FAO's Perspective and Work on Sustainable Biofuel Production

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What is not true

- **Sweeping statements on biofuel sustainability** - Food crop feedstock always bad / Energy crops and residues always good

- **Simple solutions to reconcile food and fuels are available**

Reality is complex

Food-based feedstocks always unsustainable?

- **Not necessarily the case** (and it depends upon what aspect of sustainability is considered!)
- **Flex crops (that produce both food and fuel) do not compete with food if fuel adds to food** – Possible but challenging through:
  - **Yield increase** (e.g. sugarcane in Brazil)
  - **Substitution of export crops** (e.g.: cassava ethanol study in Tanzania)
  - **Integrated food-energy systems** (IFES)
  - **Outgrower schemes**

By-products/residues – Panacea?

- Agricultural/wood/fisheries by-products/ **residues becoming commodities as increasingly used** (IEA predicts residues 25-30% of biofuel feedstock energy by 2050)

- Use of by-products allows for 10-30% **reduction in land needs**

BUT

Watch out for:

- **competing use of agricultural residues** (soil management – feed – bioenergy)
  - Cheapest fertiliser and soil protection for small-scale farmers
  - Often more than 40% animal feed in developing countries
- **Handling implications**

Energy crop'/second generation - The silver bullet?

- **More conversion efficient** (uses all parts of the plant)
- **Less DIRECT competition** with food security

BUT

- **Less edible by -products** as whole plant is used for bioenergy
- **Possible negative environment effects**
- **Possible INDIRECT competition with food security**
  - Regarding land use
  - Regarding the use of agricultural residues (soil, feed, energy)
- **No flexibility between food and energy markets**
- **Scarce diffusion of commercial scale value chains**

Certification is the cure for all ills?

Source: Dubois, 2008

Only works if many other things are in place

Most address poorly food security
+
Challenges for smallholders

5. Other elements

4. Monitoring ,evaluation, verification
Audit, certification or participatory review

3. Tools
Incentives and disincentives for policy implementation

2. Policies
Policies, standards, regulations for sustainable bioenergy

1. Actors' roles
Roles (Rights, Responsibilities,& Benefits) of concerned actors and institutions defined and agreed upon

BASIC CONDITIONS
- Secure and equitable tenure conditions
- Favourable market and investment
- Institutionalised participatory decision-making mechanisms
- Formal recognition of primary actors and institutions (government, private sector and civil society)

What is true

- **Sustainable biofuel production is complex**
- **One should embrace this complexity** rather than oversimplifying things
- **Assessment of biofuel's sustainability must be:**
  - **evidence-based,**
  - **contextualized, and**
  - **integrated**

Key messages on land

Often more about "Whose" and "What" Land

A lot to do with land and natural resources governance

Voluntary guidelines on sustainable tenure governance of land, forests and fisheries

ILUC can be an issue but there are ways to minimize ILUC risks

Key message on food prices

There is a link

BUT

Biofuels are one amongst many other factors that influence food prices

Need to look at it at country and household levels where it matters!

