



# Web-based sustainability assessment tools for Bioenergy projects on underutilized lands in Europe

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## Internal Calculator [FORBIO] 2016 – 2018 (Excel based)



## Automated assessment tool [BIOPLAT-EU] 2019 – 2021 (Web-based)



# FORBIO: Fostering sustainable production of advanced biofuels on underutilized lands

- FORBIO will assess the feasibility of using underutilized lands in **Italy, Germany and Ukraine** for biomass production **without interfering with** the production of food or feed, or with **land currently used for** recreational and/or conservational **purposes**. Romania, Poland, Ireland, UK and Hungary are outreach countries.
- Competition with other uses of the land is only one component of **bioenergy sustainability and a number of cross-cutting environmental, social and economic aspects may present challenges** while ensuring that sustainability standards are met.
- FORBIO will **develop a methodology to assess the sustainable bioenergy production potential on available “under-utilized lands” in Europe** (contaminated, abandoned, fallow land etc.) at national and local level.



# FORBIO Partners



WIP – Renewable Energies



Food and Agriculture Organization of the United Nations



Geonardo Environmental Technologies Ltd.



Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria



Biochemtex Spa



Blacksmith Initiative - UK



Scientific Engineering Centre "Biomass" Ltd.



Center for Promotion of Clean and Efficient Energy



Forschungsinstitut für Bergbaufolgelandschaften e.V.



Polish Biomass Association



European Landowners' Organization



University of Limerick

•FORBIO is an H2020 project made of **11 partners** from **8 EU Member States** + **1 partner from Ukraine**

•Started in January 2016 and expected to end in **December 2018**, for a duration of **36 months**, the project received funding for **1.9 million EUR**

•The coordinator of FORBIO is WIP-Renewable Energies (Germany)



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

# FAO's approach to the Sustainability Assessment in FORBIO:

- Harmonized Data collection campaign

**FORBIO**
**ENVIRONMENTAL INDICATORS**

**SOIL QUALITY INDICATOR**

**STEP 1 TOTAL SURFACE USED FOR BIOENERGY FEEDSTOCK PRODUCTION**

1.1 Total surface	Ha	0
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**STEP 2 SITE CHARACTERIZATION**

**2.1 Location**

2.1.1 Longitude and latitude	λ	φ
	0-00	0-00

**2.2 Climatic information**

	Average rainfall (mm)	Average temp. (°C)
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	0	0
July	0	0
August	0	0
September	0	0
October	0	0
November	0	0
December	0	0

**STEP 3 PHYSICAL, CHEMICAL AND BIOLOGICAL PARAMETERS**

3.1 Physical parameters			
Symbol	Unit	Value	
3.1.1 Aggregate stability	AS	% of soil > 0.25mm	0
3.1.2 Available water capacity	AWC	% Volumetric water	0
3.1.3 Bulk density	BD	g/cm <sup>3</sup>	0
3.1.4 Infiltration	F	mm/hrs	0
3.1.5 Soil crust		kg/cm <sup>2</sup> or Mpa	0
3.1.6 Soil structure and macropores			0
3.1.7 Total Porosity	PD	% volumetric	0

3.2 Chemical parameters			
Symbol	Unit	Value	
3.2.1 Reactive Carbon		mg/kg	0
3.2.2 Soil Electrical Conductivity	EC	mS/cm	0
3.2.3 Soil Nitrate	NO <sub>3</sub>	mg NO <sub>3</sub> -N/m <sup>3</sup>	0
3.2.4 Soil pH	pH		0
3.2.5 Phosphorus	H <sub>2</sub> PO <sub>4</sub> /HPO <sub>4</sub> <sup>-</sup>	mg/kg	0
3.2.6 Potassium	K <sub>2</sub> O	mg/kg	0

3.3 Biological parameters			
Symbol	Unit	Value	
3.3.1 Particulate Organic Matter	POM	g/kg	0
3.3.2 Potentially Mineralizable Nitrogen	PMN		0
3.3.3 Soil Enzymes		U/g of dry soil	0
3.3.4 Soil Respiration		mg CO <sub>2</sub> -C/m <sup>2</sup> /day	0

**STEP 4 TOTAL ORGANIC CARBON**

4.2 Total organic carbon	g/kg	0
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**STEP 5 SOIL CONTAMINATION OR POLLUTION**

5.1 Heavy metals			
Symbol	Unit	Value	
5.1.1 Lead	Pb	ppm or mg/kg	0
5.1.2 Chromium	Cr	ppm or mg/kg	0
5.1.3 Arsenic	As	ppm or mg/kg	0
5.1.4 Zinc	Zn	ppm or mg/kg	0
5.1.5 Cadmium	Cd	ppm or mg/kg	0
5.1.6 Copper	Cu	ppm or mg/kg	0
5.1.7 Mercury	Hg	ppm or mg/kg	0

5.2 Petroleum hydrocarbons			
Symbol	Unit	Value	
			0

5.4 Pesticides			
Symbol	Unit	Value	
5.4.1 DDT		ppm or mg/kg	0
5.4.2 Persistent pesticides		ppm or mg/kg	0
5.4.3 Polar pesticides		ppm or mg/kg	0

