Exploring the BiogasDoneRight concept

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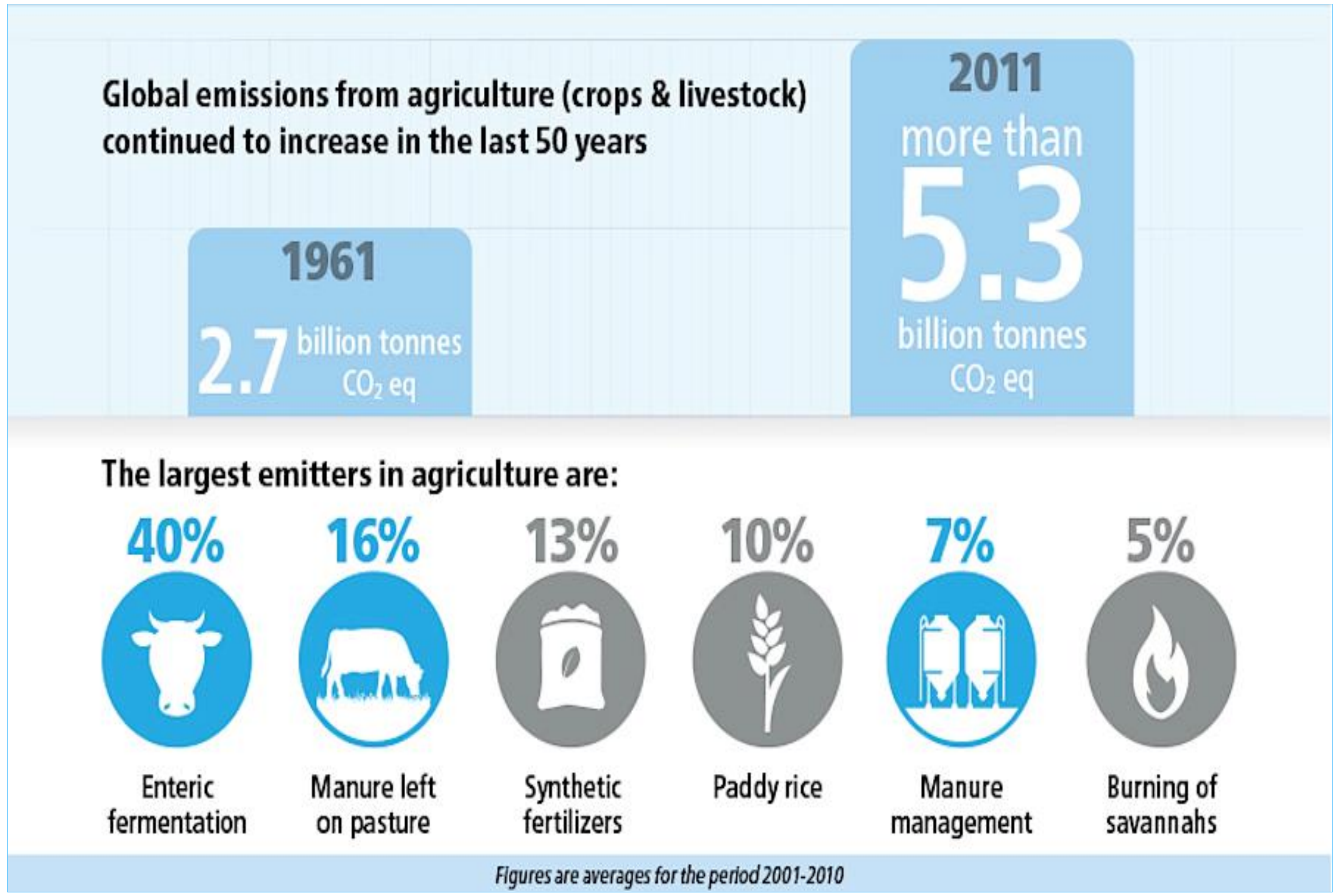
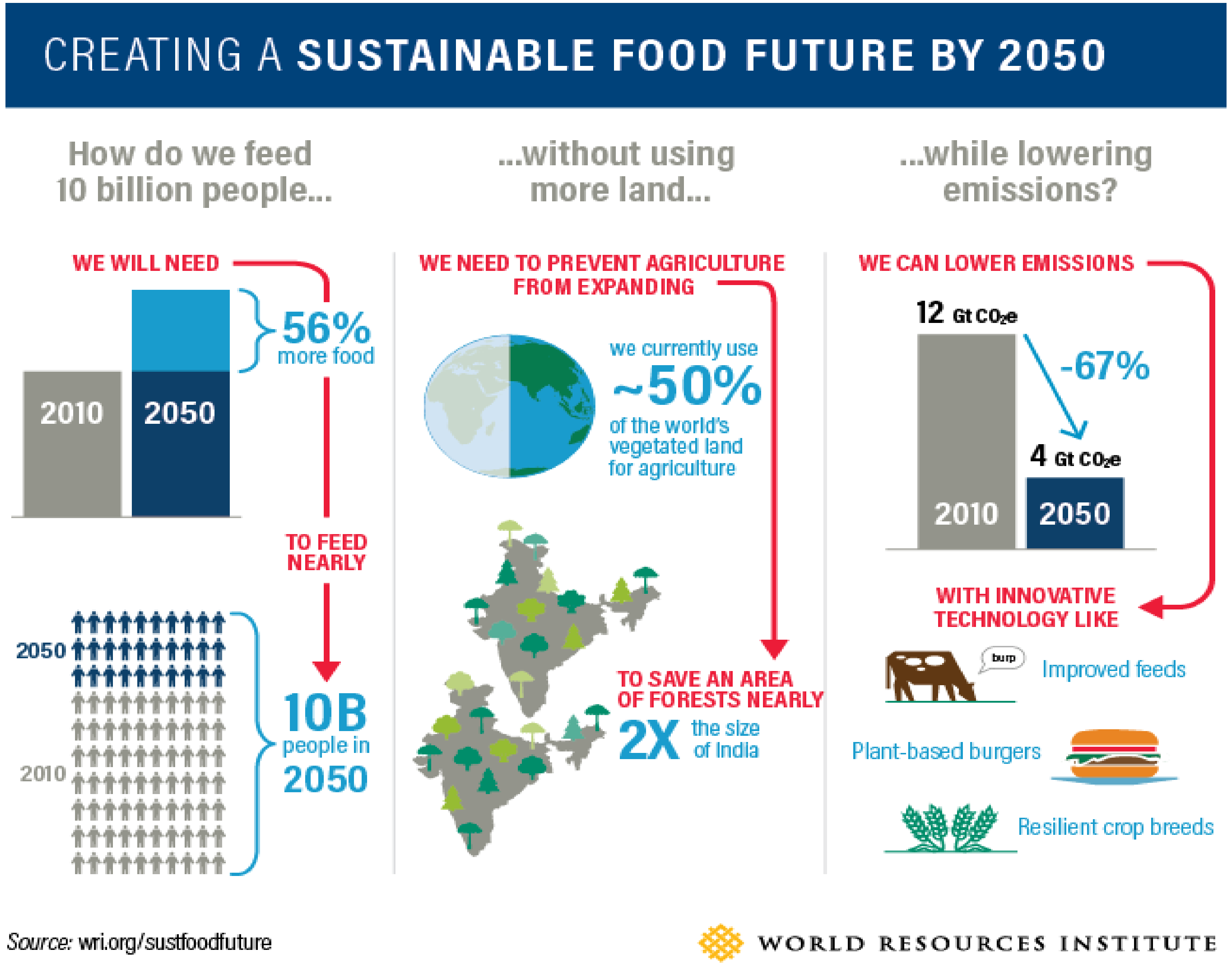
Importance of feedstock in Anaerobic Digestion: Characteristic & Potentials
DiBiCoo Webinar Series: 003 – 7 September 2020

Agriculture and environment: from problem to solution?



