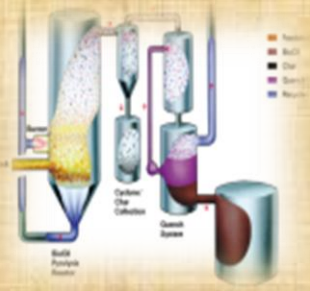
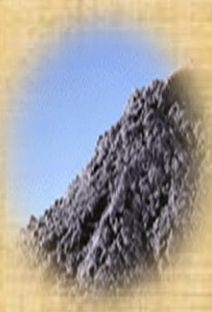
Bioraffinerien in Argentinien – Status quo und Zukunftsperspektiven

Biorefineries in Argentina – status quo and future perspectives











Jorge Antonio Hilbert

ARGENTINA: FACTS AND FIGURES

Official name: Argentine Republic

Chief of state: MAURICIO MACRI

Capital: Buenos Aires

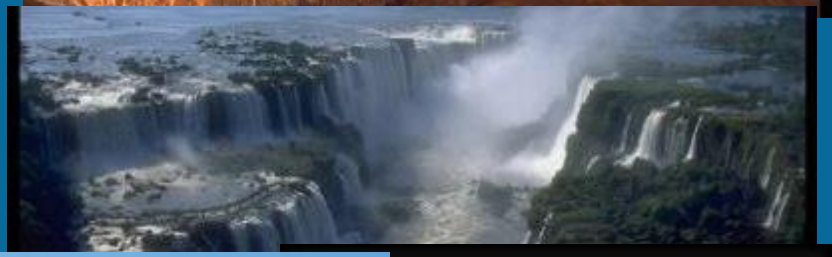
Area: 2.8 million sq km

Population: 40 million inhabitants

GDP (purchasing power parity): US$ 550 billion

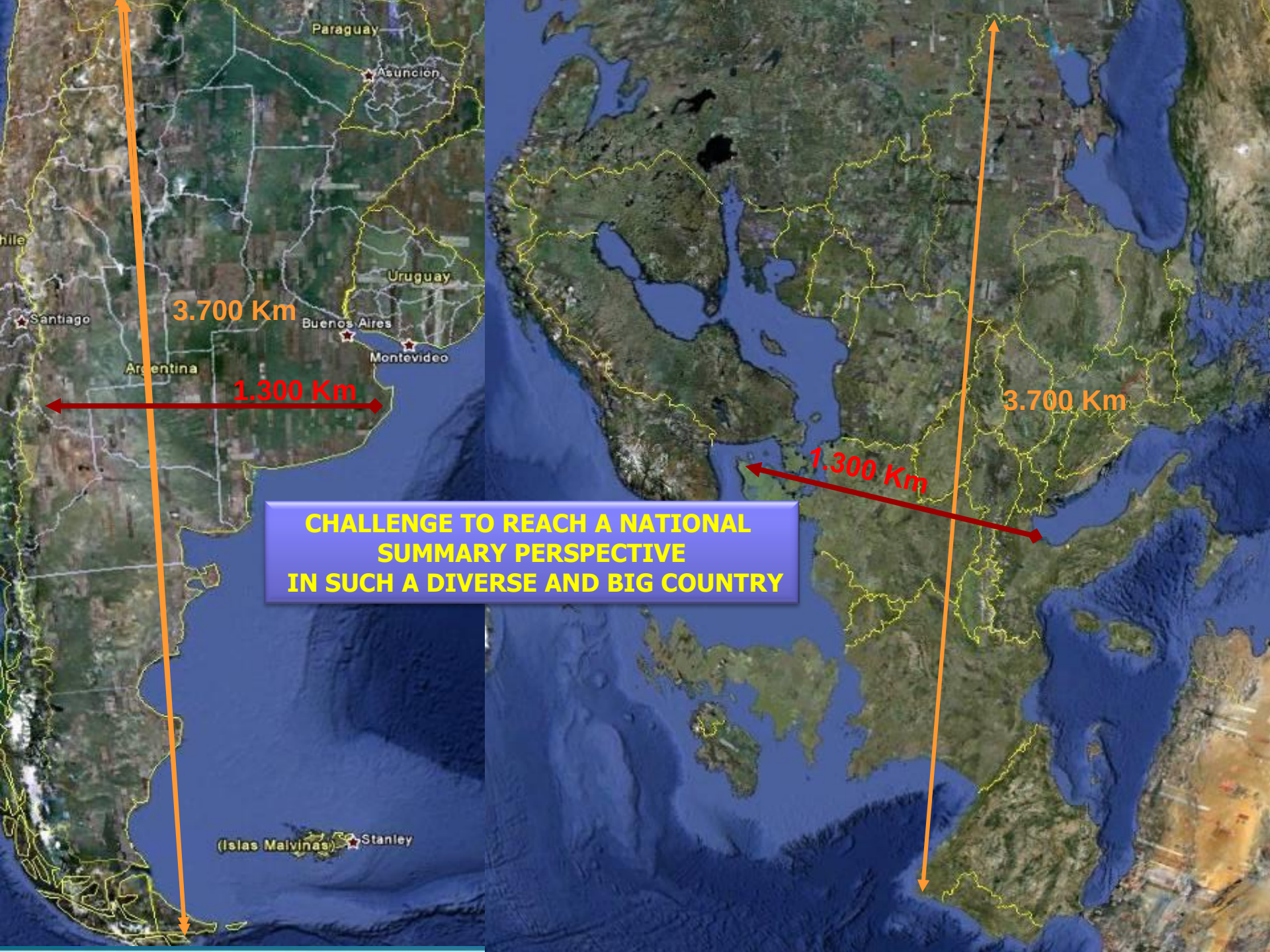
GDP - per capita (PPP): US$ 12,500

Great dependency on Ag products



Instituto Nacional de
Tecnología Agropecuaria

Source: CIA-The World Factbook and INDEC


Paraguay
Asuncion
Uruguay
Santiago
Buenos Aires
Montevideo
Argentina
3.700 Km
1.300 Km
(Islas Malvinas)
Stanley
3.700 Km
1.300 Km
CHALLENGE TO REACH A NATIONAL
SUMMARY PERSPECTIVE
IN SUCH A DIVERSE AND BIG COUNTRY

Ministerio de Agroindustria
Presidencia de la Nación

is a public decentralized body subordinated to the Ministry of Agroindustry with operative and financial autarchy.

MISSION

"To carry out and foster actions addressing the innovation of agricultural and livestock, agro-food and agro-industrial sectors to contribute to the competitiveness of agro-industrial chains, environmental health and sustainability of productive systems, social equity and territorial development, through research, technological development and extension".
(2005-2015 Institutional Strategic Plan)

NATIONAL STRUCTURE

- Central office B.A.
- 15 Regionales centers
- 53 Experimental stations
- 6 Research centers
- 13 Research institutes
- 300 Extension units
- 9 Innovation parks
- INTA group members:
- Foundation ArgenINTA

  Private company INTEA S.A

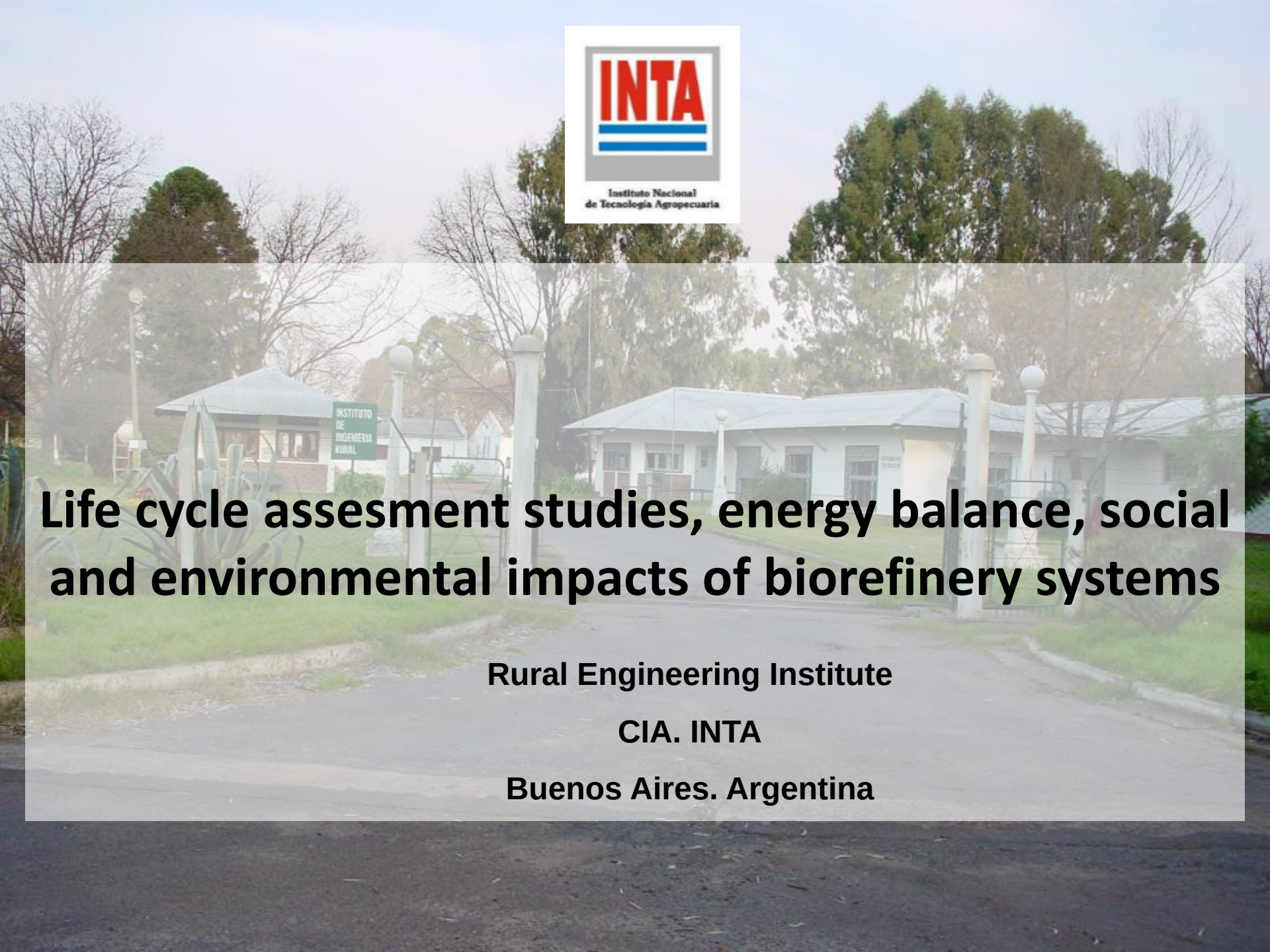
7300 EMPLOYEES

Year budget 270 M dollars

http://www.inta.gov.ar

http://inta.gob.ar/videos/institutional-video-in-english/view


Castelar National Research Centre
BIOENERGY
Office & research groups
Agroindustry research center
Rural engineering research institute
Biotechnology research institute
Microbiology research institute
Soils research institute
Water and climate research institute
Image © 2008 DigitalGlobe
Google
34°36'13.05" S 58°39'52.37" O
elev. 15 m
Alt. ojo 3.60 km