5.5 Fertilizers			
Symbol	Unit	Value	
5.5.1 Nitrate	NO <sub>3</sub>	ppm or mg/kg	0
5.5.2 Phosphate (e.g. Sodium triphosphate)	PO <sub>4</sub> <sup>-</sup>	ppm or mg/kg	0
5.5.3 Phosphorous	P	ppm or mg/kg	0
5.5.4 Potassium	K		0

**STEP 6 PROTOCOL OF BEST MAN**

6.1 Best management practice	
Continuous cover	
Cropping residues in field	
Organic fertilizers/compost	
Green manure	
Provide good fertilization	
Minimum tillage	
NO tillage	
Natural drainage	
Improved drainage	

**TAVOLA 11: PIOMBO**

ARPAS

Determinazione dei valori di fondo nelle matrici ambientali dell'area di Portofucino (CI)

Ubicazione e determinazioni analitiche campagne

SUOLA  
21x47.000.00.0  
Tab.14.1. Fucino: 100 mg/kg; Tab.15.1. Fucino: 100 mg/kg

**TAVOLA 16.1**  
Confronto Suoli  
Monitoraggio 2008  
Valori Fondo 2008  
PIOMBO

Area Ricotta Polveri (Marelli 1996)

Pb mg/kg

Soil Pb mg/kg

- 0 to 100
- 100 to 1000
- 1000 to 3217

Scale: 0m, 2000m, 4000m

Marzo 2009



# FAO's approach to the Sustainability Assessment in FORBIO:

- Harmonized Data collection campaign (Data entry sheets + literature)
- Development of tailored set of Sustainability Indicators

## FORBIO SUSTAINABILITY INDICATORS

ENVIRONMENTAL	SOCIAL	ECONOMIC
Life-cycle GHG	Land Tenure	Productivity
Soil Quality	Change in Income	Net Energy Balance
Non GHGs	Jobs in Bioenergy Sectors	Gross Value Added
Water Use and Efficiency	Modern Energy Access	Trainings
Water Quality		Infrastructures and logistics for bioenergy distribution
Biodiversity		
Land Use Change		Capacity and flexibility of use of bioenergy



# FAO's approach to the Sustainability Assessment in FORBIO:

- Harmonized Data collection campaign (Data entry sheets + literature)
- Development of tailored set of Sustainability Indicators
- Indicators measurement through purpose built calculator

**FORBIO Assessment of Sustainability Tool - F.A.S.T.**

Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership (GBEP)  
FORBIO Project H2020

COVER	SOIL TYPE	SANDY	MODERATELY LOAMY	MEDIUM LOAMY	LOAMY	CLAYEY
Others lands	Ha	26.515				
Urban areas	Ha	7.200				
Industrial sites	Ha	0	0			
Wetlands	Ha	13.343				
Others	Ha	5.972	0			
Underutilized NON-agricultural land (e.g. EX-mining sites)	Ha	0				
Shrubland	Ha	0	0	0	0	0
	% SOM	0,00	0,00	0,00	0,00	0,00
	Soil salinity	-	-	-	-	-
	ECW mS/cm	-	-	-	-	-
	ESP %	-	-	-	-	-
	pH*	-	-	-	-	-
	TOT Ha	0	16.720	0	0	0

**AGRICULTURE**

**NON AGRICULTURE**


29 November 2014 CLIMATIC INFORMATION







Effective precipitation	637	Surf. Water Runoff	0.0831	Ground water recharge	0.0365	Precipitation	1.02965954
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# FAO's approach to the Sustainability Assessment in FORBIO:







- Harmonized Data collection campaign (Data entry sheets + literature)
- Development of tailored set of Sustainability Indicators
- Indicators measurement through purpose built calculator
- Further discussions with local stakeholders


**1. Environmental barriers**  FORBIO


- Air quality (pollutants and GHG considerations) 
- Soil quality (soil properties, soil contaminants and pollutants, etc.) 
- Water quality (leaching of chemicals, both pollutants and contaminants, fertilizers and pesticides into aquifers, ground and surface waters) 
- Water availability/stress (irrigation facilities, needs, stresses and competition) 
- Species invasiveness and biodiversity (bioenergy feedstocks' invasiveness and control measures, biodiversity status and perspectives in the study area, etc.) 
- Landscape (restrictions and limitations to changes of original patterns) 






 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 801348


**2. Social barriers**  FORBIO

- Land tenure (land ownership in the study area: is land owned by the farmers, municipalities, region, etc.) 
- Employment in agriculture (what is the average age of farmers, their wage, what are market trends in agriculture in the specific area, etc.) 
- Income generation 
- Health conditions and implications; health safety 
- Novelty acceptance and stakeholder's buy-in and ownership, confidence level (new value chains) 
- Financial Security (long term vs short term contracts) 

 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 801348

**3. Techno-economic barriers**  FORBIO

- Profitability (market conditions for biomass production, avg costs & revenue analyses, etc.) 
- Access to credit (loans, microloans, equity, other forms of financing for this kind of value chains) 
- Incentives (tax breaks, tariffs, etc.) 
- Capacity development (human and institutional) 
- Agronomic needs (materials, inputs, techniques, equipment, training) 

 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 801348



# Calculator for the measurement of Sustainability Indicators

- Based on FAO's experience with the assessment of sustainability through the use of the GBEP Indicators the use of a **common harmonized instrument** to measure indicator values is an asset
  - In the context of FORBIO the FAO team **tested an approach** that set the basis for further developments and scaling-up in the future
  - This approach **is not a deliverable** of the project but it has proven instrumental to produce the deliverables under FAO's responsibility
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# FORBIO Assessment of Sustainability Tool – F.A.S.T.

