitive source of renewable energy, that can play a key role in decarbonising energy systems by responding to the needs of a wide range of demands

FAO also states that the links between bioenergy & food security are complex and the effort to make the development of bioenergy to become sustainable becomes even more challenging when trying to capture its potential benefits on rural development, climate and energy security.

Sustainability & Biomass

The Land issue

- A “food, energy and environment trilemma”:

Controversies surrounding biomass use arising from food-price spikes, the demand for land, and consequent direct and indirect land-use change

“The failure to address the demand for energy & materials, in particular to develop alternatives to counter the depletion of petro-chemical resources, is expected to result in major economic & social disruption on a global scale”

Sustainability & Biomass

Land competition arising from “food, energy & environment” trilemma

Sustainability & Biomass

The Land issue

- Increasing demand for non-food biomass, especially fuel crops & derivates, will inevitably lead to an expansion of global arable land at the expense of natural ecosystems;

- Aspirations & incentives to increase non-food biomass use intended to counteract climate change and environmental degradation, are bound to a high risk of problem shifting and may even lead to a global environment deterioration;

Biomass derived energy (Bioenergy)

- **Unavoidable agri-food waste** arising from an efficient system holds the promise of a **suitable feedstock resource for bio-economy purposes**, as such waste cannot be prevented and becomes a byproduct;

- **Avoidable wastes** may represent mismanagement and inefficient use and are rather not characterized as a sustainable feedstock source for a bio-economy;

Biomass derived energy (Bioenergy)

- Worldwide potential of bioenergy is regarded as **limited**, due to **multi-functional role** of land & needs for food, feed, timber, fiber production and nature conservation & climate protection;

- Bioenergy potential for **climate change mitigation** remains **unclear** due to large uncertainties about future agricultural yield improvements & land availability for biomass plantations;

Sustainability & Biomass

Biomass derived energy (Bioenergy)

- Large-scale bioenergy production & associated additional demand for irrigation may further intensify existing pressures on water resources;

- Land clearing for new crop- and pasture land but also due to the use of biomass for traditional heat & energy production;

- Adverse impact of forest ability on carbon sequestration when forest carbon released for bioenergy production purposes;

Sustainability & Biomass

Biomass derived energy (Bioenergy)

- **Straw removal** from agricultural fields may lead to a deterioration of humus;

- Energy crops grown with the **use of agrochemicals**, particularly herbicides and fertilizers for **maximizing productivity** may lead to further environmental problems and **fertility & biodiversity loss**;

- **No scientific consensus** whether bioenergy as a whole contributes to/abates global climate change;

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Some conclusions

- **Policies** promoting biomass for non-food purposes will need to take potential land use conflicts into account;

- Increasing biomass energy production beyond a certain level would have **significant effects** on land use & conventional agricultural markets;

- Besides uncertainties of cost-effective use biomass production, large-scale energy crop production may create **conflicts** with other **sustainability aspects**;
Best Practices on Biomass Management
1. Management of crop harvest residues

- Crop residues play an important role:
  - Replenish soil organic carbon & nitrogen pools;
  - Reduce soil erosion;
  - Preserve soil moisture;
  - Maintain soil productivity;

1. Management of crop harvest residues

Crop residues for bioenergy production needs to be carefully assessed due to long-term negative impact on soil fertility and production capacity!

1. Management of crop harvest residues

- Be careful on how much biomass from crop residues will remove from the field: there’s a limit!