Life cycle assesment studies, energy balance, social and environmental impacts of biorefinery systems

Rural Engineering Institute

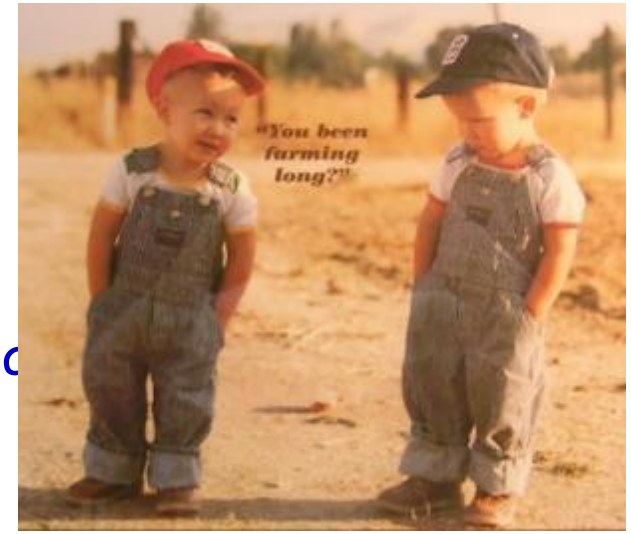
CIA. INTA

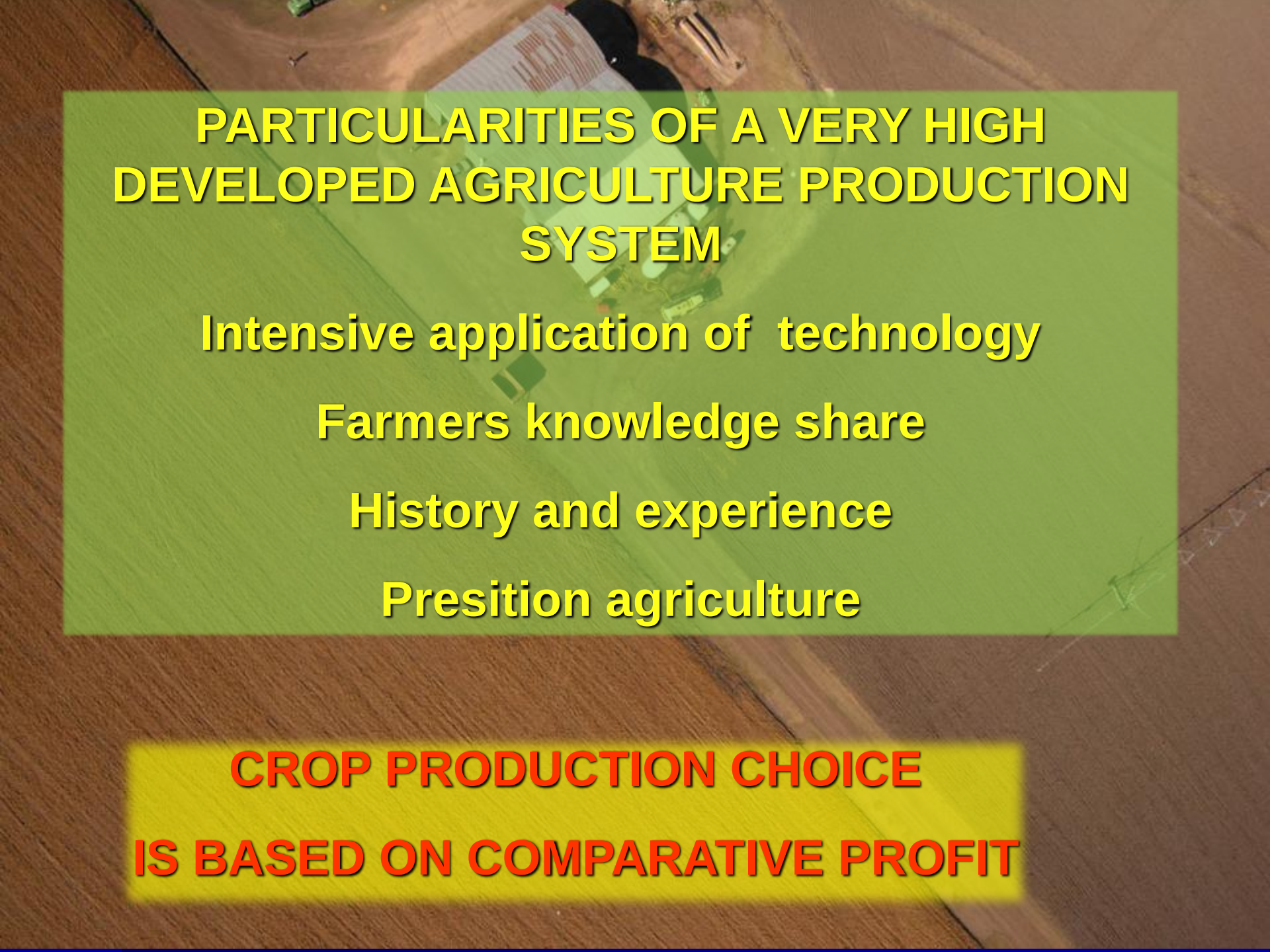
Buenos Aires. Argentina


What type of agriculture producing biomass for biorefineries we umagine

Agriculture milestones

- Traditional farming – **Ag 1.0**
  - Self-sufficiency, and natural methods of fertilizing, weed and pest control
- Mechanized farming – **Ag 2.0**
  - Mechanization and chemical fertilizing and weed/pest control
- Precision farming – **Ag 3.0**
  - Resource management responding to inter- a intra-field variabilities in crops
- Smart farming – **Ag 4.0**
  - Various definitions, focusing on human well being, economic, and ecological sustainability





PARTICULARITIES OF A VERY HIGH DEVELOPED AGRICULTURE PRODUCTION SYSTEM

Intensive application of technology

Farmers knowledge share

History and experience

Presition agriculture

CROP PRODUCTION CHOICE

IS BASED ON COMPARATIVE PROFIT

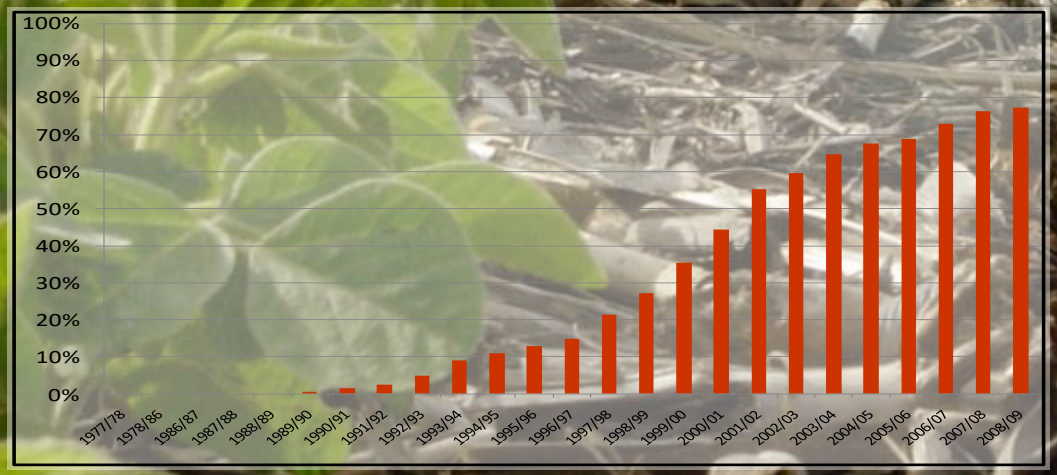
High tec mature farm machinery technology Development of high level employment in rural towns