- The full assessment of the GBEP Indicators requires complex calculations for a number of its indicators;
  - Most experiences with their measurement relied on several different tools and ultimately the mathematical operations necessary have been performed using excel spreadsheets;
  - FAO has worked with different versions of those spreadsheets prepared by several authors (Indonesia, Colombia, etc.) and realized the need for harmonization in order to expedite measurements and therefore enable simple monitoring
  - To respond to such need we created the FORBIO Assessment of Sustainability Tool
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# FORBIO Assessment of Sustainability Tool – F.A.S.T.

- FAST represents an expedite way to measure the sustainability indicators

## ITS FEATURES:

- **PRACTICALITY:** quick, standardized and comparable sustainability assessments
  - **COMPREHENSIVENESS:** Overall perspective of sustainability results
  - **DYNAMISM:** Possibility to forecast future scenarios on the basis of historic trends (test policies, etc.)
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# FORBIO Assessment of Sustainability Tool – F.A.S.T.

## FORBIO SUSTAINABILITY INDICATORS

ENVIRONMENTAL	SOCIAL	ECONOMIC
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Biodiversity		
Land Use Change		Capacity and flexibility of use of bioenergy



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# How does FAST work?

The indicators are divided in three pillars

Environmental, Social and Economic

Each pillar has:

- Two points in time for the assessment (BASELINE sheet and a TARGET sheet)
- a set of specific indicator sheets

Only the BASELINE (or REF 1) and TARGET (or REF 2) entry sheets of each pillar require entry of data

Then, all other sheets will **automatically calculate** values for each indicator

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# How does FAST work?

The BASELINE (or REF 1 point) includes information to describe the initial situation: **site characterization**

The TARGET (or REF 2 point) includes information to describe the bioenergy value chain situation: **value chain characterization**

The INDICATOR SHEETS use information from the previous sheets and from reference sheets included in FAST to **calculate indicator's values** of the pathway analysed **according to the GBEP methodology** (in FORBIO its adapted version)

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# How does FAST work?

For each indicator, there is the projection into the future of the conditions expected **without** the bioenergy development (**i.e. baseline scenario**) and **with** the addition of the bioenergy development (**i.e. target scenario**)

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$$I_V = TS_V - BS_V$$

*Where*

*$I_V$ : Indicator's Value*

*$TS_V$ : Target Scenario Value*

*$BS_V$ : Baseline Scenario Value*

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# Baseline situation



## FORBIO Assessment of Sustainability Tool

Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership (GBEP)  
FORBIO Project H2020

PROVIDE THE REFERENCE YEAR FOR

BASELINE

2017

TARGET AREA

TARGET AREA SURFACE (ha)

35.745

Agriculture

Ha

18.706

total

Annual crops and fallow lands (FAOSTAT Arable Land)

Ha

14.796

Permanent crops

Ha

1.338

Permanent meadows and pastures

Ha

2.572

Underutilized/contaminated agricultural land

Ha

18.706

Forest

Ha

7.331

Natural Forest or underutilized forest

Ha

5.980

Managed Forest

Ha

1.351

Others lands

Ha

9.708

Urban areas

Ha

1.260

Industrial sites

Ha

1.117

Wetlands

Ha

0

Others

Ha

7.331

Underutilized/contaminated NON-agricultural land (e.g. E

Ha

1.117

AGRICULTURE

NON AGRICULTURE



■ Annual crops and fallow lands  
(FAOSTAT Arable Land)  
■ Permanent crops



Industrial sites

Wetlands

Others



**COMUNE DI PORTOSCUSO**

Provincia di Carbonia Iglesias  
Ufficio del Sindaco

Prot.n. 3084

ORDINANZA N. 9 del 06/03/2014

IL SINDACO

VISTA l'ordinanza sindacale n. 47 del 15.9.2010 con la quale viene consentita la vendita di uve e vini solo se conformi alla normativa;

VISTO il comunicato stampa della ASL n. 7 emesso in data 23.1.2012 con cui viene raccomandato di differenziare la provenienza dei prodotti ortofrutticoli da consumare per la fascia di età dei bambini da 0 a 3 anni;