Sustainable Biofuels: What is needed

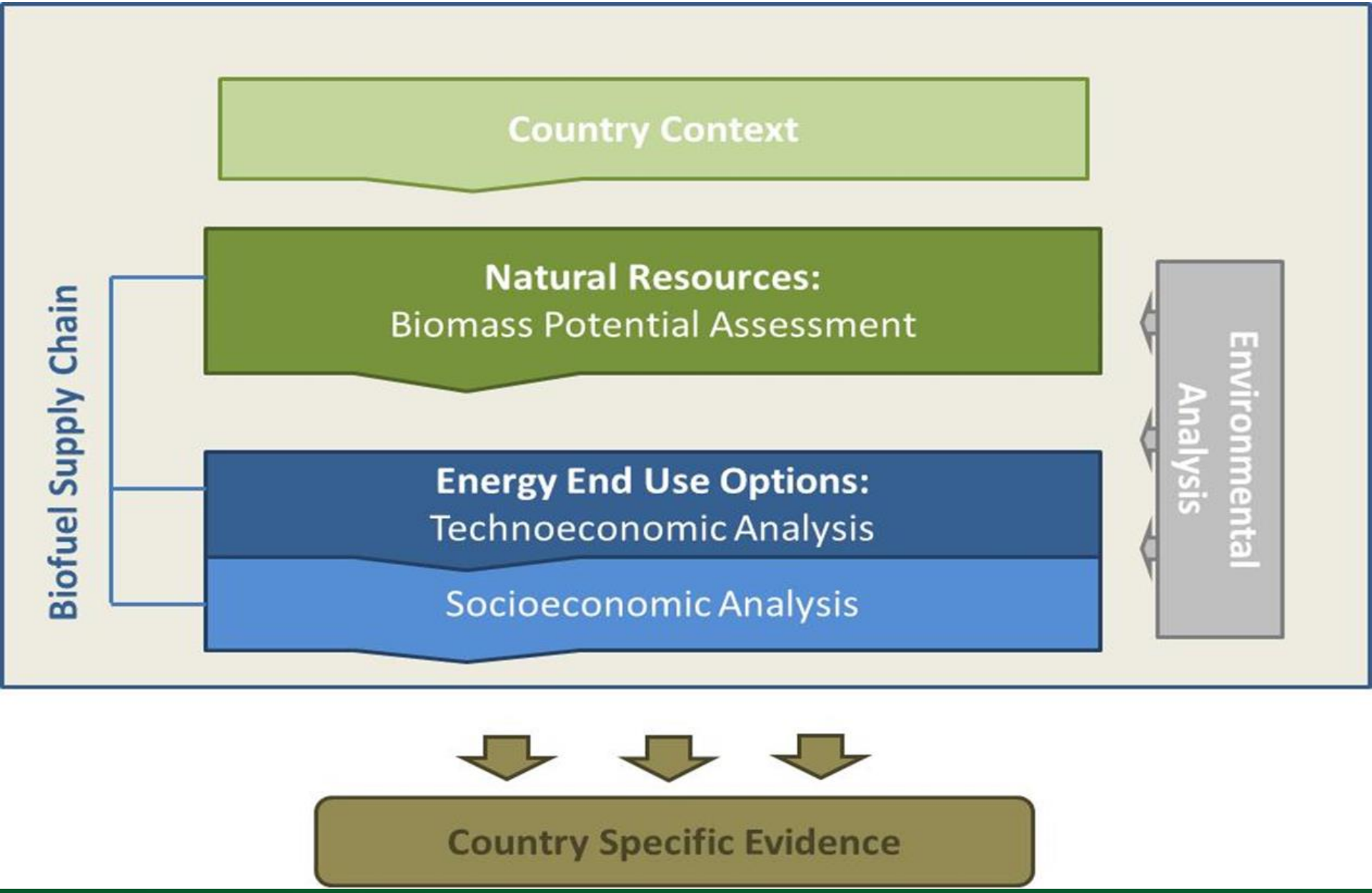
- **An in-depth understanding** of the situation and related opportunities and risks as well as synergies and trade-offs;
- **Implementation of good practices** by investors/producers in order to reduce risks and increase opportunities;
- **An enabling policy and institutional environment** to promote the implementation of good practices;
- **Appropriate monitoring and evaluation** of impacts and performance of good practices and policy responses
- **Political will, capacities** and **good governance** to implement the above

FAO's Sustainable Bioenergy Support Package

Typology of FAO Tools for Sustainable Bioenergy

	Before project implementation: Screening and risk prevention	**After project implementation: Assessment and monitoring**
Local Impact	BEFS Operator Level Tool	IFES analytical framework
Regional/ National impact	BEFS Rapid Appraisal	GBEP indicators

BEFS Approach – Territotial Level



BEFS Operator Level Tool (OLT) - for Investments

Key environmental and socioeconomic issues to consider in assessing operator level impacts on food security:

1. **Change in the supply of food** (crops and livestock) to the domestic market

2. **Resource availability and efficiency of use** (land, water and fertilizers)

3. **Land** and **income displacement** and related **compensation**

FAO BEFSCI OPERATOR LEVEL FOOD SECURITY ASSESSMENT

Operation Overview	
Name (Company/Sponsor/Organization)	ABC Tanzania Ltd.
Bioenergy Feedstock	Sunflower
Total hectares	15000
Latitude	-6.328125
Longitude	34.1455078125

Country: United Republic of Tanzania

Key	
	Potential Benefit for Food Security
	No Significant Influence on Food Security
	Potential Risk to Food Security