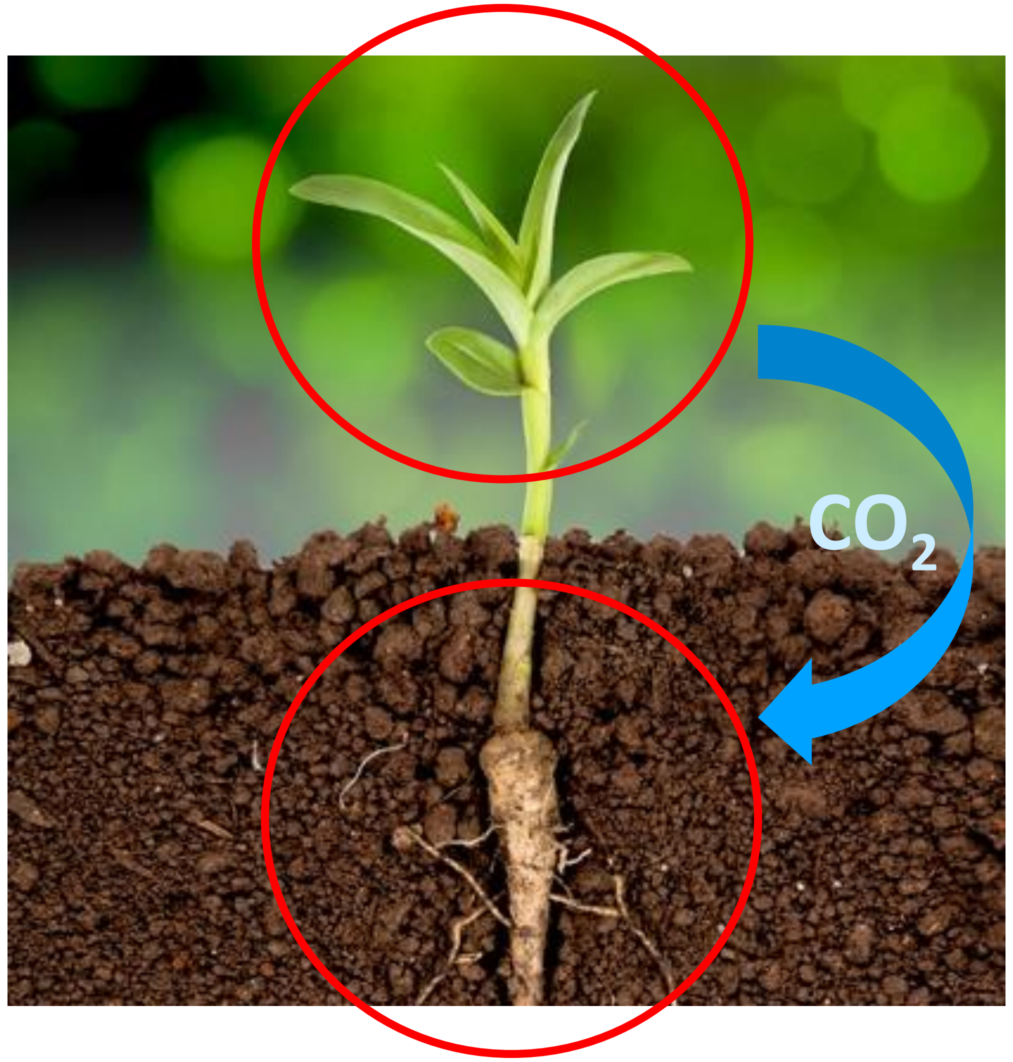
Source: IPCC "Mitigation report" 2014

13 % of GHG emissions from agriculture

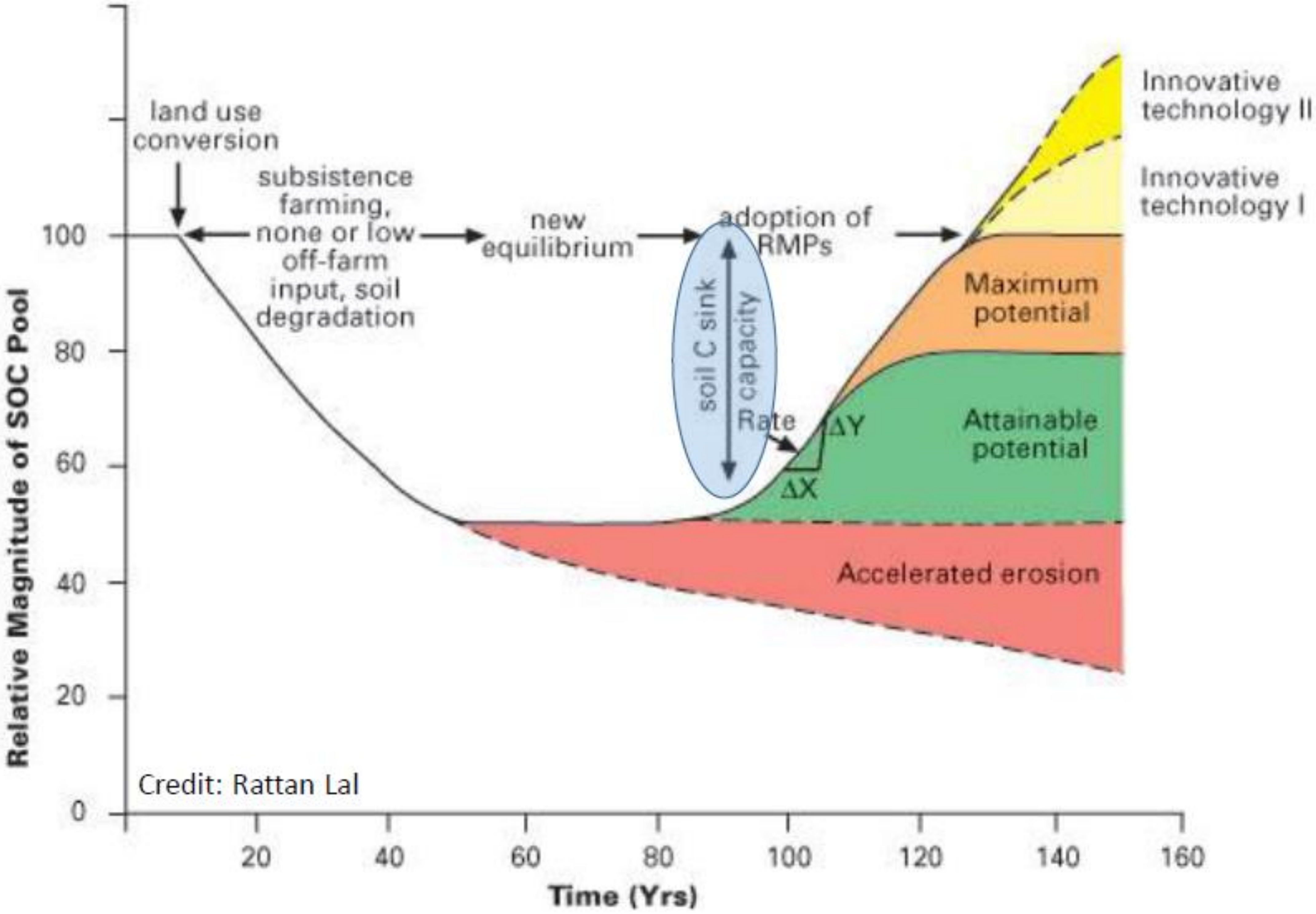


Agriculture and Soil C change potential

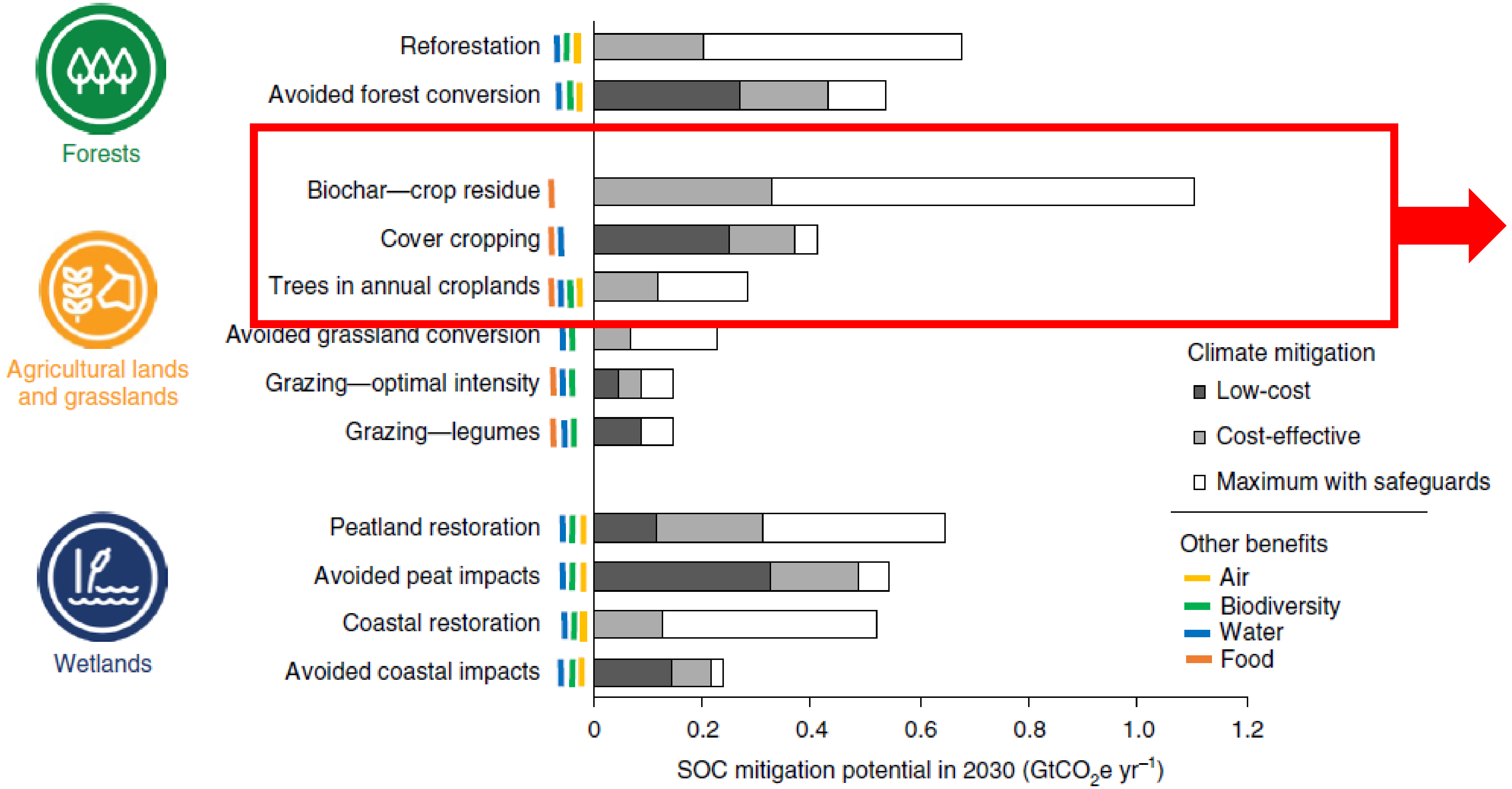
PHOTOSYNTHESYS
CO_2 capture and organication