VISTA la nota del Dipartimento di Prevenzione dell'Asl Carbonia prot. PG/2014/5435 del 04/03/2014, acquisita al prot. generale del Comune di Portoscuso al n. 2988 del 05/03/2014 portante ad oggetto "Valutazione su attività di indagine ambientale sanitaria del territorio di Portoscuso. Proposta di adozione provvedimenti e di informativa alla popolazione", con la quale si propone l'indicazione di emanazione di ordinanza di divieto di commercializzazione di alcuni prodotti orticoli e si propone l'emanazione di raccomandazione universale, a titolo precauzionale di limitazione del consumo per uso familiare di ogni prodotto derivante dalle attività orticole del territorio comunale di Portoscuso;

VISTE le risultanze delle indagini condotte sullo stato ambientale del territorio del Comune di Portoscuso comprendenti:

1. le valutazioni sul rischio sanitario determinato dall'assunzione di prodotti ittici lagunari e di alimenti coltivati nell'ambito territoriale del Comune di Portoscuso formulate dall'Istituto Superiore della Sanità nei seguenti rapporti:

- "Valutazione del rischio igienico sanitario dei suoli compresi nel sito di interesse nazionale del Sulcis Iglesiente Guspinese", trasmesso dal Comune di Portoscuso al Dipartimento di Prevenzione della ASL di Carbonia in data 10.03.2011 con prot. n. 2438;
- "Integrazione del Piano di monitoraggio finalizzato all'acquisizione di conoscenze sito specifiche di tutte le matrici ambientali in riferimento alle attività agro pastorali e di pesca nel territorio comunale di Portoscuso", trasmesso dal Comune di Portoscuso al Dipartimento di Prevenzione della ASL di Carbonia in data 24.02.2014 con prot. n. 2541.

2. gli esiti degli accertamenti analitici derivanti dal prelievo di matrici biologiche animali e vegetali effettuate, in virtù di specifici accordi contrattuali tra IGEA, ASL di Carbonia e Istituto Zooprofilattico Sperimentale della Sardegna, dal mese di giugno 2013 a tutt'oggi certificati dai rapporti di prova resi disponibili alla data odierna;

VALUTATO quanto previsto dalle vigenti normative in materia di commercializzazione di alimenti;

ANALIZZATE le potenziali ripercussioni sulla salute della popolazione derivanti dal consumo degli alimenti contenenti le matrici oggetto di indagine;

VISTO l'art. 54 del D.Lgs 18.08.2000, n. 267;

Pagina 1 di 3

RESULTS

START

EN-BASELINE

EN-TARGET

AIR EMISSIONS

SOIL QUALITY

WATER USE

BIODIVERSITY

LUC

S-BASELINE

S



## *Target Scenarios tested*

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T1: Giant reed (*Arundo donax*) – rainfed

T2: Giant reed (*Arundo donax*) – irrigated

T3: Milk thistle (*Silybum marianum*) – rainfed

T4: Smilo grass (*Piptatherum miliaceum*) – rainfed

Bioenergy pathway: Lignocellulosic ethanol (with CHP)

Technology: PROESA<sup>®</sup> (steam-explosion, Enzymatic liquefaction, SSF)

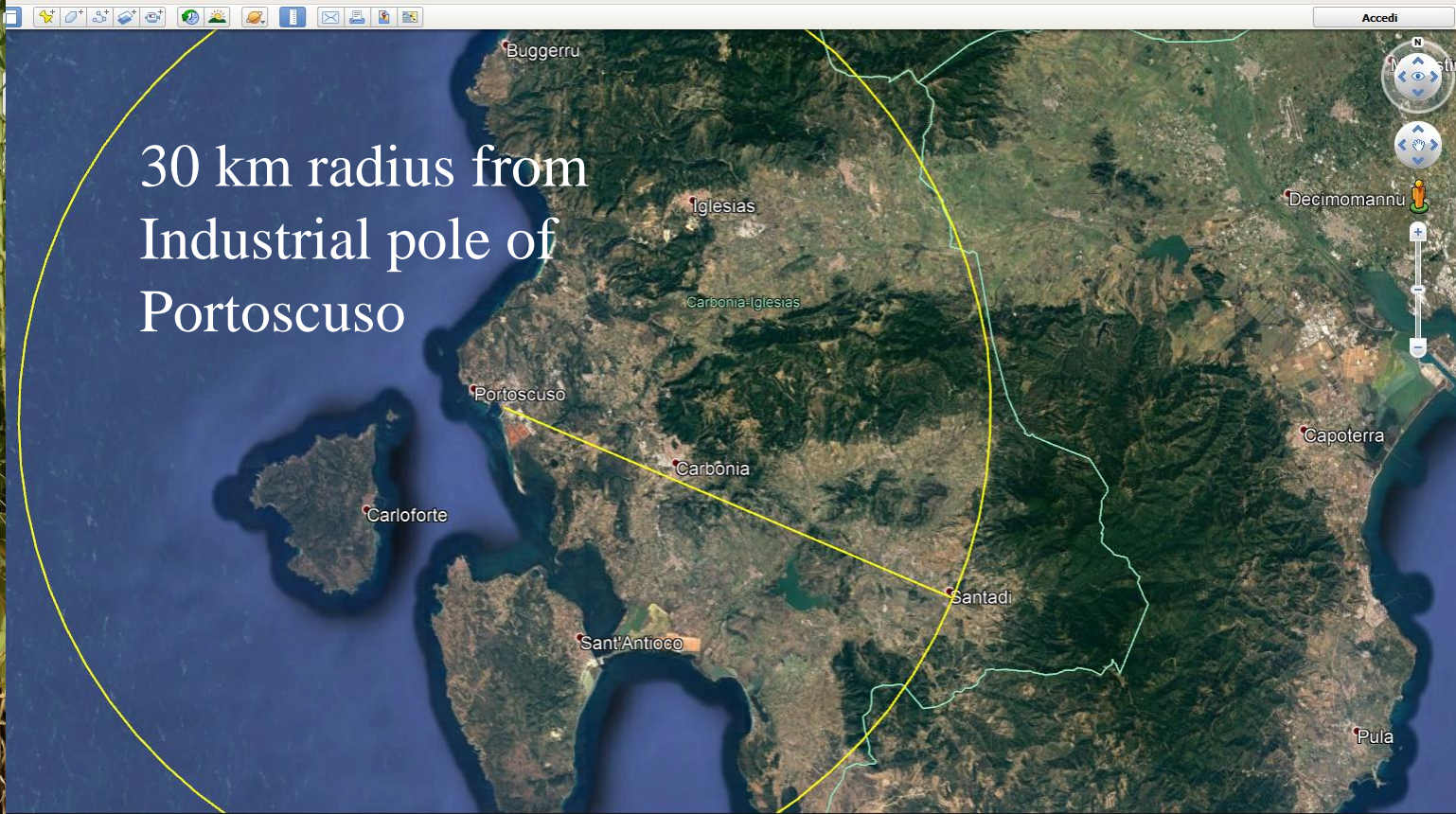
Target output: 40,000 tons of ethanol per year