1. CHANGE IN THE SUPPLY OF FOOD TO THE DOMESTIC MARKET

1.1	Former/Current land-use (prior to operation)	hectares
	Subsistence agriculture	2000
	Commercial agriculture	7000
	Livestock grazing	5000
	Fallow land	3000

1.4 Change in the supply of food basket items to the domestic food market — **tons**

CROPS

Cereals and tubers	2000
Sugar crops	-4200

2. RESOURCE AVAILABILITY AND EFFICIENCY OF USE

2.1	Land and/or water scarcity	No land and water scarcity
2.2	Land Use Management	Up to two practices

Crop	Land use efficiency	Fertilizer application efficiency
Sunflower	More efficient than national average	
Maize	More efficient than national average	

Examples of good practices

- Agro-ecological zoning
- Outgrower schemes
- Integrated food energy systems
  - Optimizing land use efficiency by mixing energy and food crops (e.g. rotations, agroforestry systems)
  - Optimizing biomass use through cascading uses (e.g. biogas from livestock manure)

How to do it? GBEP Sustainability Indicators

PILLARS		
Environmental	**Social**	**Economic**
INDICATORS		
1. Life-cycle GHG emissions	9. Allocation and tenure of land for new bioenergy production	17. Productivity
2. Soil quality	10. Price and supply of a national food basket	18. Net energy balance
3. Harvest levels of wood resources	11. Change in income	19. Gross value added
4. Emissions of non-GHG air pollutants, including air toxics	12. Jobs in the bioenergy sector	20. Change in consumption of fossil fuels and traditional use of biomass
5. Water use and efficiency	13. Change in unpaid time spent by women and children collecting biomass	21. Training and re-qualification of the workforce
6. Water quality	14. Bioenergy used to expand access to modern energy services	22. Energy diversity
7. Biological diversity in the landscape	15. Change in mortality and burden of disease attributable to indoor smoke	23. Infrastructure and logistics for distribution of bioenergy
8. Land use and land-use change related to bioenergy feedstock production	16. Incidence of occupational injury, illness and fatalities	24. Capacity and flexibility of use of bioenergy

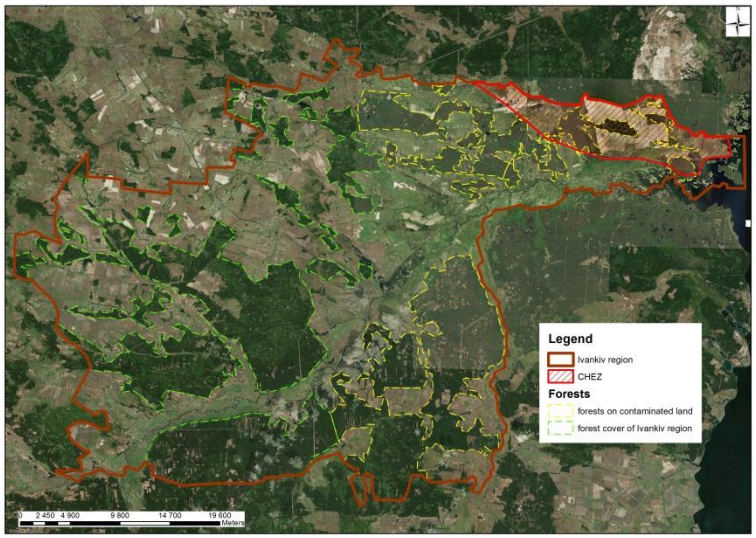
Agreed by 23 countries & 13 international organizations involving a total of 46 countries and 24 int. organizations