SOIL FERTILITY
CO_2 sequestration via OM



Additional SOC storage potential for 12 natural pathways to climate mitigation

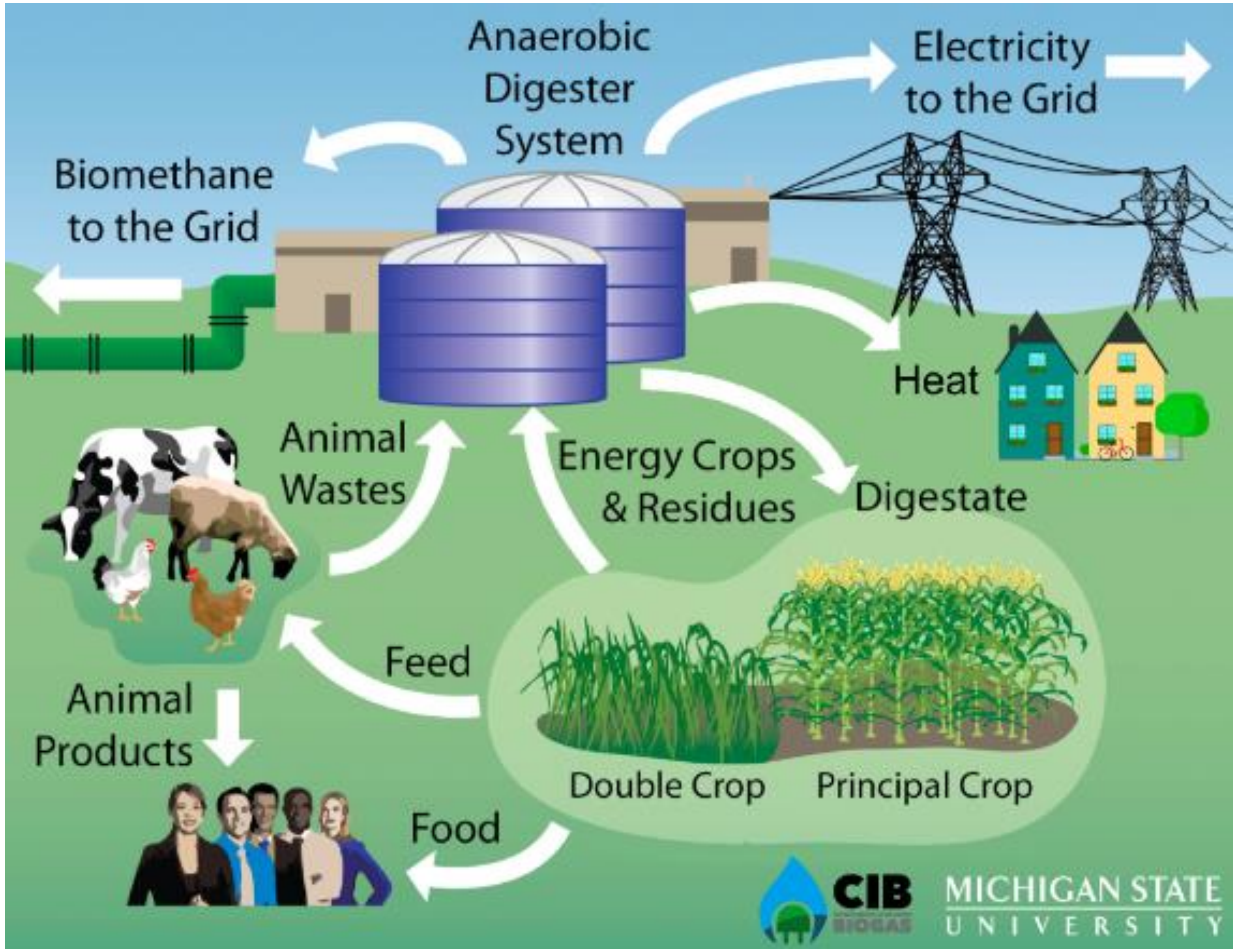


Bossio et al., 2020

R. Lal, 2019

Agroecology and BIOGASDONERIGHT approach

Biogasdoneright, Agroecology and soil OM



Bioenergy/Biogas integrated in farm

Farm development

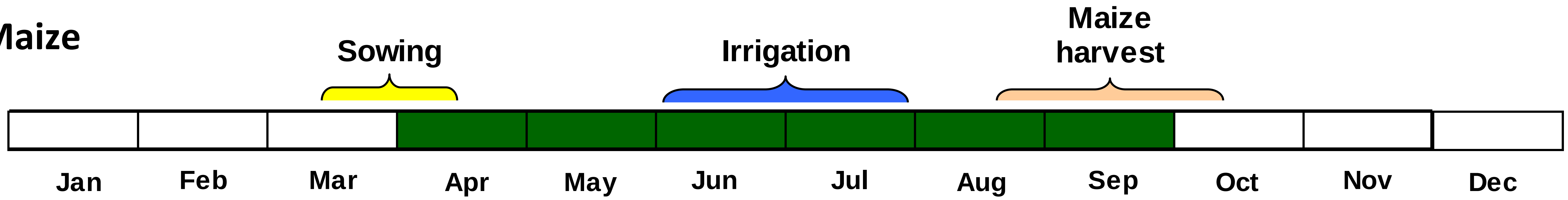
Conventional Agriculture

Farm with livestock, crops production for food and feed

One or two crops per year (tipically maize)

Fertilization with mineral fertilizers and effluents

Crop: Maize



- ✓Covered soil **6 months** per year
- ✓Total biomass produced above soil **23 DM t/ha/year (seed ~13)**
- ✓Irrigation: **necessary**
- ✓Erbicides: **necessary**
- ✓Soil tillage: **hard (plowing)**
