From land demanding to low input & high efficiency feedstocks

Calliope Panoutsou; Imperial College London
Contents

• Why feedstocks “high” on the agenda?
• Critical supply chain components
• Land
• Feedstock production
• Handling
• Critical Issues
• Conclusions
Why feedstocks „high“ on the agenda?

Biofuel production costs

Source: OECD
Critical supply chain components

- Land
- Feedstock production
- Conversion
- Handling/Logistics
The “land” limit

- Availability/ conflicting uses
  - 4-5 t/yr wheat (~ 50 GJ/ yr)
  - 5-6 t/yr corn (~ 60 GJ/ yr)
  - 9-10 t/yr s/beet (~ 110 GJ/ yr)
  - 10-15 t/yr e. grasses (~ 170-200 GJ/ yr)

- Yields & cropping practices
  - 3-10 t/yr e. grasses in marginal lands (~ 30-120 GJ/ yr)

- Technology & Infrastructures (efficiency & compatibility)

- Scale of production

- Sustainability criteria
  - Land, water, biodiversity
So we need to introduce land use strategies, subject to regional ecology & climate

**Environmental baseline**
**Land use (region specific)**

- **Land** which is not used productively at reference time
  - High Conservation Value (e.g. Natura, etc.)
    - No land use changes
  - Degraded
    - Supporting services related evaluation (e.g. how much water, nutrient, etc. is required to make them productive)

- **Land** under use at reference time
  - High Nature Value Farming, Environmentally Oriented Farming
    - Policy should not change
  - Common agricultural & forest land uses
    - Set aside, Olive Groves, dehesas, etc.
    - Policy could be modified/Improved in terms of sustainability, efficiency, Innovative management (4F, double cropping, etc.)

So we need to introduce land use strategies, subject to regional ecology & climate.
Issues under consideration when evaluating land use for biomass & biofuels

• Land use allocation
  – Land use changes:
    • Within one land cover (e.g. agriculture)
    • Between land cover classes (e.g. grassland to biomass, etc.)
  – Evaluation parameters:
    • Carbon balance
    • Soil erosion
    • Water management
    • Species richness

• Land use intensity
  – Crop choice & pattern
  – Management intensity
  – Influence on the structural diversity of farmed landscape (e.g. effect of annual & perennial crops is different)

Sources: O’Connell et al., 2005; EEA, 2007; Pettersen, 2008
Feedstock production: From land demanding to low input & high efficiency

- Energy crops: Conventional & new species
  - Yield optimisation
  - Farmers perception

- Forest: from harvest operations after stem wood removal & complementary fellings.
  - Optimised logistics
  - Integration to current activities

- Agriculture: from field activities; animal raising;
  - Standardisation
  - Integration to current activities

- Biowaste streams: Municipal solid waste, Construction/Demolition wood; packaging; household; market; garden; food; slaughter, etc

- Algae: Photosynthetic organisms growing in aquatic environments
  - Cost reduction
By November 2011: [www.biomassfutures.eu](http://www.biomassfutures.eu)

**Atlas of supply per feedstock**

Example: land availability for dedicated energy crops

**Using 5% of good land**
High yields, very likely indirect land use effects

**Using 10% of fallow and other land**
Medium yields, medium indirect land use effects

**Using abandoned land**
Low yields, minimum indirect land use effects
RES-Directive + NREAP targets reached
No use of biodiversity rich areas (HNV farmland)
No use of areas of high carbon stock

Perennial crops released land:
Preference for >50% GHG mitigation (whole pathway)
Cheapest crop mix per region
But not only: Cuttings-prunings permanent crops 2020

Factors determining potential:

• Permanent cropping area (e.g. vineyards, fruit trees, nuts and berries, olives and citrus)

• Sustainability constraints:
  – Some risk of soil compaction, if heavy machinery used
  – Loss of soil carbon when roots removed of old plantations, certainly when ploughed up after many years

• Source data used: Capri baseline 2020, Biomass Futures modelling

EU: 7302 Ktoe (2% of total potential)
Feedstock matrix remains diverse

2010

2020

- Wastes
- Agricultural residues
- Rotational crops
- Perennial crops
- Landscape care wood
- Roundwood production
- Additional harvestable roundwood
- Primary forestry residues
How can we mobilise existing streams while working with optimising new species?

Improving quality & optimising logistics

(Source: Markku Karlson, UPM)
# Handling

<table>
<thead>
<tr>
<th>Potential handling stage</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separating and sorting</td>
<td>Consists of operations that segregate components of plant material based on shape, size, or density.</td>
</tr>
<tr>
<td>Mixing / blending</td>
<td>Involves bringing two or more of the same or differing materials together for the purpose of preparing a mixture with improved biomass characteristics.</td>
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<tr>
<td>Drying</td>
<td>May be used to reduce the moisture of biomass. The goal is to change the moisture content of the biomass to levels that are safe for long-term storage or final processing.</td>
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<tr>
<td>Densification</td>
<td>Can be any operation that changes the state and/or reduces the volume of a given mass of biomass. This size reduction can increase the unit density of biomass, resulting in a smaller space required for storage and transportation.</td>
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Feedstock production

- Develop plant/tree varieties and optimise management practices to meet conversion requirements (integrated solutions for fibre and energy).
- New biomass production system concepts on arable and forest land to optimise yielding potentials under sustainable management practices.
- Improve knowledge of breeding tools and apply existing biochemistry techniques to relevant species.

Harvesting/Collection/Handling

- Develop harvesting and collection systems (new equipment, new chains) to maximise supply by minimizing costs per unit.
- Develop feedstock quality and monitoring systems both for wet and for dry storage.

Storage & Transport

- Develop feedstock quality and monitoring systems both for wet and for dry storage.
- Test efficient transport systems according to location; existing infrastructures, etc.
The BioResources Map is a mapping tool for sustainably produced biomass resources and plantations. This tool will initially be used as a test case for certified and other plantations of energy crops. These can be located anywhere in the world.

The information provided stays confidential within the core team of the BioResources Map project which consists of EC officials, the project coordinator Acconia, the BioResources Map developer Mappingbook and some key external advisors.

The BioResources Map is still under development but we expect it will be finalised by the end of the 2011. Of interest is the possibility of using the BioResources Map as a common reporting tool for certified plantations.

Contact:
Dr Julie Tolmie
Mappingbook Ltd
London UK
julie.tolmie@mappingbook.eu
Critical issues

• Which are the most promising feedstock types (within each category, ie forestry, energy crops, agriculture, algae) in time sequence (starting from now to 2030-2050)
• What are their yields now & what changes are expected in the future?
• Do they have conflict with other sectors (or expected to have in the future) like food; biomaterials, etc.
• What is the cost & how much it is expected to "change" for 2030-2050?
• Which are the most efficient ways of mobilising such feedstocks (covering the full supply chain-to the plant gate)?
• At which stage along the supply chain (is it higher yields? or optimised logistics for example) should the emphasis for future development be placed?
• What are the most important sustainability issues related to their production & use?
Conclusions

Land demanding feedstocks

- Require optimisation in production & management/handling
- New business concepts with intermediate companies undertaking the handling/logistics & providing interface between farming/forest community – end users
- Strengthen communication with farmers
- Estimate the European capabilities for indigenous feedstock production

Low land demanding feedstocks

- High yielding with no requirements for “useful” land BUT
- Capital intensive and still need substantial RTD across all the supply chain steps
Thank you

c.panouttsou@imperial.ac.uk