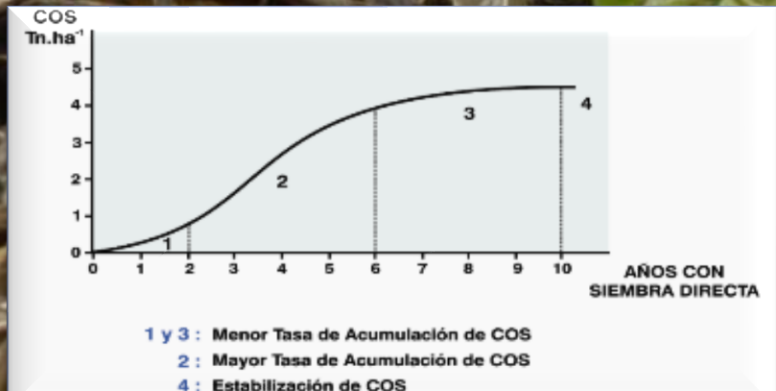
Water Footprint

INTA

No till technolgy conserves energy water resources and carbon in the soils

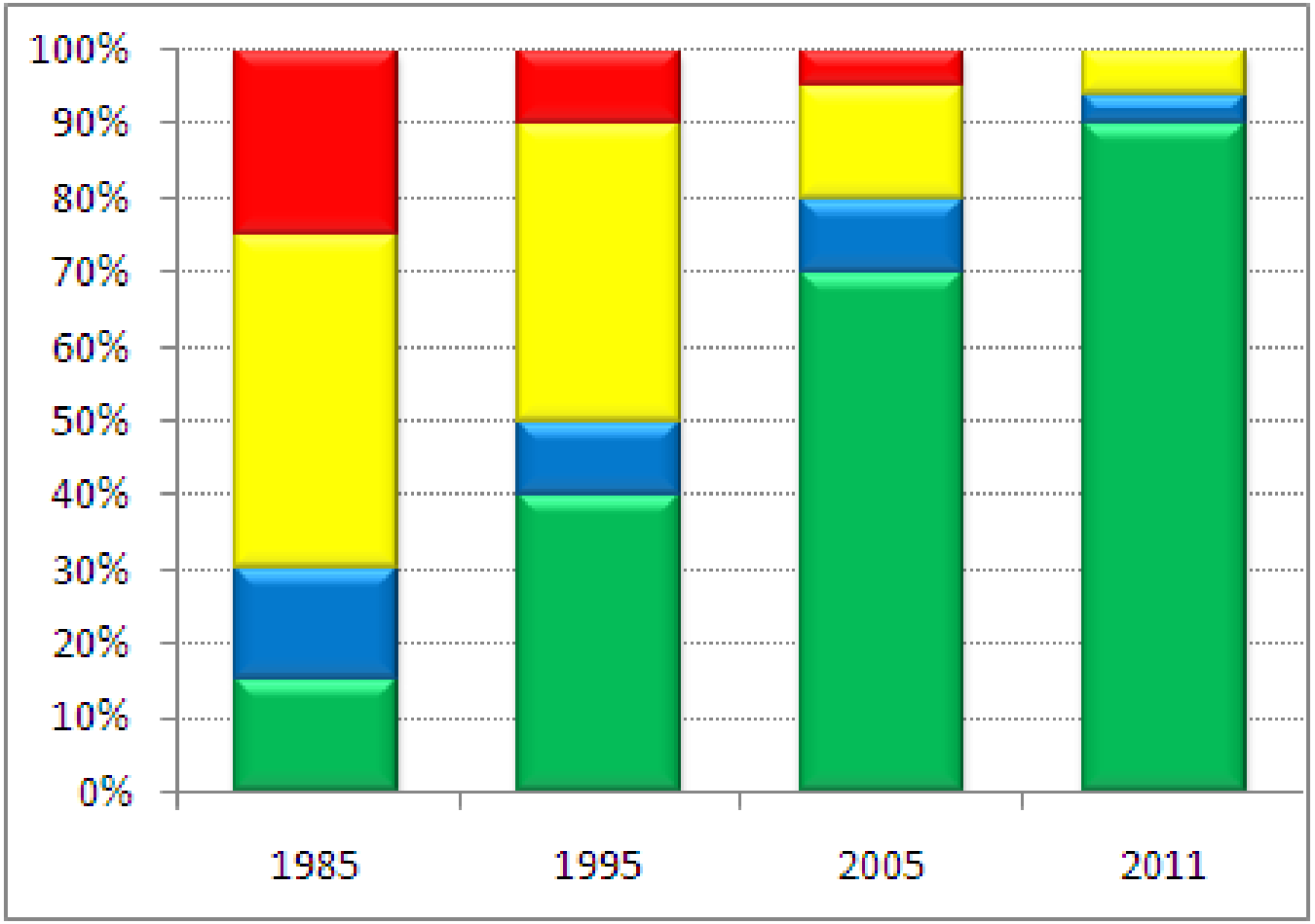
MORE THAN 80 % OF THE SURFACE





Technology improvement impact

Promedio ponderado de la utilización de productos fitosanitarios en una rotación según los marbetes.



RED: Class I

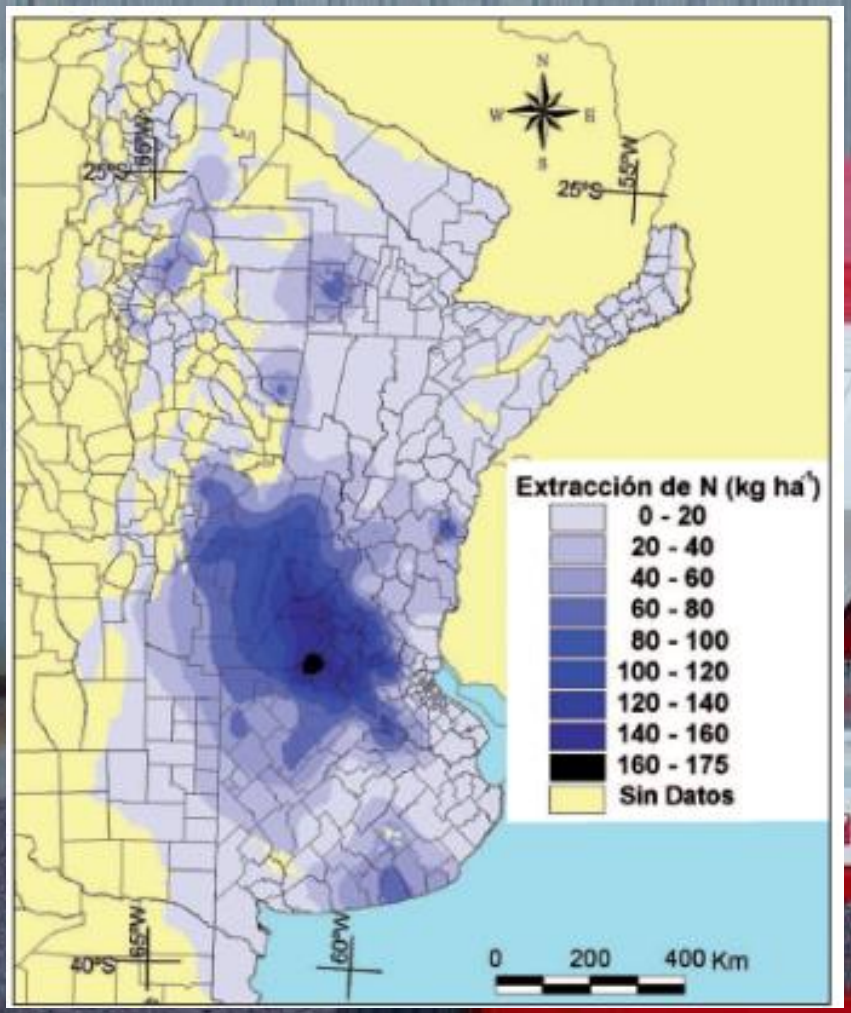
YELLOW: Class II

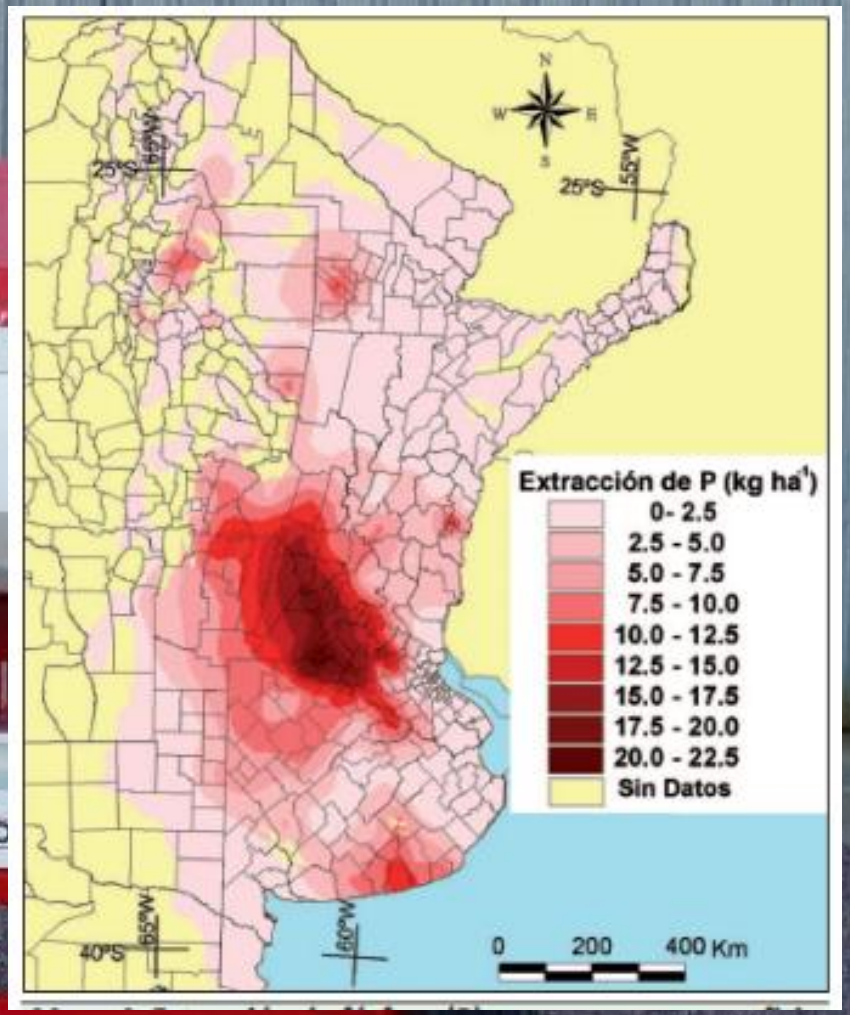
BLUE: Class III

GREEN: Class IV

Fuente: I+D, Movimiento CREA

* La presente clasificación toxicológica se realizó según los rangos de la OMS de agosto de 2012 (no se consideró aún la Res. de SENASA 302/12 en la que se reclasifican las categorías de los marbetes).





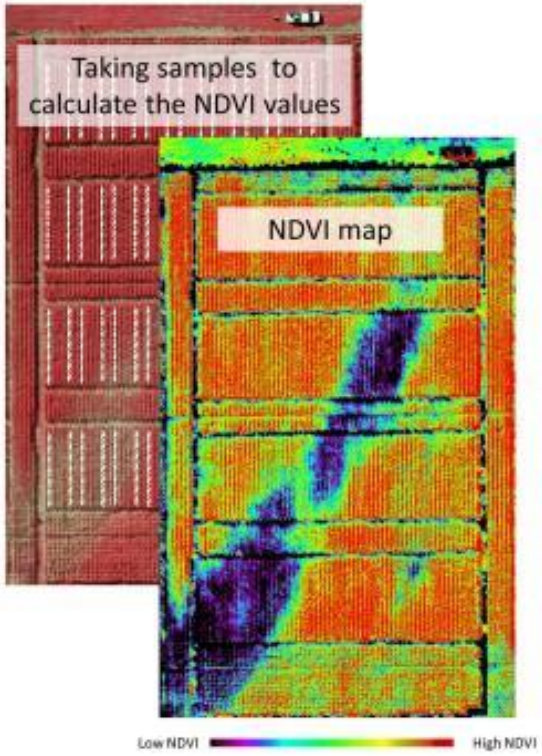
Nutrient balance concerns on the main grain production area

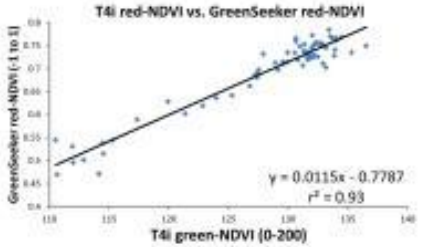
Fuente Extracción y balance de nutrientes en los suelos agrícolas de la Argentina Cruzate Casas 2012

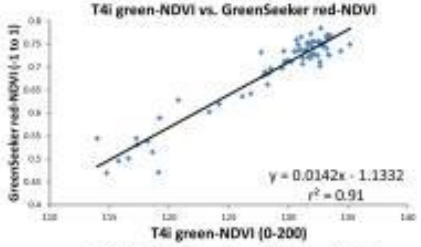
Inteligent agriculture 4.0

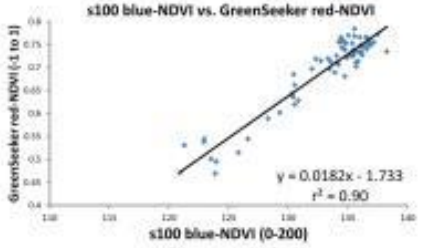
We multiply each day our capacity of measure, save and analyze to make desitions in real time