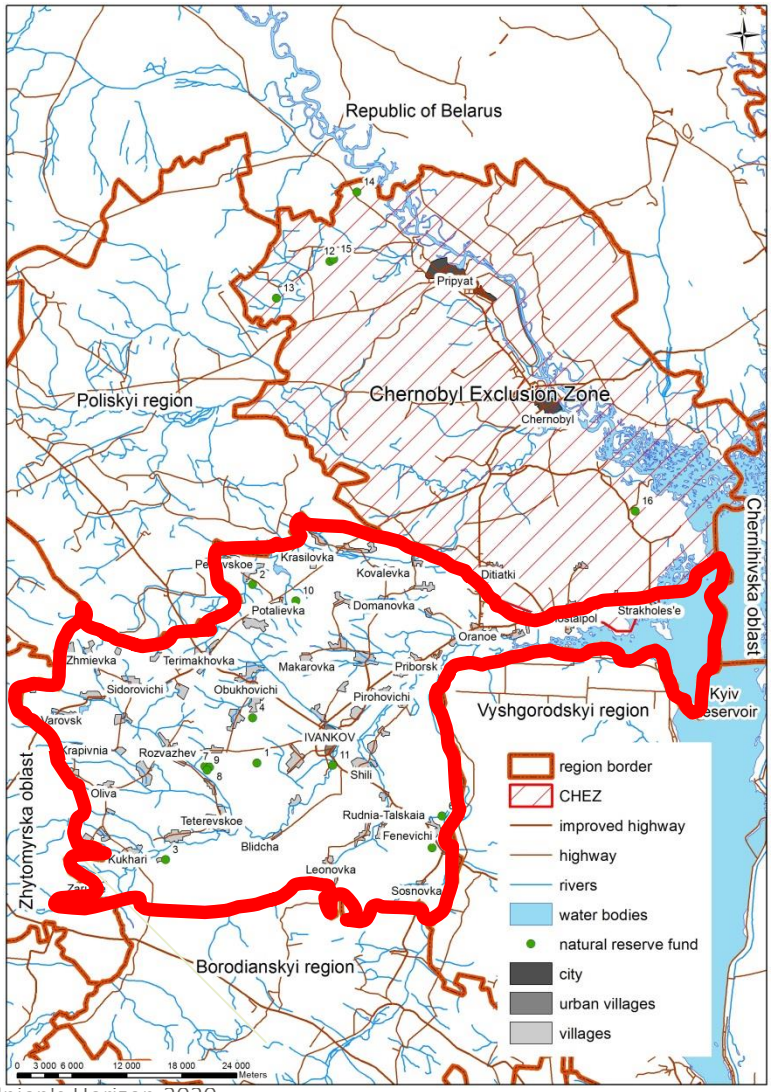
FAO's key messages on biofuels

- **Sustainability of biofuels is context specific.** Therefore its assessment must be based on reality not models and global studies
- **Tools and knowledge are now available** to help governments and operators reduce risks and enhance opportunities of biofuel development
- *Per se* **biofuels are neither good nor bad.** What matters is the way they are managed
- **Biofuels** should be viewed as another **opportunity for responsible investment in sustainable agriculture, rural development and bioeconomy**.

Target areas

- Ukraine:
  - ALL INDICATORS = Area of the Chernobyl Non-Exclusion Zone (185,829 ha);





This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

Literature Review

- Based largely on D2.xx

The majority of the sources reviewed and that will be used for the assessment of the Indicators of Sustainability are shared with the Agronomic and Techno-economic assessments performed under WP2 for each of the case study countries.

- Additional literature sources

For specific topics (especially environmental indicators), further literature review was necessary and publicly available peer-reviewed journals have been consulted.

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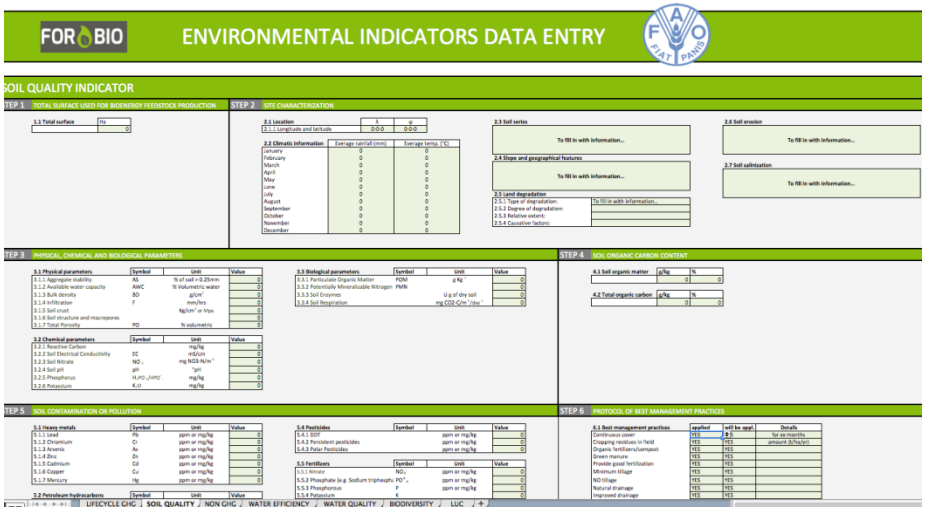
Data Entry Sheets