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## *Examples from the Target Scenarios tested*





# Example of Target Scenario tested



## FORBIO Assessment of Sustainability Tool FAST

Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership (GBEP)  
FORBIO Project H2020

Type of ADVANCED BIOFUEL	Cellulosic Ethanol	-	TARGET adv. biofuel PRODUCTION	40.000	t/year	expected prod.	40.000	t/year	
CROP USED FOR FEEDSTOCK PRODUCTION			UNDERUTILIZED AGRICULTURAL LAND					UNDERUTILIZED	
		CROP 1	CROP 2	CROP 3	CROP 4	CROP 5	CROP 1	CROP2	
Name		G. REED	-	-	-	-	-	-	
Growth cycle		Perennial	-	-	-	-	-	-	
Yield	tonnes/ha	10,0	-	-	-	-	-	-	
Advanced biofuel prod	tfstk/tfuel	4,50	-	-	-	-	-	-	
ADV. BIOFUEL PRODUCTION	tonnes	40.000	-	-	-	-	-	-	
Total ADV. BIOFUEL PRODUCTION	tonnes			40.000					
TOTAL TONNES OF LACTIC ACID AND AMINC	Tonnes	0	0	0	0	0	0	0	
TARGET CULTIVATED SURFACE	Ha	18.000	-	-	-	-	-	-	
Total cultivated surface	Ha			18.000					
REQUIRED FSTK QUANTITY	Tonnes	180.000	-	-	-	-	-	-	
Total	Tonnes			180.000					
Distance from field to Fuel Plant	Km	40	-	-	-	-	-	-	
TRANSPORT OF BIOMASS	Vehicle type	Tractor	-	-	-	-	-	-	
Distance from Fuel Plant to distributors (km)		100							
TRANSPORT OF FUEL	Vehicle type	Truck	-	-	-	-	-	-	
SOIL CHARACTERIZATION									
	SANDY	Suitability	Suitable	-	-	-	-	-	





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# **SUSTAINABILITY ASSESSMENT: SOME EXAMPLES FROM THE CASE STUDY IN ITALY**

## **INDICATOR: AIR QUALITY**

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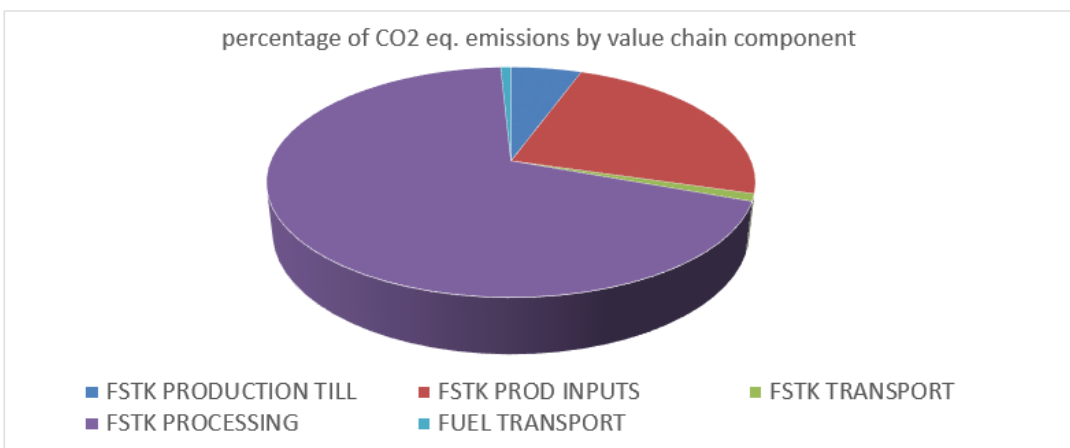
# Preliminary results: Air quality