- ✓Soil organic matter: **stable or in decrease**

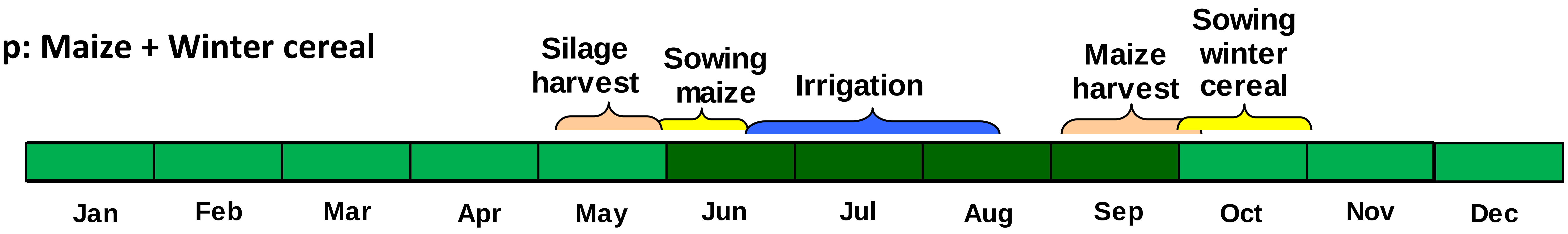
Biogasdoneright Agriculture

Farm with livestock, crops production for food, feed and energy

Minimum tillage/mo till, two crops per year

Fertilization based on DIGESTATE

Crop: Maize + Winter cereal

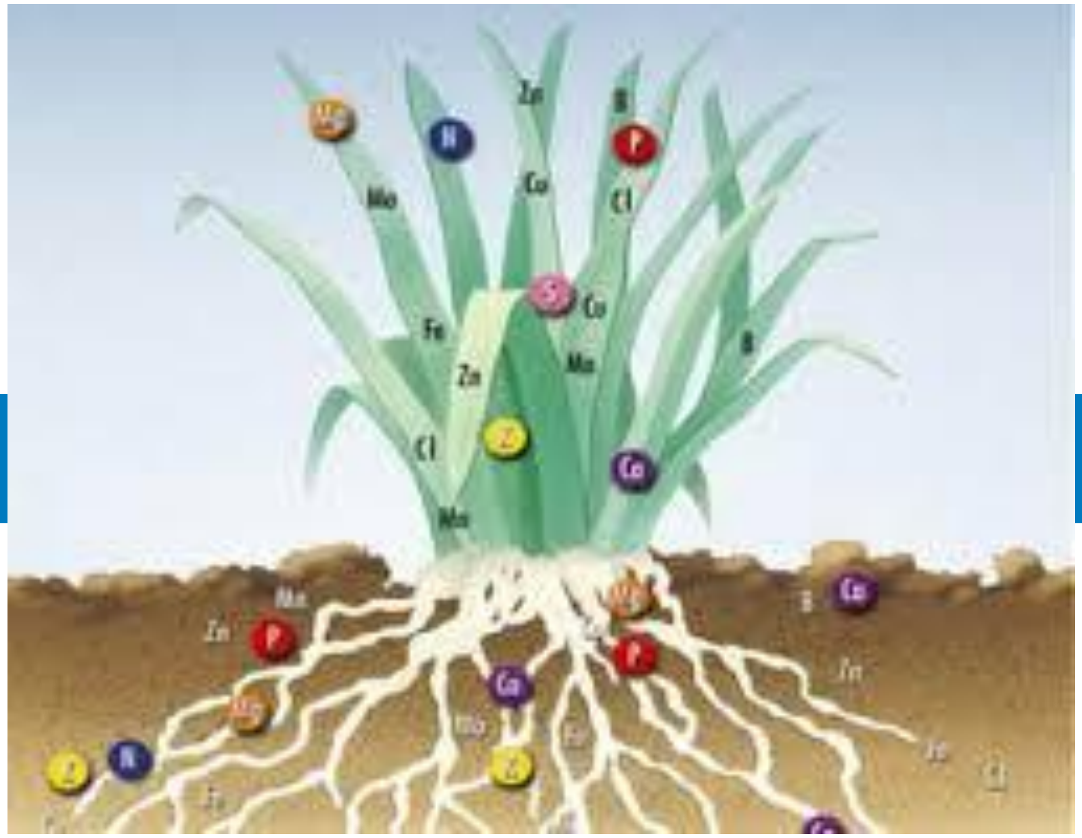


- ✓Covered soil **12 months** per year
- ✓Total biomass produced above soil **30 DM t/ha/year (18 maize + 12 w. cereal)**
- ✓Irrigation: **necessary**
- ✓Erbicides: **reduced (if two crops are harvested possible not needed)**
- ✓Soil tillage: **reduced**
- ✓Soil organic matter: **increase**

CIB
CONSORZIO ITALIANO
BIOGAS

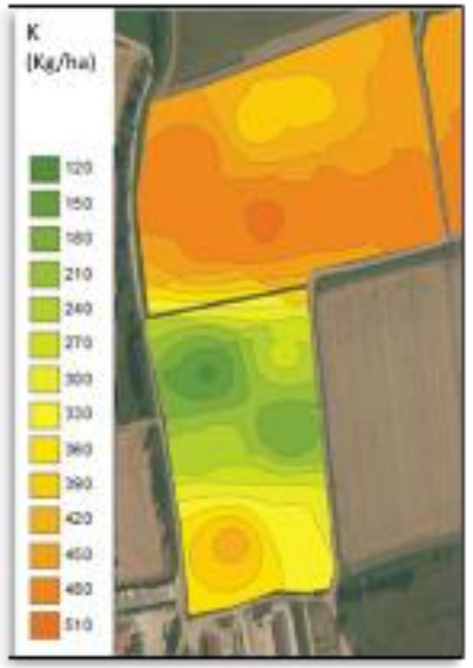
From NPK to C-NPK
with digestate nutrient recycling