- Harmonization of definitions and understanding

The production of the data entry sheets for each pillar and for each case study, has been an operation performed collaboratively between FAO and the rest of the partners in the case study countries (WIP-FIB; CTXI-CREA; SECBio-BI). A common understanding of the reference system and how to apply available statistics to them was reached through a number of teleconferences and webinars.



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Country-specific data inventory report

For each country the report includes:

- Overall presentation of the study
- Definition of the *target area*
- Data usage: disaggregated information on the type and use of data sources

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3.3. Country-specific data inventory report

3.3.1. Italy

The data inventory for the case study site in Italy (Sulcis Iglesiente) is for the most part composed by primary as well as secondary data. Tertiary data (modelled information) was also retrieved and included in this inventory for specific indicators. Primary information was collected by the University of Sassari in collaboration with Biochemtex, one of the FORBIO partners and technology provider of the PROESA process for second generation ethanol production from lignocellulosic biomass, on field trials in three locations. The collection of primary data through field trials in the Sulcis supported the study of Biochemtex on the agronomic feasibility of giant reed and its suitability as a feedstock for second generation ethanol. The result of these experiments has led to the composition of a PhD Thesis on „Cropping Systems for Biomass Production in Mediterranean Conditions: Implantation Techniques and Soil Carbon Balances" (Arca, 2017). Unpublished data from the technology provider (Biochemtex) has also been used to validate the results of the data inventory concerning the second generation ethanol process.

In general terms, the specialized literature on experiences with giant reed in Italy, and specifically in Sardinia, is not abundant however, some authors have worked consistently with this dedicated energy crop in the country (e.g. Fagnano). In addition, as previously mentioned, concerning general statistics and agro-ecological data the Regione Sardegna has a highly reliable monitoring, verification and reporting system and most information (even if often in aggregated form) is readily available online. CREA is the Italian FORBIO partner responsible for a number of deliverables concerning the case study site within the context of this project and was capable of obtaining tables and reports from the specialized agencies in the Region to complement most of the environmental data entry sheets. In addition to databases and reports, CREA collected, analyzed and edited georeferenced information and maps to calculate with accuracy several disaggregated spatial attributes of the Sulcis district that are not available in literature.

*Definition of the **target area**:*

In the Sulcis case study, two distinct ***target areas*** have been defined for A) environmental, and B) social and techno-economic indicators. For environmental indicators, the ***target area*** has been defined as the surface of the watersheds (in hectares) interested by levels of Lead (Pb) and other heavy metals exceeding the national and regional limits imposed by law. The area was built by using the contour of the contaminated area so defined, as a result of the interpolation of point data on contamination levels in the topsoil collected by ARPA Sardegna in 2008. The resulting area has been calculated via GIS software to be 8,295 ha. The watersheds that

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include the contaminated area extent to 25,252 ha and this represents the ***target area*** for the environmental indicators in Italy. These calculations have been included in the data entry sheet related to the Land Use situation (Figure 6).

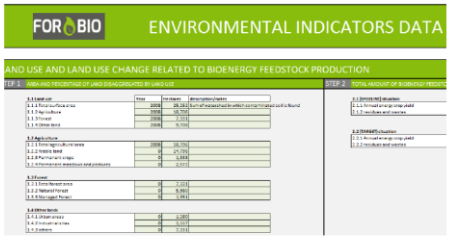

Figure 6. Example of site characterization data collection using data entry sheets

In addition, the various land cover and land use categories have been calculated starting from georeferenced maps retrieved by CREA.

The ***target area*** that describes the social and techno-economic indicators is the equivalent area of the seven (7) municipalities interested by the contamination of soils, even if this is partial. The socio-economic ***target area*** then, is slightly larger than the reference ***target area*** used for environmental sustainability analyses.