## FORBIO Assessment of Sustainability Tool FAST

Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership (GBEP)  
FORBIO Project H2020

MISSIONS	Tot Mj <sub>fuel</sub>	<b>gCO<sub>2</sub> eq per Mj<sub>fuel</sub></b>	<b>32,78</b>	<b>gCO per Mj<sub>fuel</sub></b>	<b>0,00697</b>	<b>gNO<sub>x</sub> per Mj<sub>fuel</sub></b>	<b>0,02150</b>	<b>gSO<sub>x</sub> per Mj<sub>fuel</sub></b>	
	1.072.400.000	<b>gCO<sub>2</sub><sub>fossil</sub> per Mj<sub>fuel</sub></b>	<b>8,68</b>	<b>gCO<sub>2</sub><sub>biog.</sub> per Mj<sub>fuel</sub></b>	<b>0,00</b>	<b>gCH<sub>4</sub><sub>fossil</sub> per Mj<sub>fuel</sub></b>	<b>0,02</b>	<b>gCH<sub>4</sub><sub>biog.</sub></b>	
	Emission change %	<b>Reduction (petrol)</b>	<b>60,88%</b>						

CROP USED FOR FEEDSTOCK PRODUCTION	UNDERUTILIZED AGRICULTURAL LAND					UNDERUTILIZED AGRICULTURAL LAND	
	CROP 1	CROP2	CROP 3	CROP 4	CROP 5	CROP 1	CROP 2
Name	<b>G. REED</b>	-	-	-	-	-	-



	CO <sub>2</sub> eq.	%
FSTK PRODUCTION TILL		6
FSTK PROD INPUTS		24
FSTK TRANSPORT		1
FSTK PROCESSING		69
FUEL TRANSPORT		1

TOTAL		FSTK PRODUCTION			INPUTS		FSTK TRANSPORT			FSTK PRO			
EN-BASELINE	EN-TARGET	AIR EMISSIONS	SOIL QUALITY	WATER USE	BIODIVERSITY	LUC	S-BASELINE	S-TARGET	LAND TEN.	INCOME	JOBS	ENERGY ACCESS	EC-BASELINE





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# **SUSTAINABILITY ASSESSMENT: SOME EXAMPLES FROM THE CASE STUDY IN ITALY**

## **INDICATOR: WATER USE AND EFFICIENCY**

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# Preliminary results: Water efficiency

## FORBIO Assessment of Sustainability Tool FAST



Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership (GBEP)  
FORBIO Project H2020

### WATER USE AND EFFICIENCY

#### UNDERUTILIZED AGRICULTURAL LAND

#### UNDERUTILIZED NON AGRICULTURAL LAND

		UNDERUTILIZED AGRICULTURAL LAND					UNDERUTILIZED NON AGRICULTURAL LAND						
		CROP 1	CROP2	CROP 3	CROP 4	CROP 5	CROP 1	CROP2	CROP 3	CROP 4	CROP 5		
Name		G. REED	-	-	-	-	-	-	-	-	-		
CROP ET	mm/year	857	-	-	-	-	-	-	-	-	-		
Effective Precipitation	mm/year	662	-	-	-	-	-	-	-	-	-		
Crop production	tonnes	180.000	-	-	-	-	-	-	-	-	-		
A. Irr. Req.	mm/year	195	-	-	-	-	-	-	-	-	-		
Unitary Water req	m3/ha	6.620	-	-	-	-	-	-	-	-	-		
	Km3/year	0,11916000	-	-	-	-	-	-	-	-	-		
Unitary W(IRR) req	m3/ha	-	-	-	-	-	-	-	-	-	-		
	Km3/year	-	-	-	-	-	-	-	-	-	-		
Tot Unitary W(IRR) Req.	Km3/year		0,00000000						0,00000000				
Wstck ren	Km3/year	0,11916000	-	-	-	-	-	-	-	-	-		

TOT Wfstk ren 0,11916000 Km3/year  
% Blue water 0

#### Wpro.ren Renewable Water used for Bioenergy Processing

Water consumption:	1,30	m3/tfeedstock
	0,00023400	km <sup>3</sup> /year
Advanced Biofuel	40.000	t/year
LHV	26,81	GJ/t
Total energy output	1.072.400.000	MJ/year
		59.578

#### TARWR Total Actual Renewable Water Resources

Total Internal Renewable Water Resources  
IRWR - km3/year

W <sub>bioenergy,ren</sub> / TARWR x 100%	-	
W <sub>bioenergy</sub> /TAWW x 100%	-	
TAWW	-	m3/year
W <sub>bioenergy</sub> / E <sub>total</sub>	0,111333458	m3/MJ
Production	2979,00	m <sup>3</sup> /tfeedstock
		I/MJ 111,3334577