NPK



C-NPK

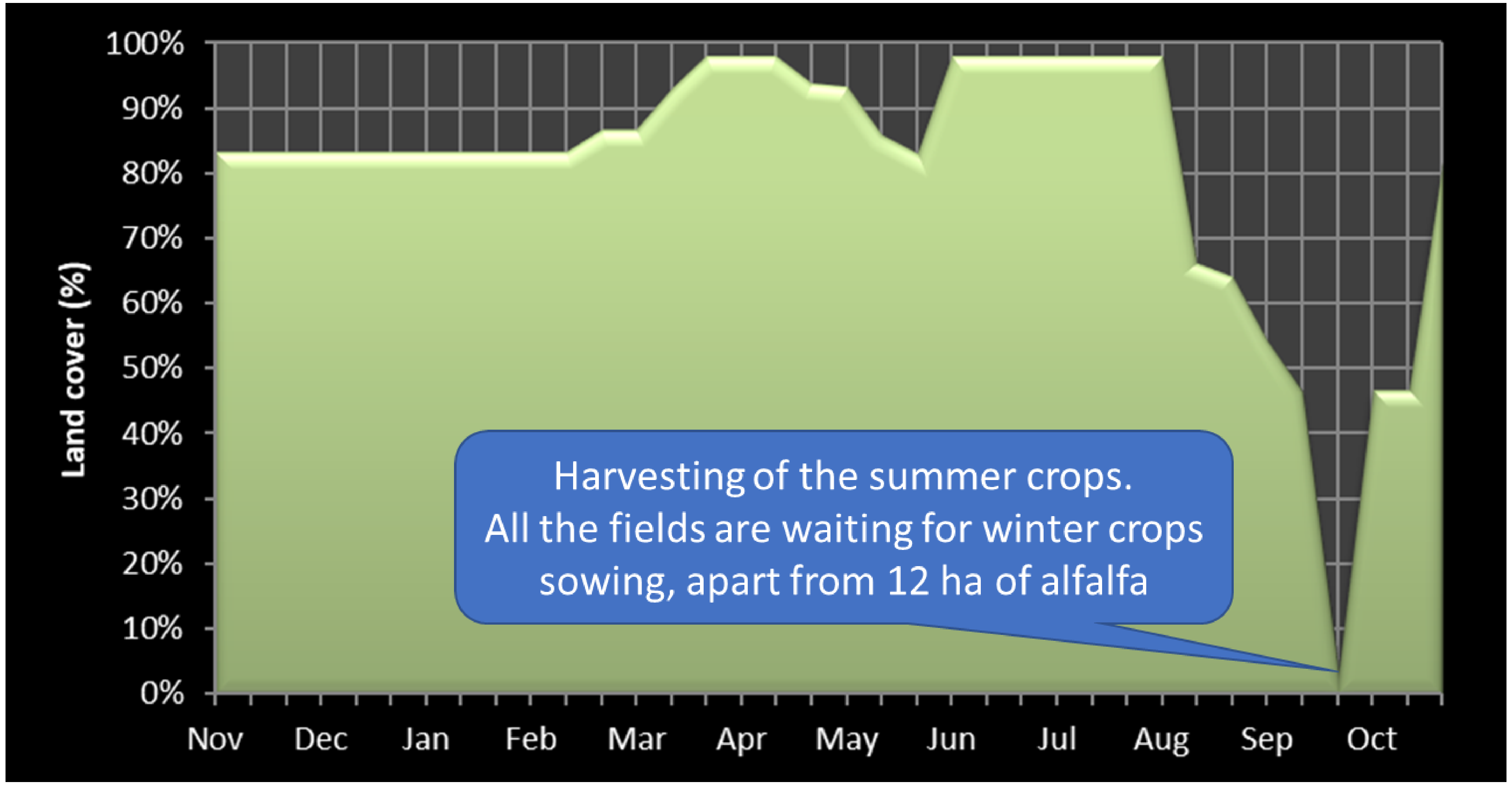
From NPK to C-NPK and sustainable agriculture



From NPK to C-NPK already in practice for sequencial cropping

Biogasdoneright
sequencial cropping and soil covering

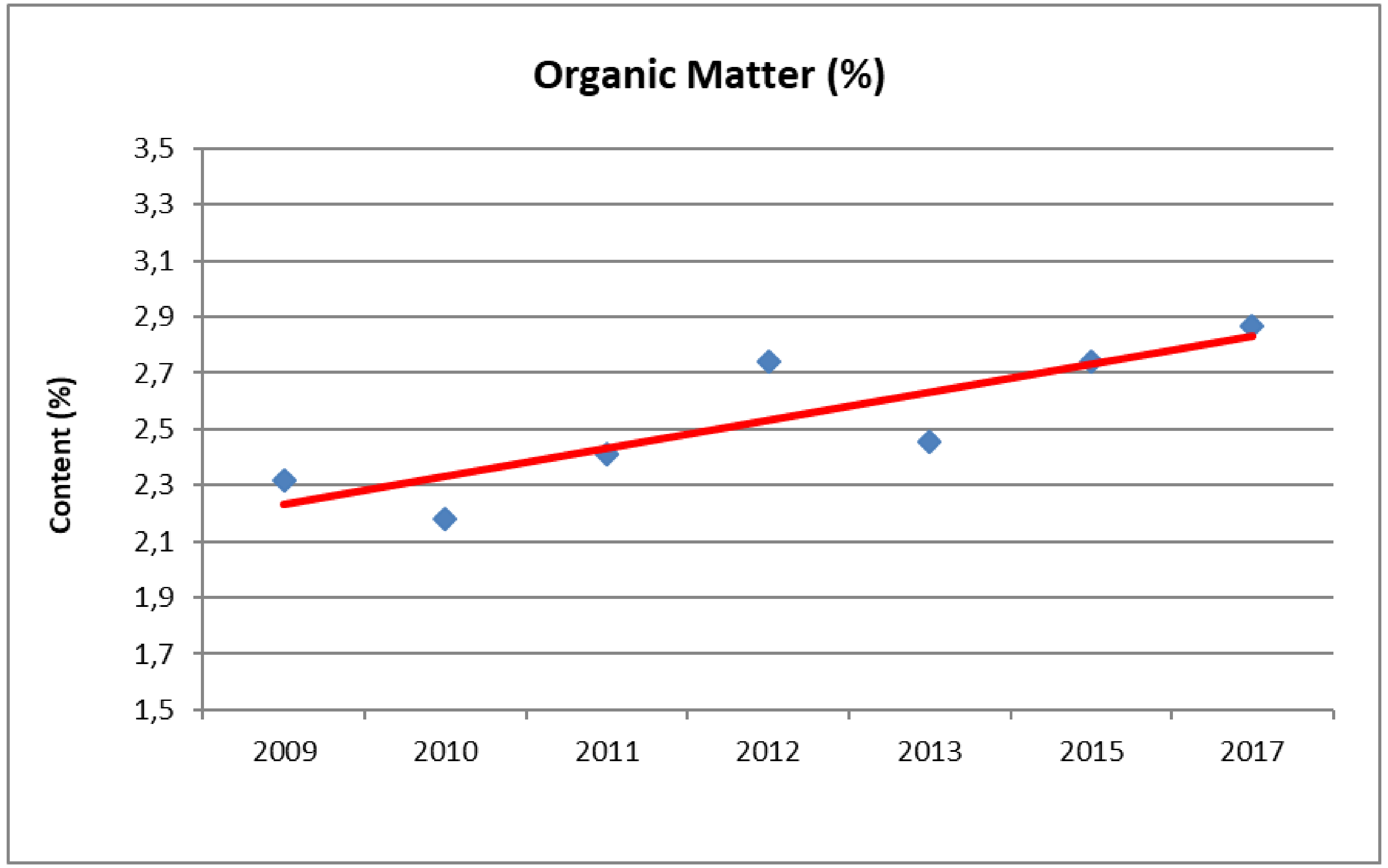
Biogasdoneright sequencial cropping and soil covering