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Italy

Overall presentation:

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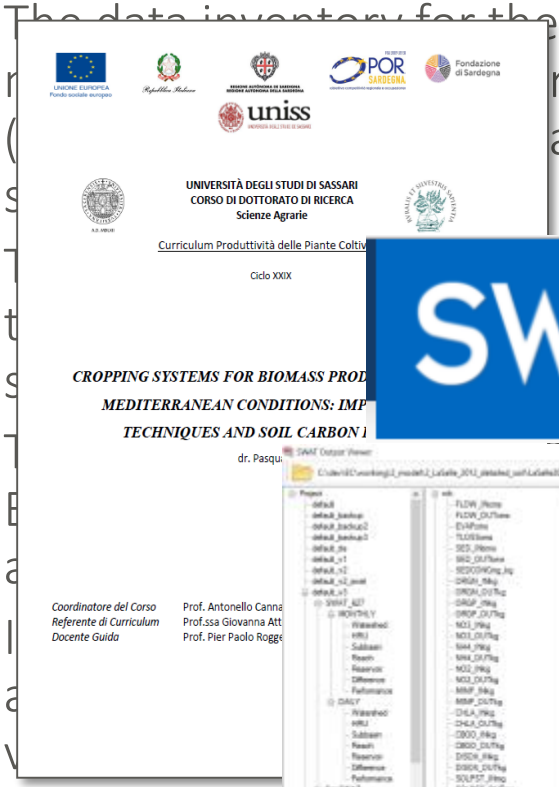