Comparing sUAS with Modified NDVI cameras Values to GreenSeeker NDVI Values

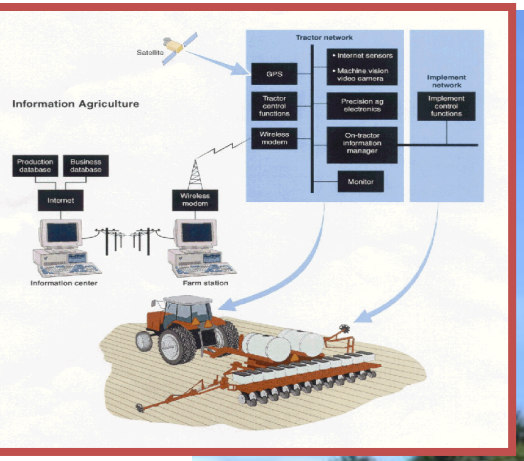


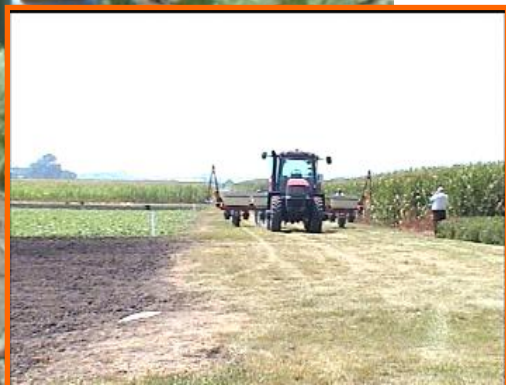




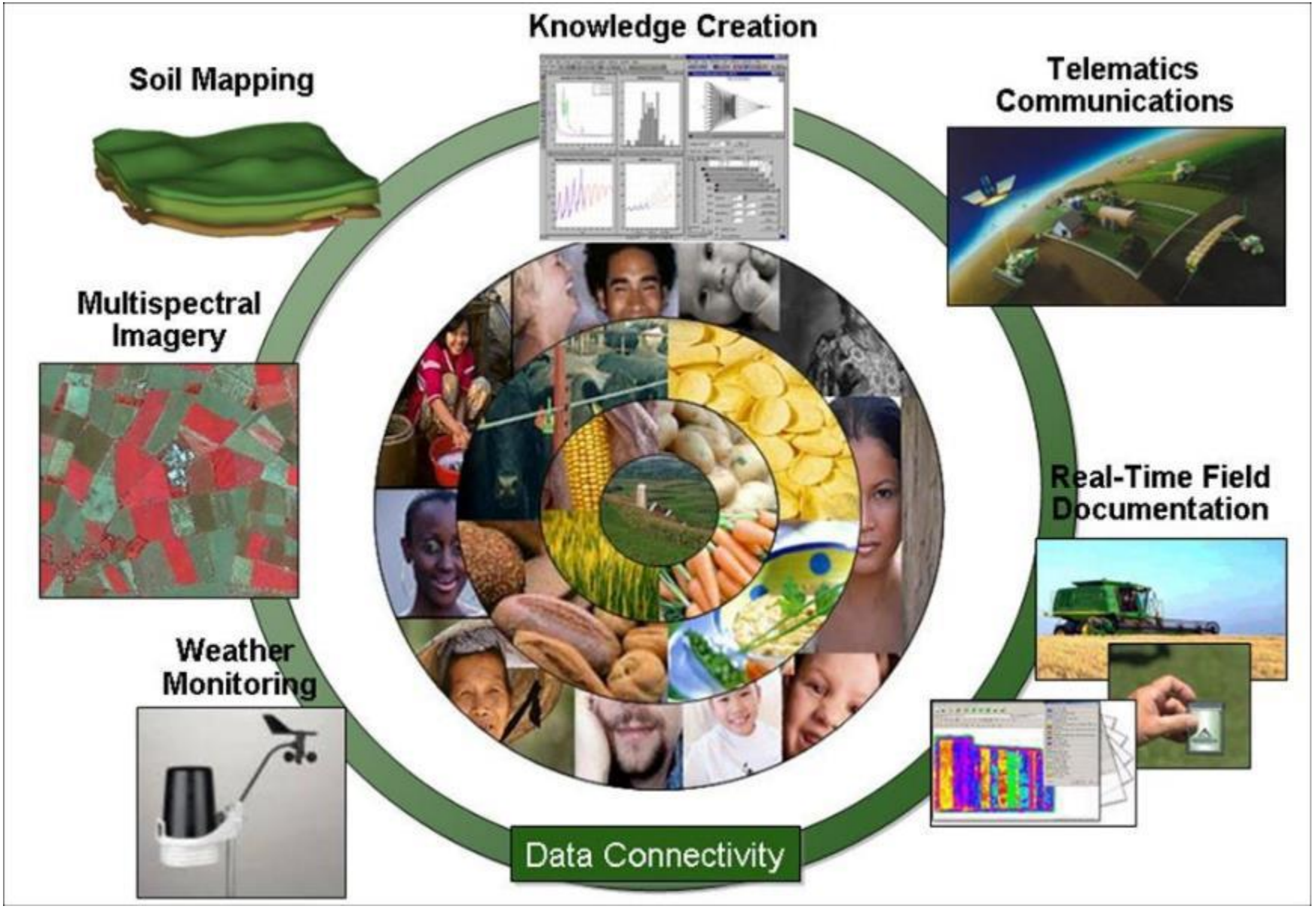


Robots will have a major impact





Intelligent information management



Oportunidades para biorefinerías sustentables

- Agricultura
  - Residues use and tranformation
  - Yield increase and pesticedes decrease
  - Artificial meat
  - Food losses reduction
  - Algae
  - New biofactories

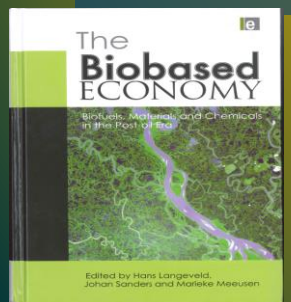
Disruptive innovations

Why small scale is possible using biomass products

- Significative energy consumption reduction by product unit.
- Lower residue volumen & treatment cost
- Lower values of raw materials
- Lower investment per unit of product generated
- Diversified markets and products
- Lower GHG emitions
- Lower logistics and transport requirements

Johan Sanders 2016

https://www.youtube.com/watch?v=rt7HfV0AKhw



Variables to consider in biomass use in a biorefinary

- Relative low price of final product
- Working force and technology availability
- Foreign currency balance of the country
- Profit of the combination of products
- Added employment and value at local level
- Risk of local and foreign policy changes
- Changes in final product public perception
- Competitive use of feedstoks in present and future markets
- Transport & logistics

SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD >160 indicators

http://sd.iisd.org/news/iaeg-sdgs-sets-workplan-for-finalizing-indicators/

Sustainable bioeconomy contributes to SDGs addressing #1 poverty, #2 food security and nutrition, #3 health, #5 gender, #6 water and sanitation, #7 **affordable and clean energy**, #8 **jobs**, #12 sustainable consumption/production, #13 **climate change**, #14 oceans, seas and marine resources, #15 terrestrial eco-systems, forests, land degradation and biodiversity, and #16 strengthened institutions.