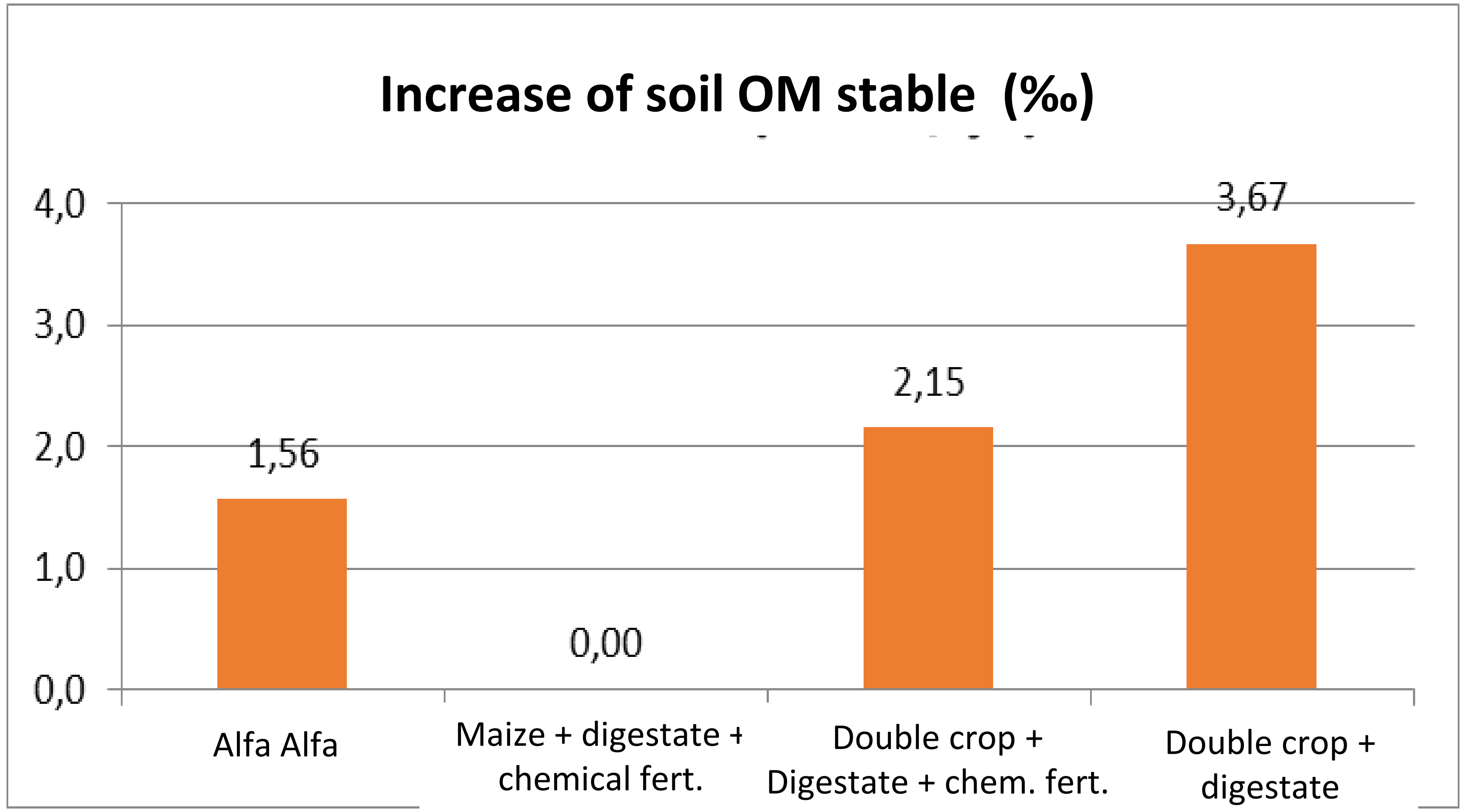
E. Folli elab. Palazzetto Farm for CIB

- Positive on-farm biodiversity impacts after replacing monocropping with sequential cropping combined with nutrient recovery via biogas digestate
- Positive impacts of the sequential cropping in terms of higher photosynthesis rate and soil use efficiency. Palazzetto farm are significantly increasing soil covered for whole year (59%) thanks to the increase of surface involved at sequential cropping.
- Positive impact on weed control efficiency and lower herbicides use.
- Positive effects in crop management and adaptability to market.

Biogasdoneright and OM increase

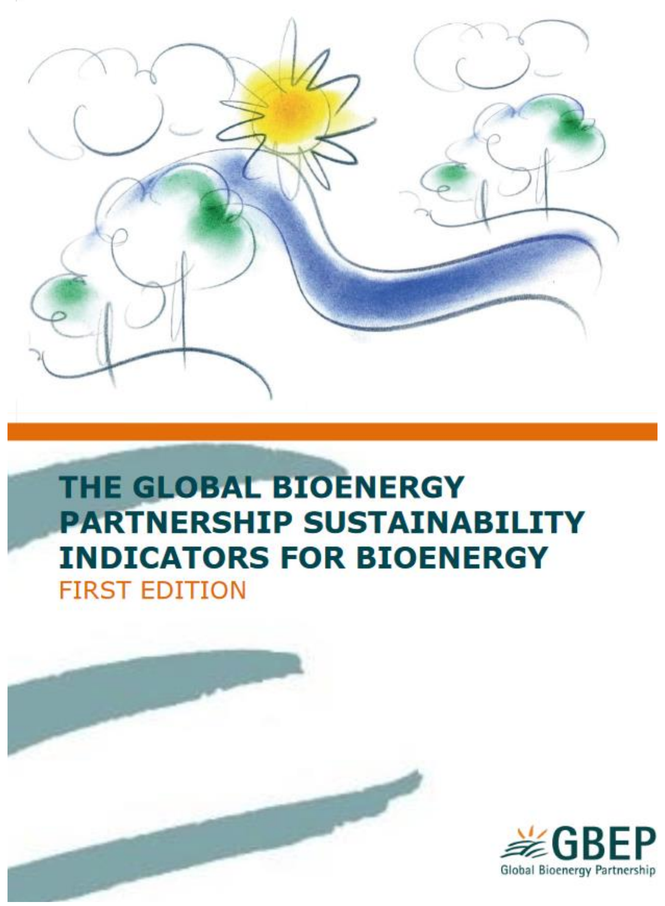


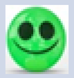
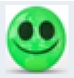
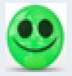
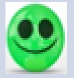
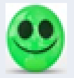
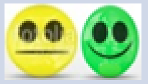
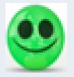
G. Bezzi et al., 2016