Practical advise:

*Leave a considerable amount of biomass to the field f.i. at least 1.3 of residues*

Ecofys, European Commission (2016) Maximising the yield of biomass from residues of agricultural crops and biomass from forestry
1. Management of crop harvest residues

- Other related best practices are:
  - Crop rotations (to preserve soil fertility)
  - Fertilization (organic amendments such as farmyard manure, slurry or compost);
  - Soil preparation;
  - Weed management;

Practical advise:

*It depends on the type of crop, climatic conditions & soil*

Ecofys, European Commission (2016) Maximising the yield of biomass from residues of agricultural crops and biomass from forestry

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1. Management of crop harvest residues

Practical advise:

- **Crop residues burning:**
  A major non-sustainable practice, should be avoided!
  - High emissions of GHG gases, sulphur dioxide, carbon monoxide, particulate matter (PM), heavy metals and dioxin...
  - Reduces soil health & fertility;
  - Damages soil beneficial biota;
  - Fire hazard;
1. Management of crop harvest residues

Practical advise:

- **Crop residues burning:**

  *The common belief that residues burning increases soil fertility is equivocal!*

  *EU has largely outlawed the practice of burning agricultural wastes in the field...*
1. Management of crop harvest residues

Practical advise:

- Crop residues **burning**:
- To leave or not to leave?
- Pruning residues can be an important fertility factor for tree crops (f.i. olive, vineyards);
- As for all crop residues they should not be burned;


1. Management of crop harvest residues

Practical advise:

- Use of mulching/compost machinery is recommended: use of mulched residues as fertilizing factor, returning back to soil;

- Be careful for pests & diseases in residues: Should be removed/destroyed burned to avoid;

2. Olive mill residues

What should I do with it?

Practical advise:

- Leaves, pits/kernels, crude olive cake, olive vegetation water;
- That’s considered farmer’s property as well, not just the olive oil produced!

2. Olive mill residues

*What should I do with it?*

Practical advise:

- fertilizer or soil conditioner;
- animal feed;
- for residual oil recovery;
- organic compounds recovery (pectin, antioxidants, enzymes);
- for energy generation;

2. Olive mill residues

What should I do with it?

Practical advise:

- Be careful on legal framework of your country with regards olive vegetation water;

- There’s a limit of how much residue water can be used without causing negative effects to the orchard soil (f.i 10 t/ha is enough);

- Eleftheriadis I. (014) Use of Olive Oil Production Residues - eubionet
3. Anaerobic digestion & Digestate

What are they?

Anaerobic digestion: biological process in which microorganisms break down biodegradable material in the absence of oxygen creating two important products: biogas & digestate;

Digestate: From materials such as manure, food waste, organic material, plants that generate biogas;
3. Anaerobic digestion & Digestate

➤ Why important?

➤ Digestate may be an important fertilizing agent containing necessary farming nutrients and micronutrients such as Nitrogen (N), Phosphorus (P) & calcium (K);
➤ It helps important nutrient recycling such as P and K;
➤ It may be a valuable fertilizer f.i. by avoiding weed and pathogens dispersion, odors, over-accumulation of nutrients in site etc.;
3. Anaerobic digestion & Digestate

- Thresholds and bottlenecks;
- EU legal framework absent;
- Conflict with existing regulations that should be clarified;
- Lack of information for farmers;

- European Biogas Association (2014) - Digestate Factsheet
4. Wood waste

Practical advise:

- Organic tree waste tree, not possible to be used for compost purposes may be used for heat energy in many different forms;
- Wood, chips or pellets;
5. Bio-gas from animal wastes

- Livestock produces a lot of waste. It could be turned into biogas to generate energy for local energy needs;

- It requires anaerobic digestion (breaking down biodegradable material in the absence of oxygen);
5. Bio-gas from animal wastes

- It may produce on-site farm energy, reduce contamination, odors etc.;
- Some sophisticated equipment required;
- Efficient especially for bigger livestock;
EXAMPLES FROM THE DANUBE AND MEDITERRANEAN REGION

Ljubljana Regional Waste Management Center, Slovenia

OPG Vrcek, meat family farm producing biogas from manure and waste, Croatia
Small biogas agricultural plant Lagada A.E., Greece

http://www.biogaslagada.eu/

Start-up for energy production from pits & egg shells, Greece

https://www.climate-kic.org/start-ups/bio2chp/

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Thank you