Souza et al. 2015

Biorefinery studies must consider all the components of biomass conversion chain

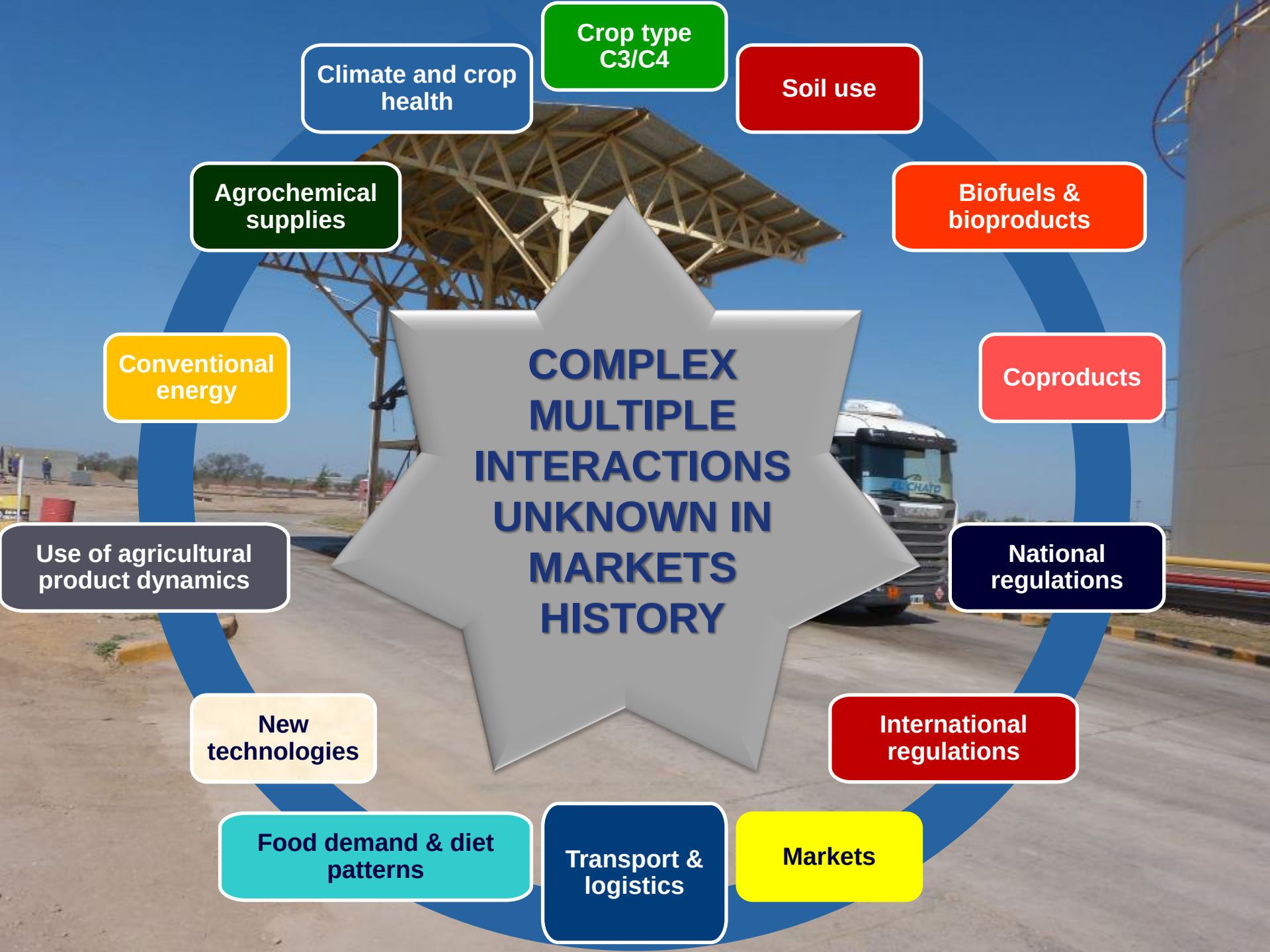
Feedstock's

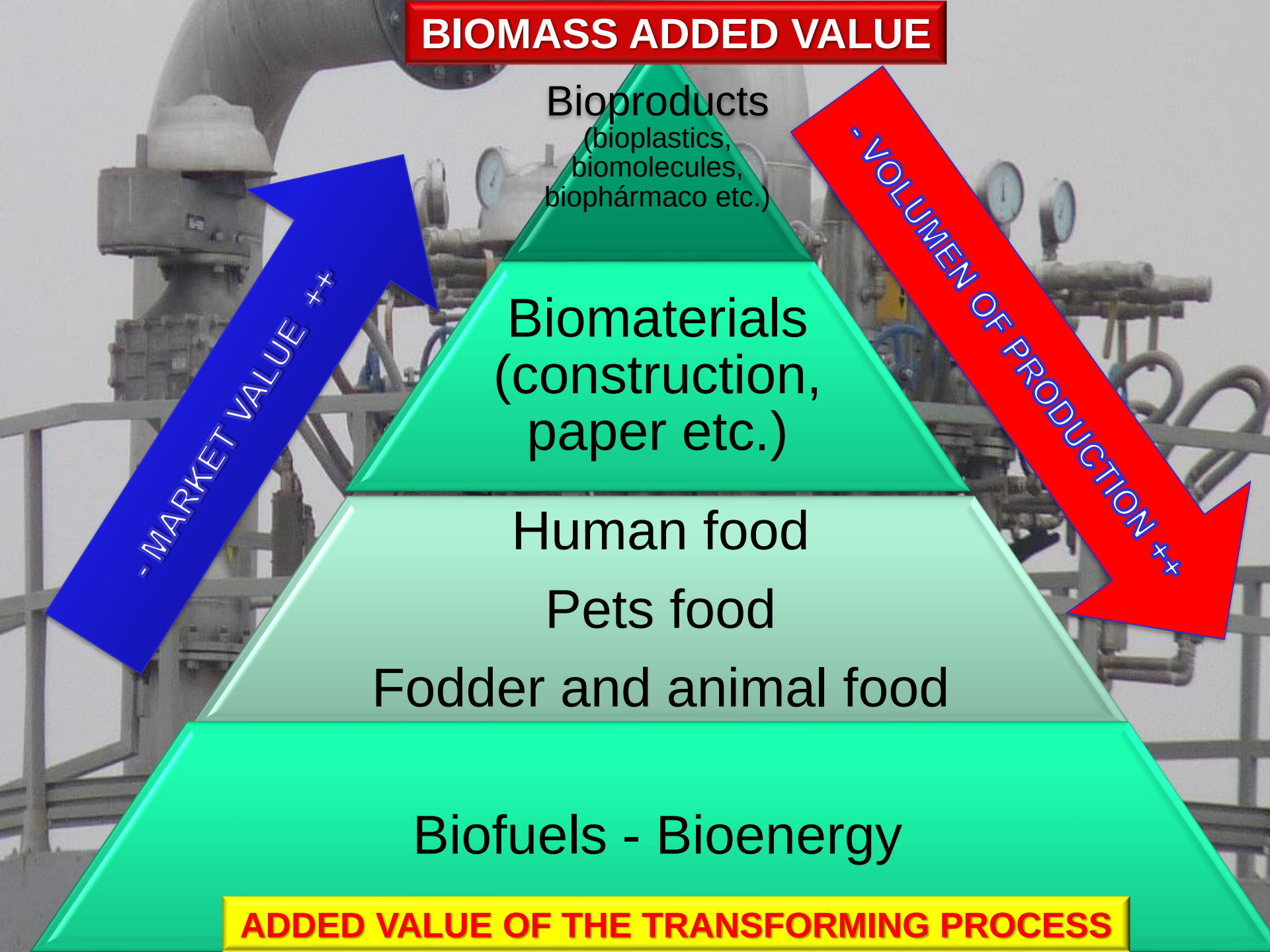
Conversión process

Type of products and makets

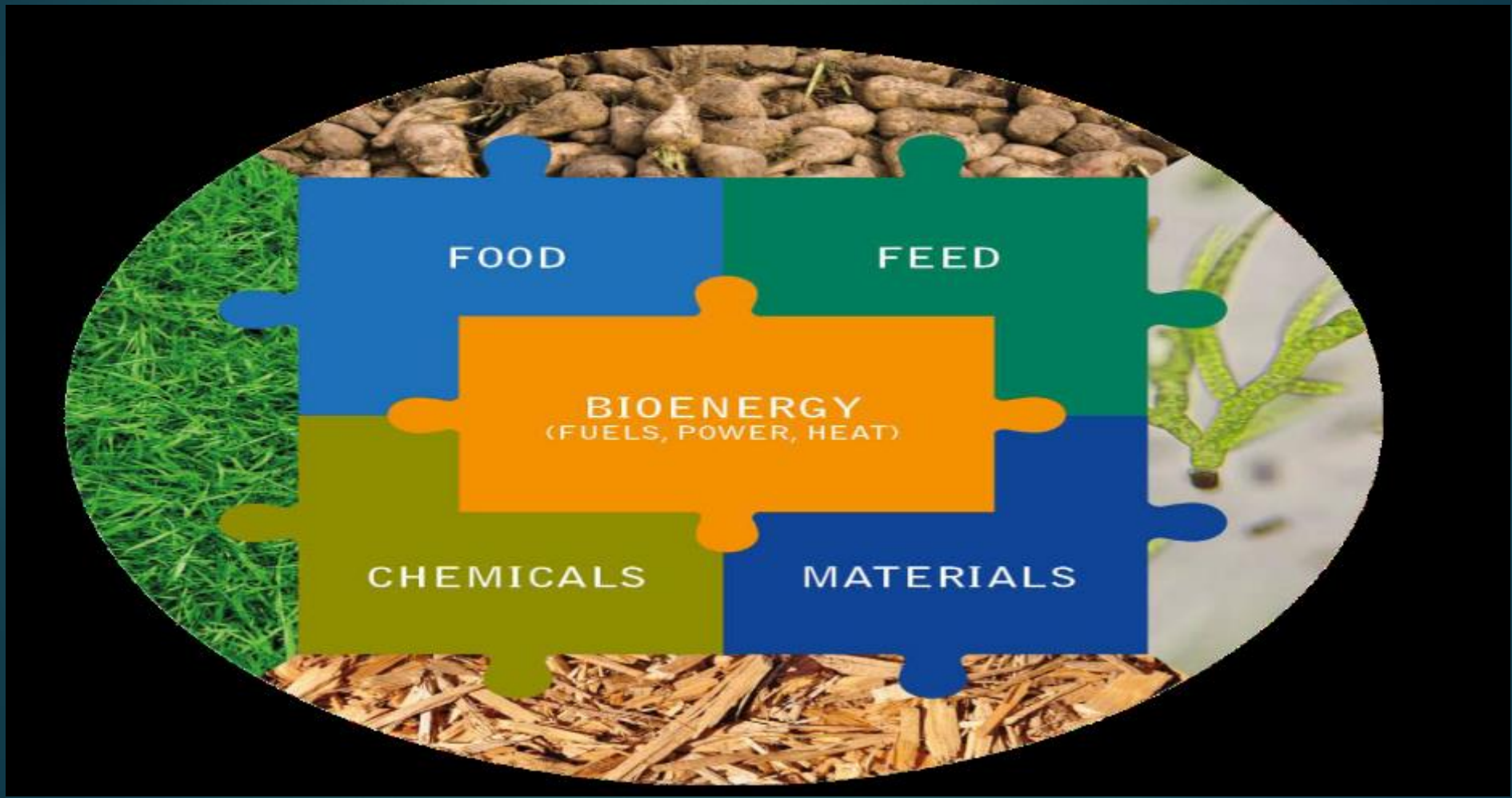
Industry and equipments adaptation to new bioproducts use

Final products values and competitiveness


Crop type C3/C4
Soil use
Biofuels & bioproducts
Coproducts
National regulations
International regulations
Markets
Transport & logistics
Food demand & diet patterns
New technologies
Use of agricultural product dynamics
Conventional energy
Agrochemical supplies
Climate and crop health
COMPLEX MULTIPLE INTERACTIONS UNKNOWN IN MARKETS HISTORY


BIOMASS ADDED VALUE
Bioproducts
(bioplastics,
biomolecules,
biophármaco etc.)
Biomaterials
(construction,
paper etc.)
Human food
Pets food
Fodder and animal food
Biofuels - Bioenergy
- MARKET VALUE ++
- VOLUMEN OF PRODUCTION ++
ADDED VALUE OF THE TRANSFORMING PROCESS

Biofuels acted as a catalizer towards a circular economy promoting the production of food feed chemicals and materials in ***biorefineries***



Argentine farmers are investing in biotechnology startup companies

BIOCERES

Institucional · Inversores · Productos y Servicios · Unidades de Negocio · Novedades · RRHH · Contacto

Soluciones de Fermentación de Bacillus

Bioceres utiliza cepas de B. subtilis genéticamente

Forbes

Core Business · Emprendedores · Ranking · Forbes Life

Llega a la Argentina 30 PROMESAS

CORE BUSINESS

Bioceres cosecha en Wall Street

17 de Abril de 2017 - Forbes Argentina

El plan de Bioceres, la empresa rosarina líder en agrobiotecnología para cotizar en Nueva York y Londres. La historia de una de las empresas más innovadoras de la Argentina, creada con apenas US$ 14.000.

En Rosario, particularmente en la sede central de Bioceres, la mayor compañía

Sobre el autor

FORBES ARGENTINA

La marca N°1 de negocios del mundo, más »

Este columna no es para vos: Habrá otra oportunidad

alternativamente lípidos y azúcares.