Penn State University, preliminar data, 2019

Biogasdoneright and GBEP env. indicators



N.	INDICATOR	DESCRIPTION	RESULT
1	Lifecycle GHG emissions	Lifecycle greenhouse gas emissions from bioenergy production and use, as per the methodology chosen nationally or at community level, and reported using the GBEP Common Methodological Framework for GHG Lifecycle Analysis of Bioenergy 'Version One'.	
2	Soil quality	Percentage of land for which soil quality, in particular in terms of soil organic carbon, is maintained or improved out of total land on which bioenergy feedstock is cultivated or harvested	
3	*Harvest levels of wood resources (NOT APPLICABLE)*	*Annual harvest of wood resources by volume and as a percentage of net growth or sustained yield, and the percentage of the annual harvest used for bioenergy*	N.A.
4	Emissions of non-GHG air pollutants, including air toxics	Emissions of non-GHG air pollutants, including air toxics, from bioenergy feedstock production, processing, transport of feedstocks, intermediate products and end products, and use; and in comparison with other energy sources	
5	Water use and efficiency	- Water withdrawn from nationally determined watershed(s) for the production and processing of bioenergy feedstocks, expressed as the percentage of total actual renewable water resources (TARWR) and as the percentage of total annual water withdrawals (TAWW), disaggregated into renewable and non-renewable water sources; - Volume of water withdrawn from nationally determined watershed(s) used for the production and processing of bioenergy feedstocks per unit of bioenergy output, disaggregated into renewable and non-renewable water sources.	
6	Water quality	- Pollutant loadings to waterways and bodies of water attributable to fertilizer and pesticide application for bioenergy feedstock cultivation, and expressed as a percentage of pollutant loadings from total agricultural production in the watershed; - Pollutant loadings to waterways and bodies of water attributable to bioenergy processing effluents, and expressed as a percentage of pollutant loadings from total agricultural processing effluents in the watershed.	
7	Biological diversity in the landscape	- Area and percentage of nationally recognized areas of high biodiversity value or critical ecosystems converted to bioenergy production; - Area and percentage of the land used for bioenergy production where nationally recognized invasive species, by risk category, are cultivated; - Area and percentage of the land used for bioenergy production where nationally recognized conservation methods are used.	
8	Land use and land-use change related to bioenergy feedstock production	- Total area of land for bioenergy feedstock production, and as compared to total national surface and agricultural and managed forest land area - Percentages of bioenergy from yield increases, residues, wastes and degraded or contaminated land - Net annual rates of conversion between land-use types caused directly by bioenergy feedstock production, including the following (amongst others): o arable land and permanent crops, permanent meadows and pastures, and managed forests; o natural forests and grasslands (including savannah, excluding natural permanent meadows and pastures), peatlands, and wetlands	

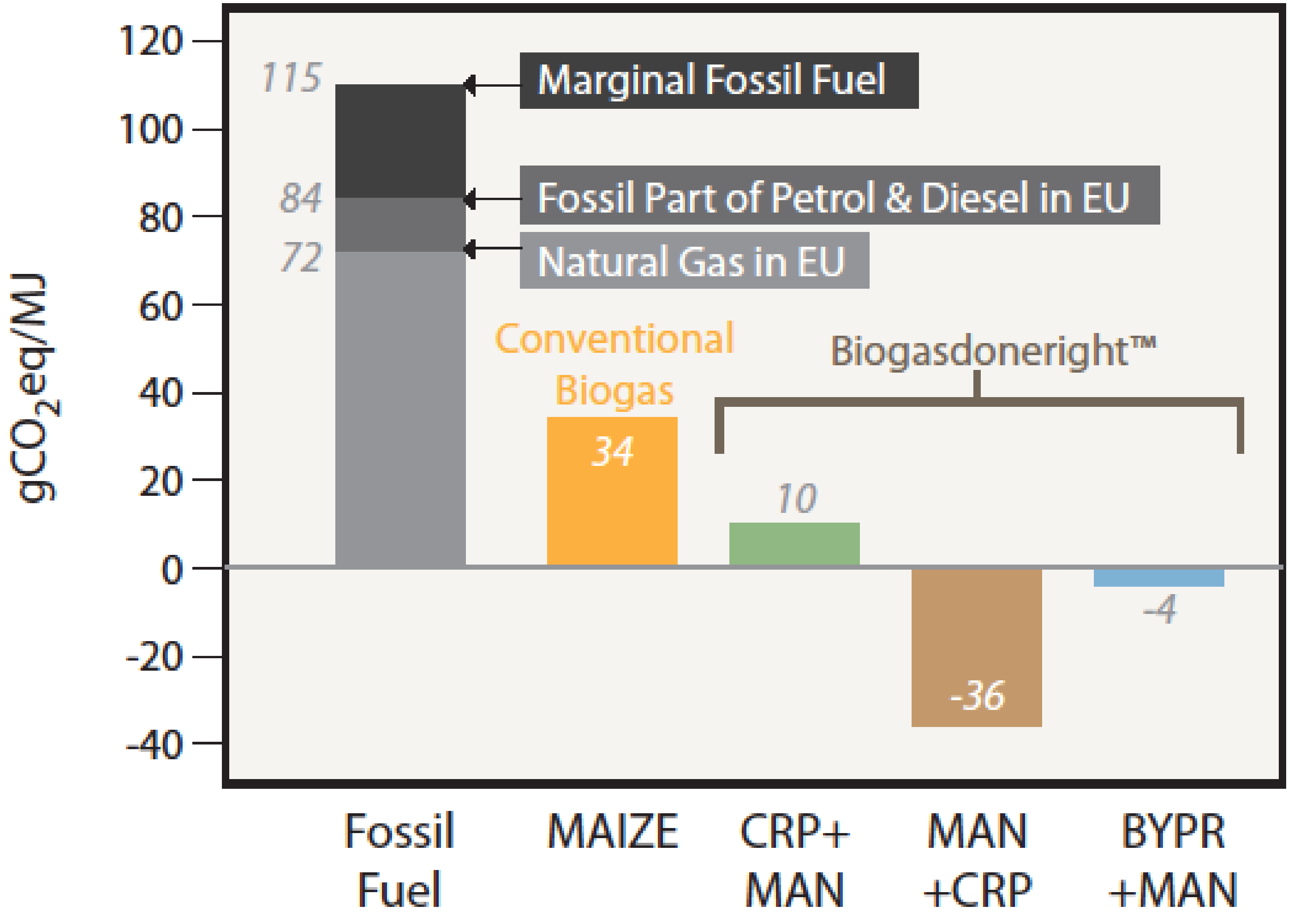
Biogasdoneright and environmental effects

Positive Effects of AD in Agriculture

- Animal manure and other by-products valorisation
- Less chemical fertilizers use and nutrient recycling
- Adoption of conservative techniques and precision farming

CO_2	Liming	12
	Chemical Fertilizers	**527**
CH_4	Enteric Fermentation	14.039
	Animal manure manag.	**3.106**
	Rice cultivation	1.710
	Residues combustion	17
N_2O	**Animal manure manag.**	**2.122**
	Soils	**8.857**
	Residues combustion	4