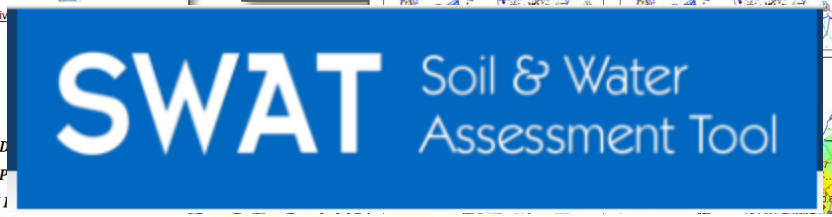

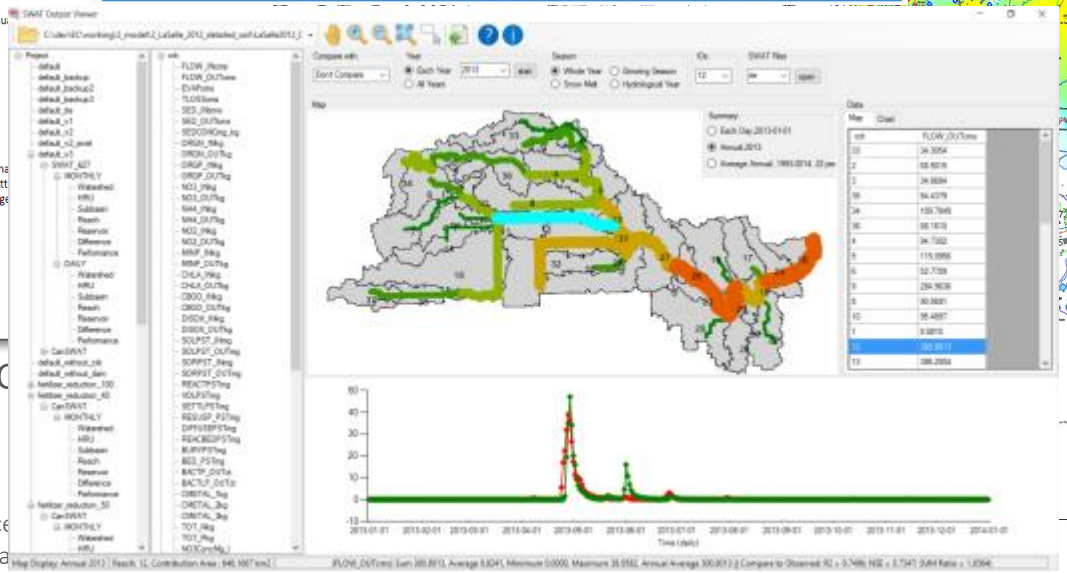

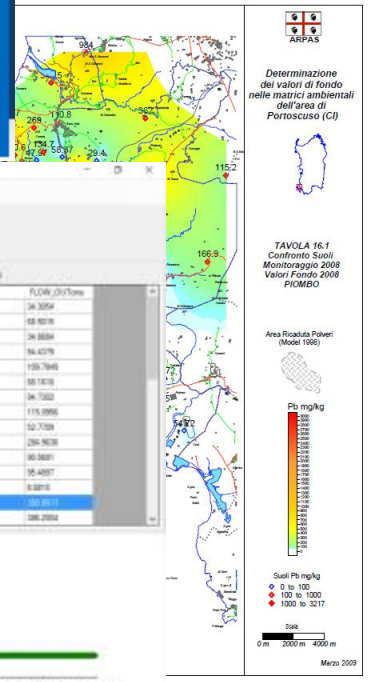

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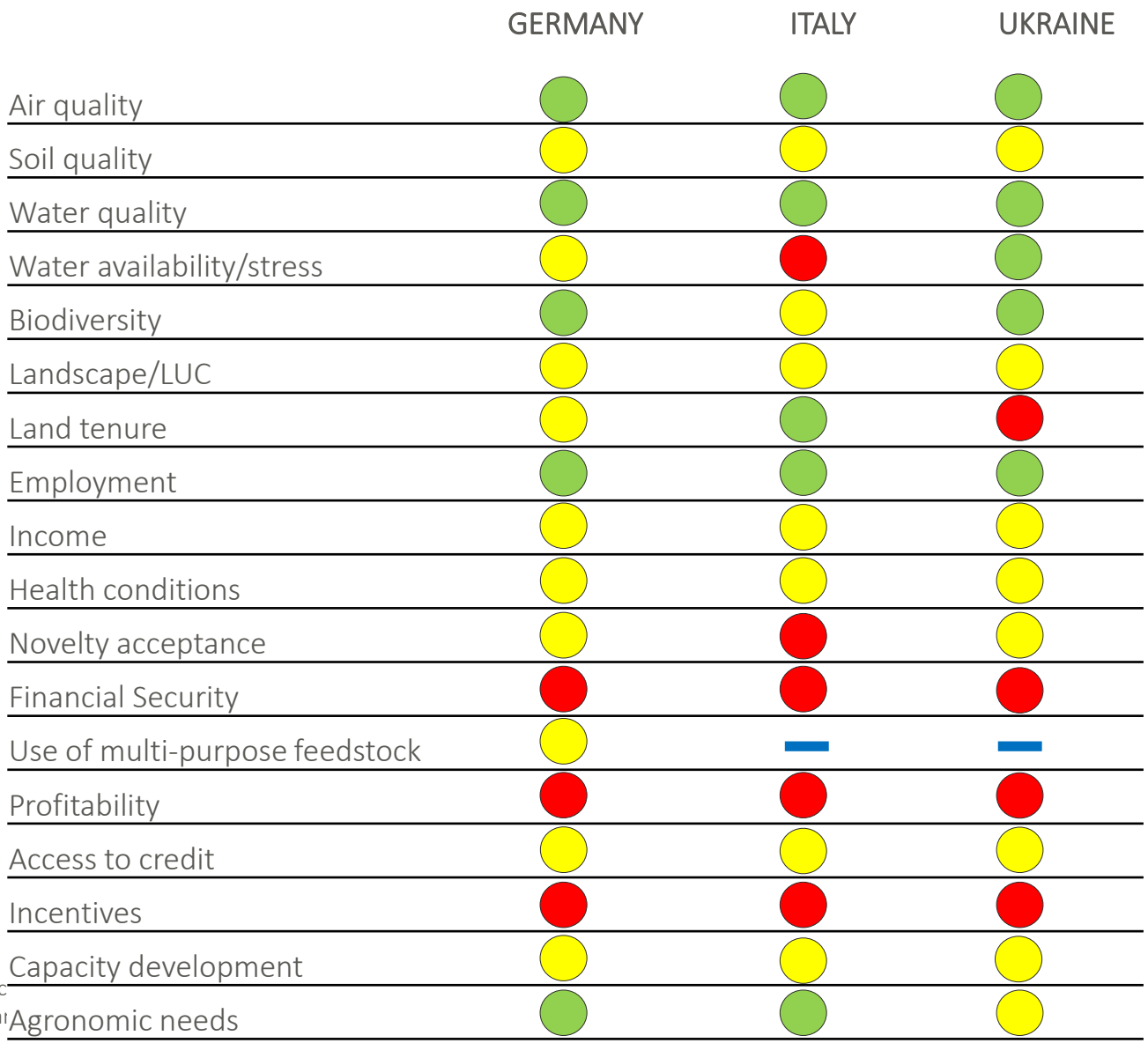
Barriers to the uptake of advanced biofuel value chains