Nuestro segmento de biotecnolo
soluciones de fermentación microb

Este segmento actualmente se foc

Plataforma de Mole

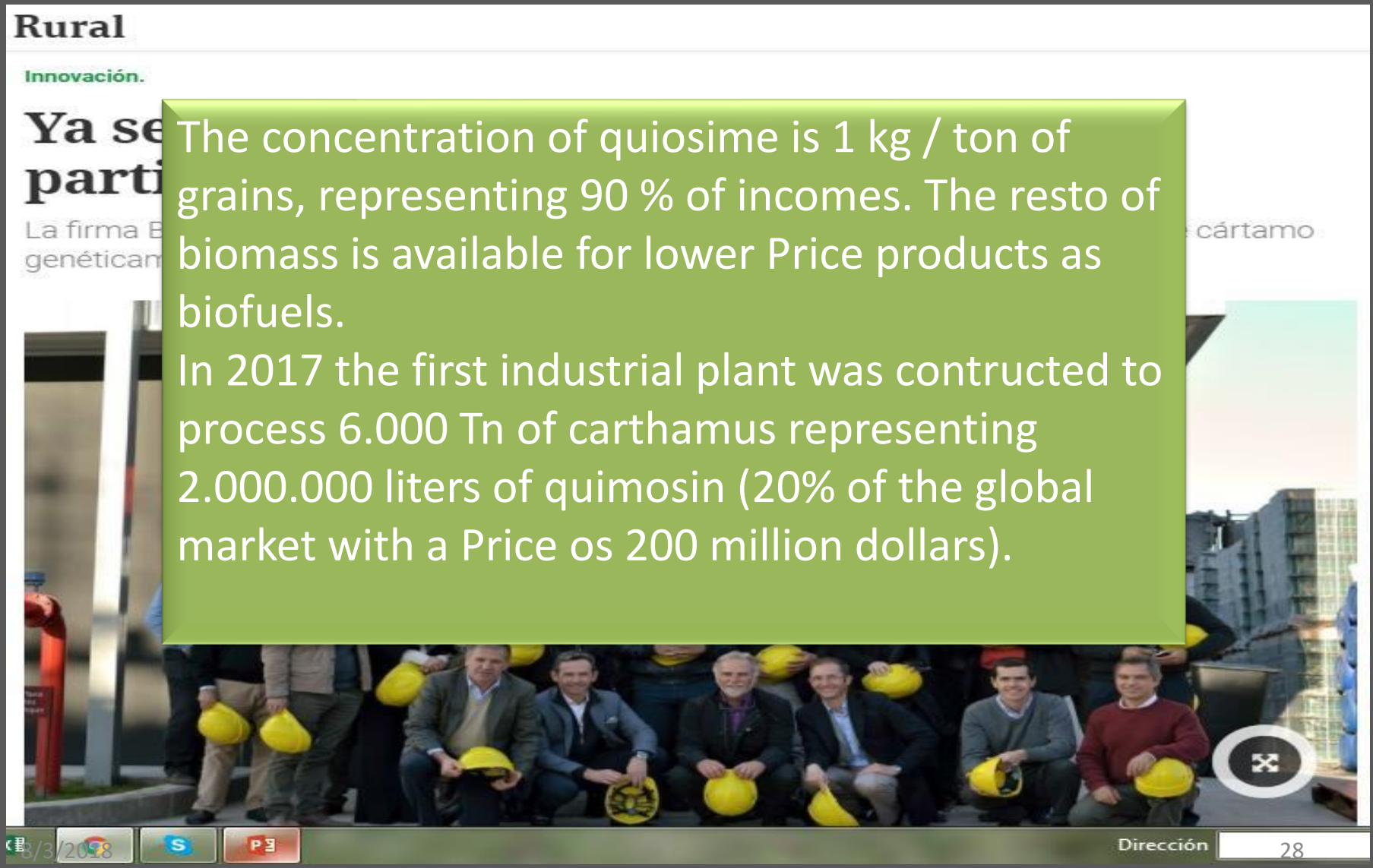
Bioceres ha desarrollado una pl
farming basada en el cultivo de
industriales valuada en <$5000/kg.

costo en compuestos de alto valor agregado.

Segmentos de Negocios

- Biotecnología de Semillas
- Biotecnología Agroindustrial
- Servicios de Investigación y Desarrollo

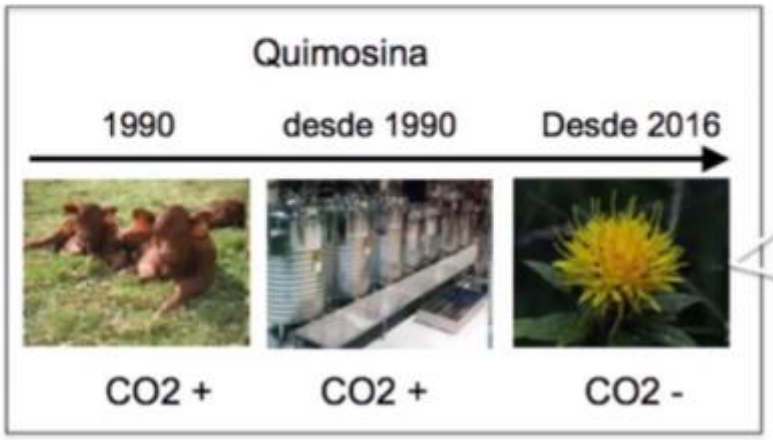
Bioceres



The concentration of quiosime is 1 kg / ton of grains, representing 90 % of incomes. The resto of biomass is available for lower Price products as biofuels.

In 2017 the first industrial plant was contructed to process 6.000 Tn of carthamus representing 2.000.000 liters of quimosin (20% of the global market with a Price os 200 million dollars).

Biotecnología Industrial: Cambio de Paradigma



El Caso Bioceres

BIOCERES

Empresa líder en biotecnología y ciencias afines, que desarrolla y comercializa productos y tecnologías para incrementar la productividad de cultivos y valorizar materias primas de origen agropecuario.

- Plataformas agrícola y bio-industrial de alto potencial de crecimiento
- Grupo gerencial con importante experiencia y conocimiento
- Múltiples alianzas internacionales para el fondeo de bioempresas y la llegada a mercados globales
- Track record en la creación y financiamiento de start-ups en Bioeconomía

INDEAR
Bioceres Semillas
semya
TRIGALL GENETICS
Verdeco
inmet
AG BM
Héritas

Environmental and energy analysis of bioethanol biorefineries

Jorge A Hilbert
Stella Carballo
Juan Pablo Vitale
Nicole Michard
Consultor externo Sebastian Galbusera INTEA S.A.
Equipo de ACA BIO Mario Alejo Dantur; Santiago Acquaroli
Equipo UNVM Maria Jose Galvan

ACABIO INTA INTeA UNIVERSIDAD NACIONAL DE VILLA MARIA

¿Why its important to study the carbón footprint of the biorefinery

Process efficiency

- Know each step in order to decrease the amount of material used:
  - Nutrients
  - Energy

Comercial reasons

- Anticipate regulatory measures
- Overcome environmental barriers of external markets
- Marketing of new products
- Create new products
- Lobby with authoroties

Relevamientos de datos:

Feedstock production

Transport & logistics

Industrial process

Final products delivery

¿Donde se generan emisiones?

Crop residues.

- Oxido nitroso. (Emisiones directas e indirectas)
- Datos: Superficie del lote. Producción del Lote.

oduction and use of fertilizers.

- Oxido nitroso. (Emisiones directas e indirectas)
- CO_2 (Fertilización con Urea y producción de fertilizantes)
- Datos: Tipo y Cantidad aplicada .

Agrochemicals production.

- CO_2 (Producción de agroquímicos).
- Datos: Tipo y cantidad aplicada.

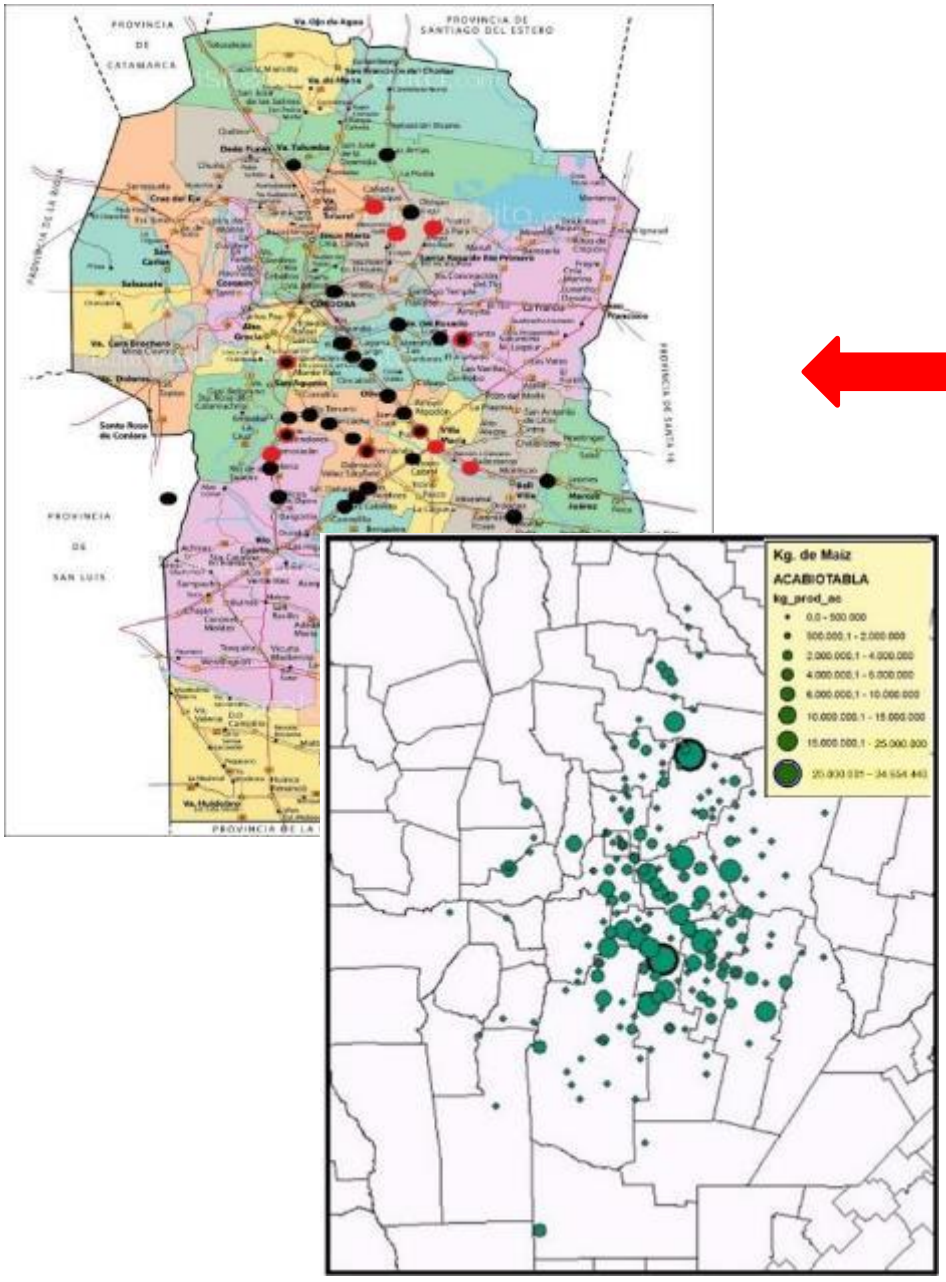
Fuel and lubricants production & use.

- CO_2 (Uso de Combustibles y Lubricantes).
- CO_2 (Produccion de Combustibles y Lubricantes).
- Datos: Tipo de laboreos y cantidad realizada.