Italian Emissions in Agriculture Mt CO_2eq ISPRA, 2018

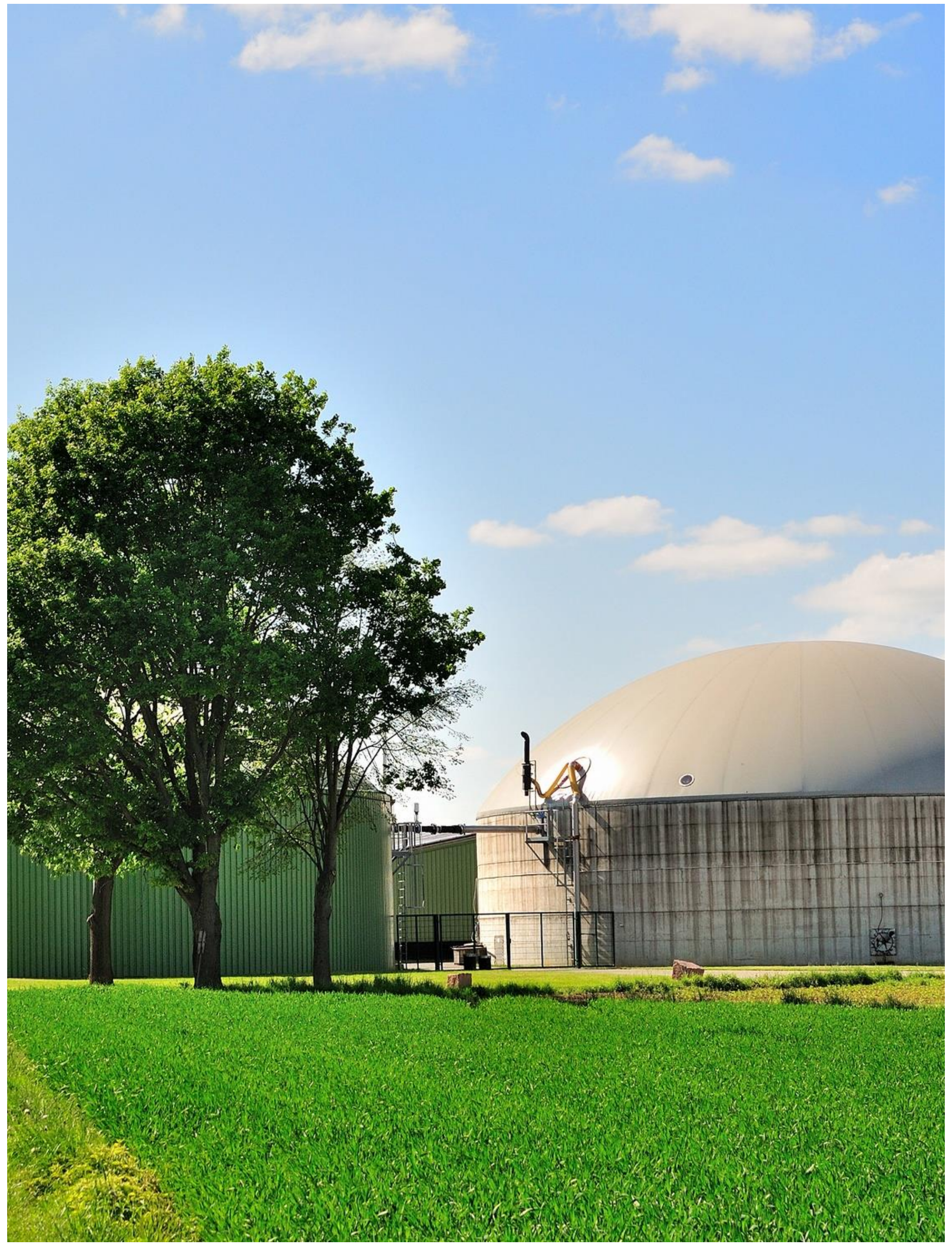


L. Valli et al., 2017

Biogasdoneright:
something more than a bioenergy

The Anaerobic Digestor infrastructure is able to revolutionize the farming practice:

- It allows the soil to be covered the whole year
- It increases the rotations
- It turns agricultural by-products into a precious resource
- It improves the WUE and NUE at the farm
- **It turns the farms from carbon emitter to a carbon sink**



Biogasdoneright potential and scalability

- **BDR is adaptable and can be applied both in small scale for development regions and medium/large scale in developed countries.**

- **ITALIAN** BIOMETHANE ROADMAP WITH BDR

2015 – **2,4 billion m^3/y** – 288.000ha (4,8% of Arable Land)

2030 – **8 billion m^3/y** – 400.000ha (6,7% of Arable Land)

- ESTIMATED POTENTIAL OF **ARGENTINA** WITH BDR

(J. Hilbert, INRA – Data in press)

Argentina could replace all of its natural gas imports with biogas produced using BDR.

Today gas is 54% of the total energy consumed in Argentina

- ESTIMATED POTENTIAL OF **USA** WITH BDR

(T. Richard, Penn State University – Data in press)

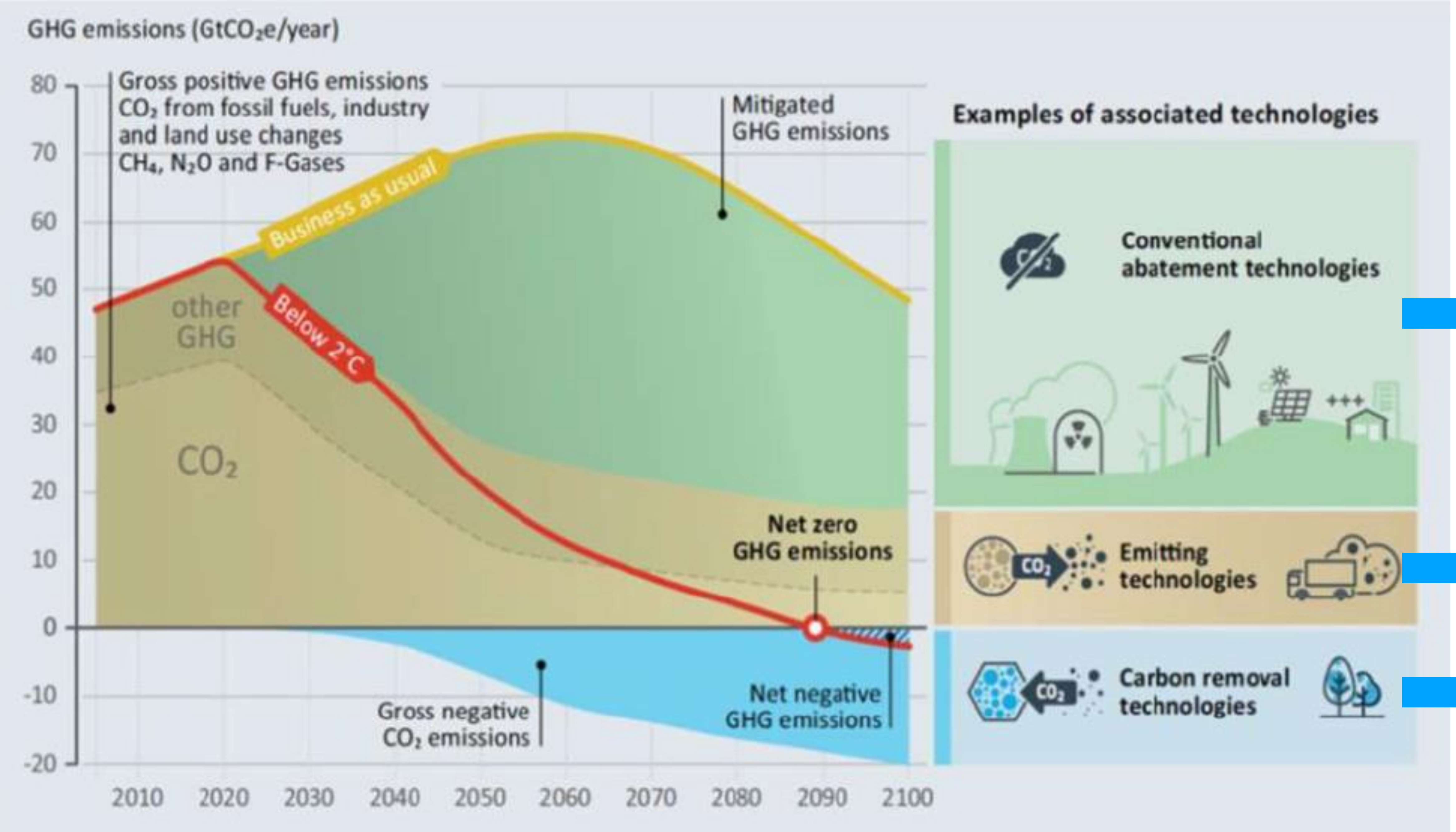
Biogas potential in the US exceeds 20% of fossil natural gas.

Double cropping can also provide water quality benefits

- ESTIMATED POTENTIAL OF **UK** and **FRANCE** WITH BDR

Data in press....

Biogasdoneright and agriculture: possible solution



National Academies Report A Research Agenda for Carbon Dioxide Removal and Reliable Sequestration (2019)

Biogas and Biomethane from agriculture can be a win win solution for food-feed and renewable energy production without ILUC risks with sequencial cropping

Biogasdoneright: lower emissions from agriculture and biocarburants

Biogasdoneright: C-seq in soil via OM and improving of soil fertility. Natural CCS way improved and optimized

Many thanks!

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