#### Wbio.ren Total Renewable Water used for Bioenergy

W<sub>feedstock,ren</sub> + W<sub>processing</sub> 0,11939400 km<sup>3</sup>/year





# Preliminary results: Water efficiency



## FORBIO Assessment of Sustainability Tool FAST



### WATER USE AND EFFICIENCY

		UNDERUTILIZED AGRICULTURAL LAND					UNDERUTILIZED NON AGRICULTURAL LAND				
		CROP 1	CROP2	CROP 3	CROP 4	CROP 5	CROP 1	CROP2	CROP 3	CROP 4	CROP 5
Name		G. REED (IRR)	-	-	-	-	-	-	-	-	-
CROP ET	mm/year	857	-	-	-	-	-	-	-	-	-
Effective Precipitation	mm/year	662	-	-	-	-	-	-	-	-	-
Crop production	tonnes	180.000	-	-	-	-	-	-	-	-	-
A. Irr. Req.	mm/year	195	-	-	-	-	-	-	-	-	-
Unitary Water req	m3/ha	8.570	-	-	-	-	-	-	-	-	-
	Km3/year	0,06170400	-	-	-	-	-	-	-	-	-
Unitary W(IRR) req	m3/ha	1.950	-	-	-	-	-	-	-	-	-
	Km3/year	0,01404000	-	-	-	-	-	-	-	-	-
Tot Unitary W(IRR) Req.	Km3/year		0,01404000					0,00000000			
Wstkrren	Km3/year	0,06170400	-	-	-	-	-	-	-	-	-

TOT Wfstk ren **0,06170400** Km3/year  
% Blue water 22,75%

#### Wpro.ren Renewable Water used for Bioenergy Processing

Water consumption:	1,30	m3/feedstock
	0,00023400	km <sup>3</sup> /year
Advanced Biofuel	40.000	t/year
LHV	26,81	GJ/t
Total energy output	1.072.400.000	MJ/year
	148.944	

#### TARWR Total Actual Renewable Water Resources

Total Internal Renewable Water Resources	
IRWR	0,0000 km <sup>3</sup> /year

W<sub>bioenergy\_ren</sub> / TARWR x 100%

W<sub>bioenergy</sub>/TAWW x 100%

TAWW

W<sub>bioenergy</sub> / E<sub>total</sub>  m<sup>3</sup>/M  l/MJ

Production  m<sup>3</sup>/t<sub>feedstock</sub>

#### Wbio.ren Total Renewable Water used for Bioenergy

W<sub>feedstock\_ren</sub> + W<sub>processing\_ren</sub> 0,06193800 km<sup>3</sup>/year





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# **SUSTAINABILITY ASSESSMENT: SOME EXAMPLES FROM THE CASE STUDY IN ITALY**

## **INDICATOR: EMPLOYMENT**

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# Employment



## FORBIO Assessment of

Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership  
FORBIO Project H2020

### JOBS IN THE BIOENERGY SECTOR

				UNDER	
CROP USED FOR FEEDSTOCK PRODUCTION			CROP1	CROP2	
Name			G. REED	-	
Growth cycle			Perennial	-	
CROP SPECIFICATIONS	TARGET CULTIVATED SURFACE	Ha	18.000	-	
NUMBERS OF JOBS					

		UNSKILLED	0,0	-
TOTAL NUMBER OF PM/Ha		Temporary	0,0	-
	BIOMASS PRODUCTION	Permanent	0,0	-
BIOMASS TRANSPORT		SKILLED	0,9	-
BIOMASS PROCESSING		Temporary	0,4	-
MAINTENANCE		Permanent	0,5	-
FUEL TRANSPORT		SPECIALIZED	0,0	-
		Temporary	0,0	-
		Permanent	0,0	-

PM TOTAL BY CROP		TOTAL	15.552	0
	UNSKILLED	0	0	0
	SPECIALIZED + SKILLED	15.552	0	0



## FORBIO Assessment of S

Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership  
FORBIO Project H2020

### JOBS IN THE BIOENERGY SECTOR

				UNDERU	
CROP USED FOR FEEDSTOCK PRODUCTION			CROP1	CROP2	
Name			G. REED (IRR)	-	
Growth cycle			Perennial	-	
CROP SPECIFICATIONS	TARGET CULTIVATED SURFACE	Ha	7.200	-	
NUMBERS OF JOBS					

		UNSKILLED	0,0	-
TOTAL NUMBER OF PM/Ha		Temporary	0,0	-
	BIOMASS PRODUCTION	Permanent	0,0	-
BIOMASS TRANSPORT		SKILLED	1,3	-
BIOMASS PROCESSING		Temporary	0,5	-
MAINTENANCE		Permanent	0,8	-
FUEL TRANSPORT		SPECIALIZED	0,0	-
		Temporary	0,0	-
		Permanent	0,0	-

PM TOTAL BY CROP		TOTAL	9.252	0
	UNSKILLED	0	0	0
	SPECIALIZED + SKILLED	9.252	0	0





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# **SUSTAINABILITY ASSESSMENT: SOME EXAMPLES FROM THE CASE STUDY IN ITALY**