Farm infraestructure

- CO_2 (Uso y producción de Combustibles y Lubricantes).
- CO_2 (Uso y producción de semillas).
- Datos: Cantidades consumidas.

Regional study on the source of materials.



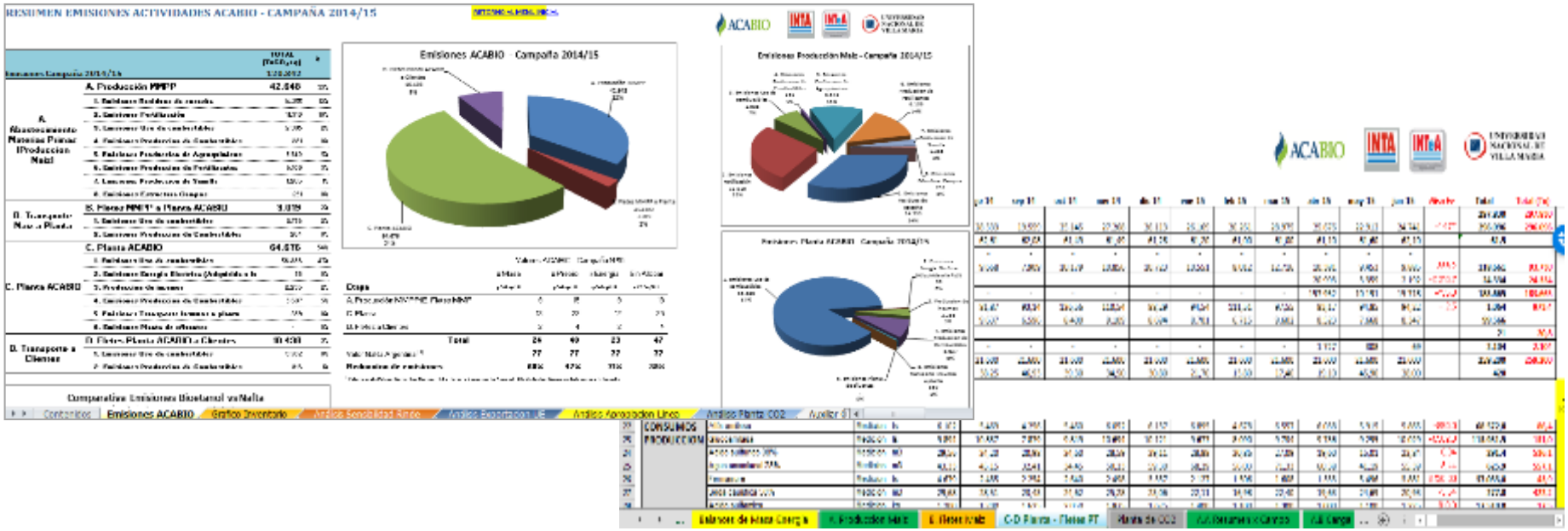
Total Maiz Ingresado:	318.008.390	Kg
Cantidad Localidades:	166	

Localidades	Kg	%
12 localidades	163.568.140	51,44%
20 localidades	207.685.380	65,31%
30 localidades	244.421.180	76,86%
40 localidades	266.329.500	83,75%
50 localidades	279.541.240	87,90%
100 localidades	309.838.950	97,43%
66 Localidades	8.169.440	2,57%

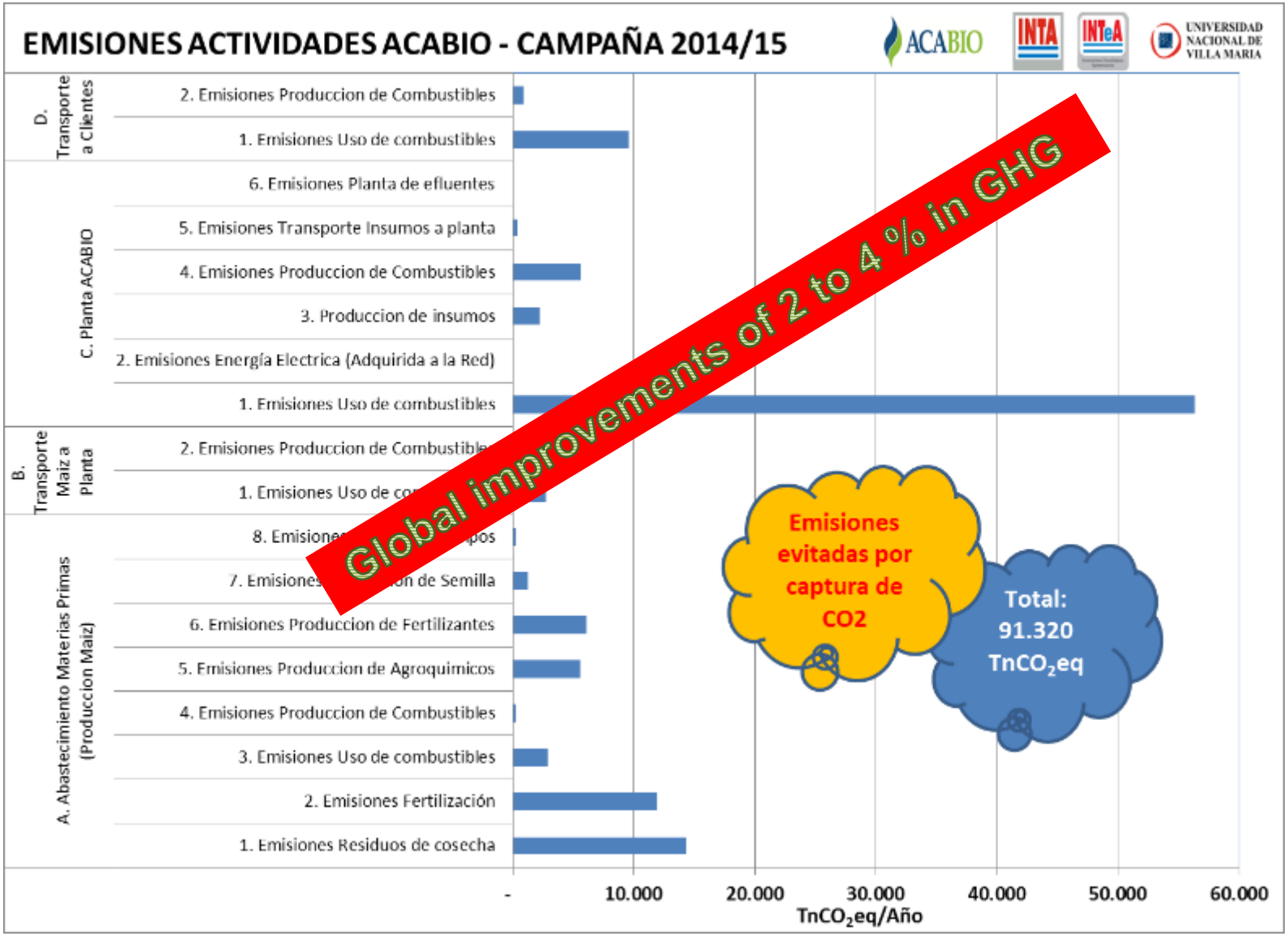
- A través de la Incorporación de la territorialidad a los análisis en función de los orígenes del maíz y las cantidades.
- Relevamiento de datos en lotes o campos que representan sistemas productivos homogéneos.
- Los datos relevados de campos en el ultimo periodo representan el 49% del total de maíz ingresado a planta.

Huella de Carbono de ACA BIO. Pasos

6. Ecalculator development: (Life Cycle Inventory - LCI).

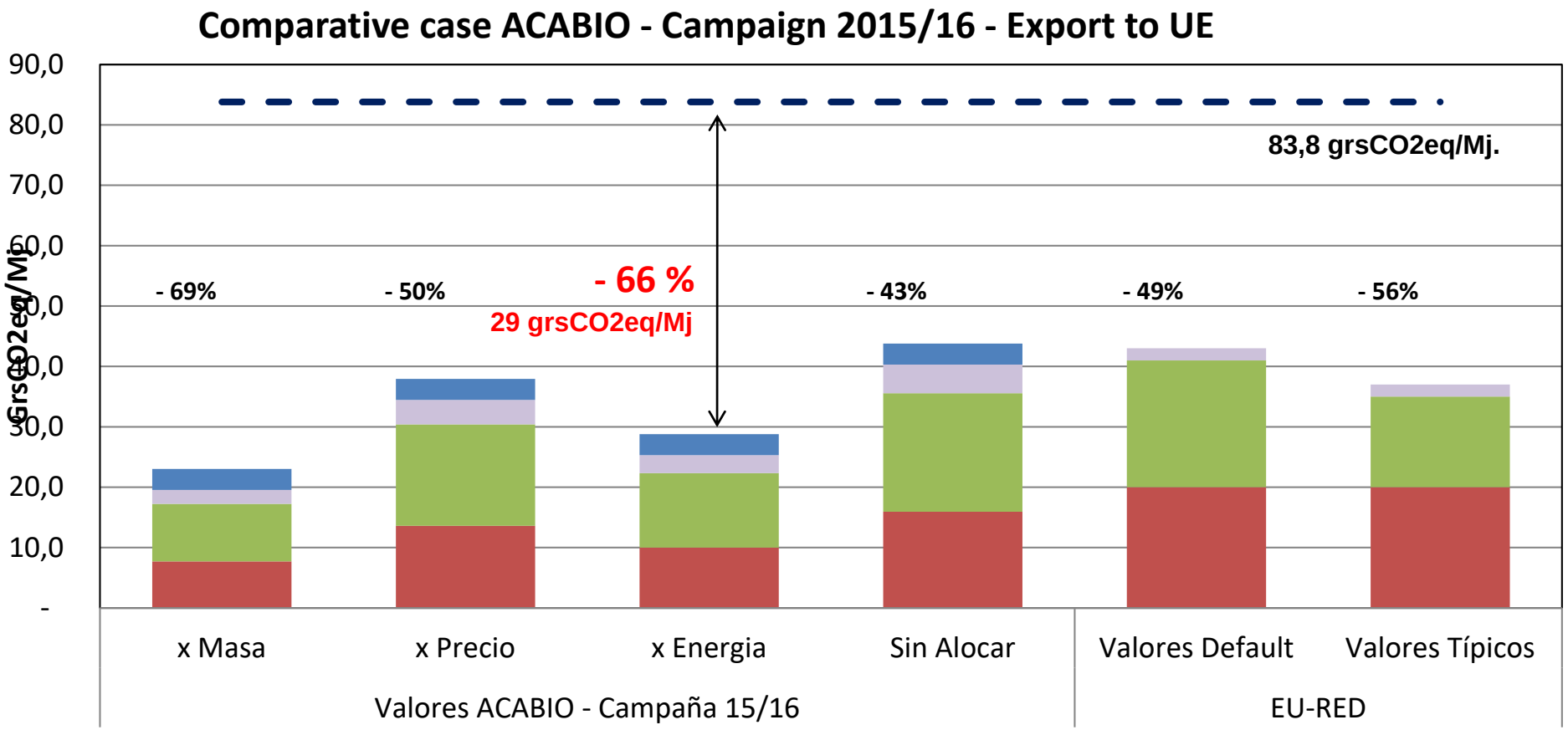


Impact of introduciend a new product as carbón dioxide



Results

Emission reductions: grsCO2eq/Mj



Limit 31 December de 2016 - Reduction 35%

Limit 31 December 2017 - Reduction 50%

Limit 1 January 2018 - Reduction 60%

ADDED VALUE FOR SOYBEAN CHAIN

CARBIO

Producción | Transporte + Acopio | Molienda | Valor Agregado

Aceite crudo

Proteinas vegetales

Productos de Soja Entera

- Aceite Envasado
- Lecitina de Soja
- Margarina
- Bio-Diesel
- Mayonesa
- Otras
- Alimento p/ Ganado
- Carnes
- Ind. Farmacéutica
- Ind. Farmacológica
- Otras
- Brotes de Soja
- Salsa de Soja
- Leches de Soja
- Otras