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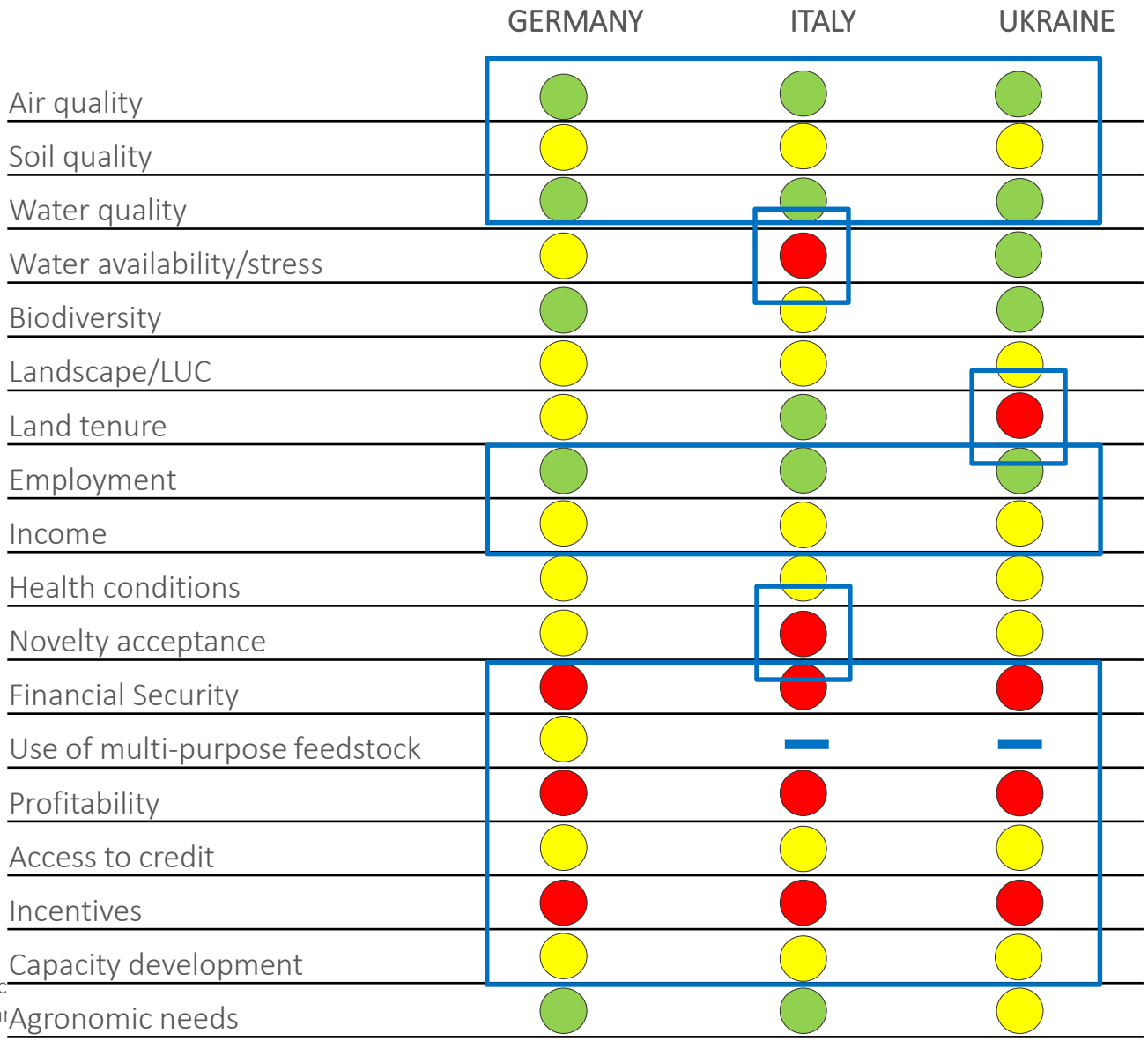

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Thank you for your attention!

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