## **INDICATOR: CAPACITY AND FLEXIBLE USE OF BIOENERGY**

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# Capacity of use of bioenergy

## FORBIO Assessment of Sustainability Tool FAST



Food and Agriculture Organization of the United Nation (FAO) / Global Bioenergy Partnership (GBEP)  
FORBIO Project H2020

### CAPACITY OF USE OF BIOENERGY

CROP USED FOR FEEDSTOCK PRODUCTION	UNDERUTILIZED AGRICULTURAL LAND					UNDERUTILIZED NON AGRICULTURAL LAND				
	CROP 1	CROP2	CROP 3	CROP 4	CROP 5	CROP 1	CROP2	CROP 3	CROP 4	CROP 5
Name	G. REED (IRR)									

TYPE OF ADVANCED BIOFUEL	Cellulosic Ethanol	COUNTRY	IT	
BASELINE	Tfuel/year	TARGET AREA	NATIONAL	EU LEVEL
Current biofuel use		227	224.865	4.225.095
Current TOTAL fuel use		5.738	5.696.000	84.949.000
TARGET	Tfuel/year	TARGET AREA	NATIONAL	EU LEVEL
Target biofuel use in the target area		227	241.171	4.225.095
TARGET biofuel use plus PROJECT PRODUCTION		40.227	281.171	4.265.095
Current TOTAL fuel use		5.738	5.696.000	84.949.000

FINAL CAPACITY RATIO	BLENDING WALL		
	TARGET AREA	NATIONAL	EU LEVEL
CAPACITY WITH BLENDING WALL	574	569.600	8.494.900
Capacity ratio for BASELINE situation	0,40	0,39	0,50
CAPACITY WITH BLENDING WALL	574	569.600	8.494.900
Capacity ratio for BASELINE situation	0,40	0,42	0,50
<b>Change in %</b>	<b>0%</b>	<b>7%</b>	<b>0%</b>
CAPACITY WITH BLENDING WALL	70,11	0,49	0,50
Capacity ratio for TARGET situation	70,11	0,49	0,50
<b>Change in %</b>	<b>17621%</b>	<b>25%</b>	<b>1%</b>
PROJECT CONTRIBUTION TO CHANGE IN CAPACITY RATIO			
<b>Change in %</b>	<b>17621,145%</b>	<b>17,788%</b>	<b>0,947%</b>





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# How to complete FAST?

The calculator can be improved and complemented through the use of existing tools (adequately adapted) produced by the GBEP members

Transfer of knowledge from the GHG & non-GHG LCA calculators (e.g. IFEU for Viet Nam and Paraguay, etc.)

Efforts on how to integrate/link SWAT for a number of aspects linked to Indicator on Soil quality, Water Use and Efficiency as well as Water Pollution

BUT: FAST is a valid example of how bioenergy sustainability assessments can be facilitated by an automated calculator; however, FAST works for the specific context of FORBIO and a broader bioenergy sust. assessment tool requires far greater efforts

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## Requirements for the production and use of a purpose-built tool to assess sustainability

The development of an automated calculator based on the FORBIO approach requires a dedicated project;

In 2018 FAO proposed the realization of a more automated, publicly available sustainability assessment tool based on FORBIO through an H2020 call for proposal

The proposal was successful and the BIOPLAT-EU will be funded starting from November 2018 until October 2021

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## BIOPLAT-EU

The project will promote sustainable bioenergy deployment opportunities through a web-based platform which will include a public user friendly tool using global information system that will assess the environmental, social and techno-economic sustainability aspects of defined value chains for bioenergy production on MUC lands and through stakeholder engagement activities. In order to remove legal barriers for the uptake of such projects, communication activities with the responsible authorities will be organised.

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## BIOPLAT-EU

**In the first phase** of the project, WP2 “Mapping of MUC lands for bioenergy production in Europe using remote sensing technology” will be mainly implemented. In this WP data collection of existing GIS maps as well as the generation of MUC land maps will be done. The outputs of this WP will be the geo-referenced basic information needed for the further development of the sustainability tool in WP3.

These outputs contain three main parts: 1) existing GIS layers such as infrastructure, bioenergy plants, etc; 2) TIER 1 map on MUC lands and 3) detailed (TIER 2) map on MUC lands for hot-spot areas.

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## BIOPLAT-EU

**In the second phase** of the project, the web-based platform will be developed (WP3: Web-based platform about MUC lands for bioenergy production in Europe). The platform will include the following:

- a. The project website which includes information about the project activities and results
  - b. The web-GIS tool composed of the GIS maps developed in WP2 and the sustainability tool for Europe and neighbouring countries (STEN)
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## BIOPLAT-EU

**The third phase** of the project includes WP4 “Case studies for the application of the tool on MUC lands for bioenergy production in Europe”, WP5 “Stakeholder mobilisation and involvement in the case studies” and WP6 “Market uptake of bioenergy projects on MUC land”. These WP will be running in parallel and will make use of the results of WP2 and WP3 to reach out to stakeholders, promote bioenergy production on MUC lands and provide consultancy.

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# Thank you

Contact us

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