Industria Automotriz
Maquinaria Agrícola
Semillas
Agroquímicos
Biogenética
Servicios Profesionales
Energía
Otras

Revolución Tecnológica en todos los eslabones de la cadena productiva

Sustainability public perception & awareness installation in society and its consequences

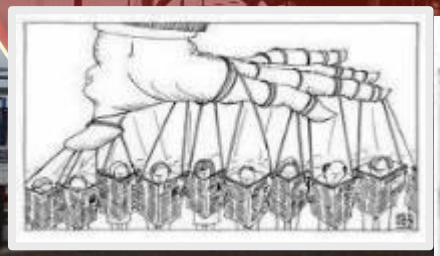
Economic actors
NGO

$$

Instalation through media

"SCIENTIFIC" SUPPORT

Pat Bagley / *Salt Lake Tribune*, de Utah, EE. UU.
La Madre Naturaleza, ante un dilema.



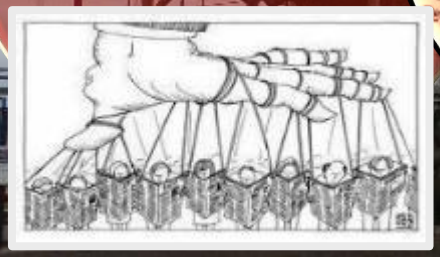
"Klimaschutz geht auch dich was an!"

Sustainability public perception & awareness installation in society and its consequences

Economic actors
NGO

$$

Installation through media



PUBLIC PERCEPTION CHANGE

Politicen Answer

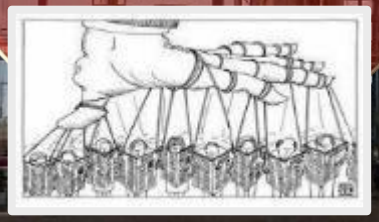
"SCIENTIFIC" SUPPORT

Sustainability public perception & awareness installation in society and its consequences

Economic actors
NGO

$$

Installation through media



"SCIENTIFIC" SUPPORT

PUBLIC PERCEPTION CHANGE

Politician Answer

Regulation and control departments

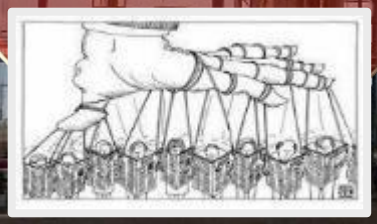
REQUIREMENTS

Sustainability public perception & awareness installation in society and its consequences

Economic actors
NGO

$$

Installation through media



"SCIENTIFIC" SUPPORT

PUBLIC PERCEPTION

CHANGE

Politician

Answer

Regulation and control departments

REQUIREMENTS

Search for scientific support of new measures

Universities

Research Institutes

Installed paradigmas

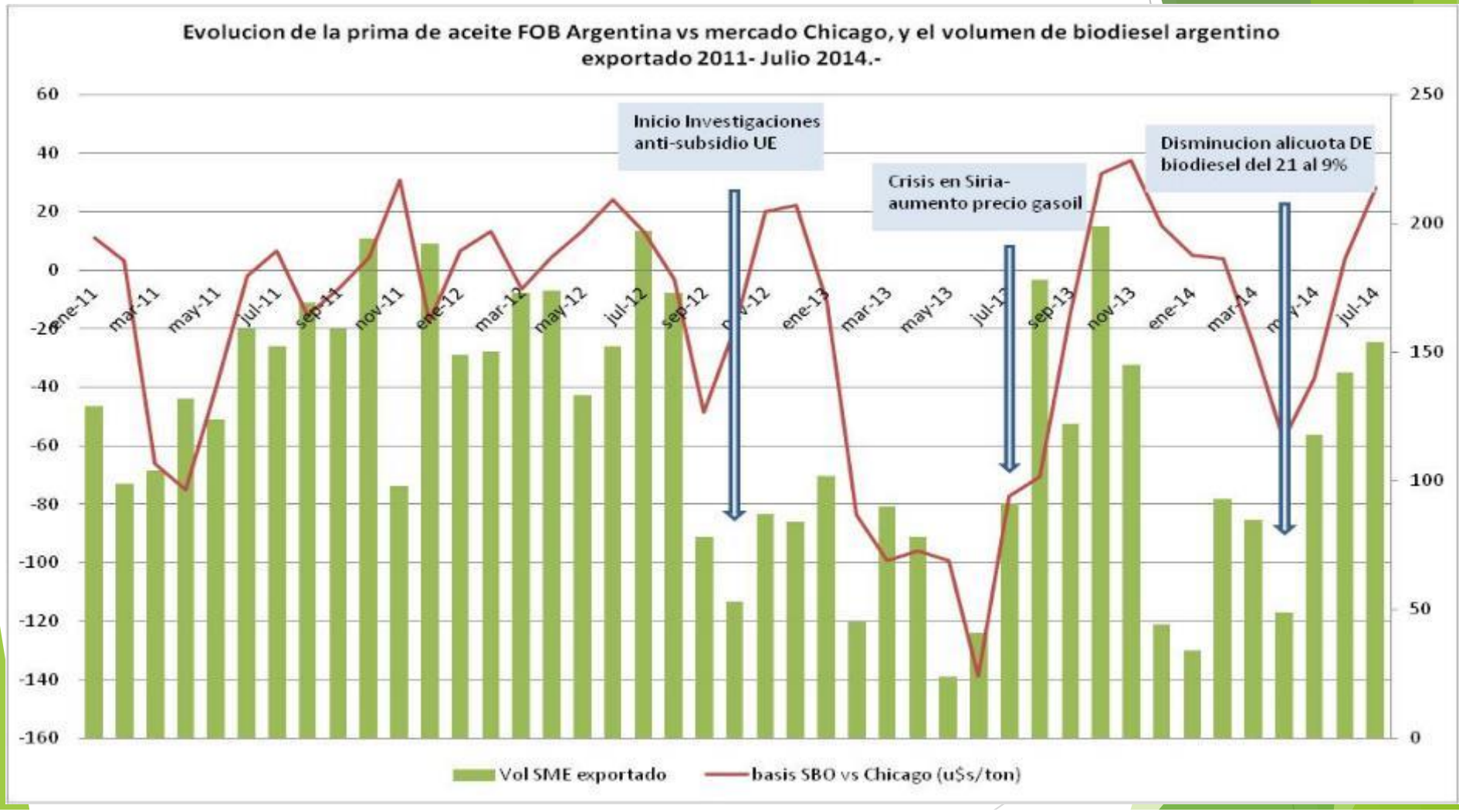
- Direct relation between bioproducts production capacity and food security
- Food competence
- Advantages of non food crops (II generation) n
- Superior costs than conventional fuels
- Direct relation between crop use and biofuel production
- Increase crop production altering forest areas
- Relative advantages on GHG savings
- Neutral or low Energy balances

Principle characteristics of bioproductos large scale production in biorefineries

- Derive from a well established transforming chains (food, fiber, feed etc.)
- Produced from a coproducts of flexcrop production
- Rely on logistics and size economy savings already established.
- Produces multiple impacts in established markets generating new products, price movements, replacements, food feed patterns etc.
- Much affected by policy and administrative changes inside and outside country boundaries
- The industry were feedstock transformation occurs has great plasticity to produce or not the biofuels according to prices profit etc.

SUSTEINABILITY OF THE VALUE CHAIN

The fall in biodiesel production is producing a "comodizations" of exports since we have to sell higher volumes in an inelastic market.



Less foreing income less tax income less investment projects less Jobs and added value.

Large plants & médium size plants

CHAMBERS CEPREB & CARBIO

CAMARA ARGENTINA DE BIOCOMBUSTIBLES

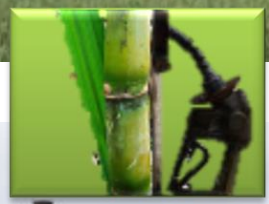
CEPREB
Cámara de Empresas Pyme Regionales Elaboradoras de Biocombustibles

eXPLORA | LDC Argentina | unitecbio

Cargill | BUNGE | VCD | Molinos Río | Vicentin | COFCO

Old and reinvesting sugarcane plants

New corn starch bioethanol plants



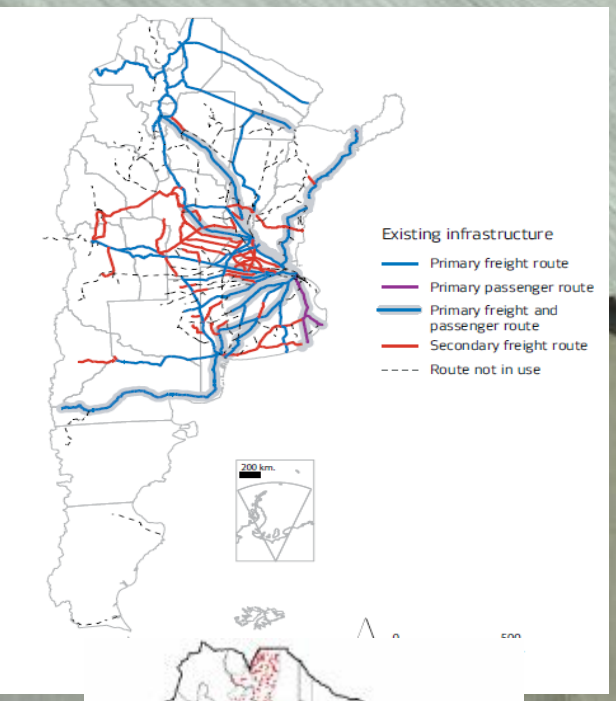
CÁMARA DE BIOETANOL DE MAIZ

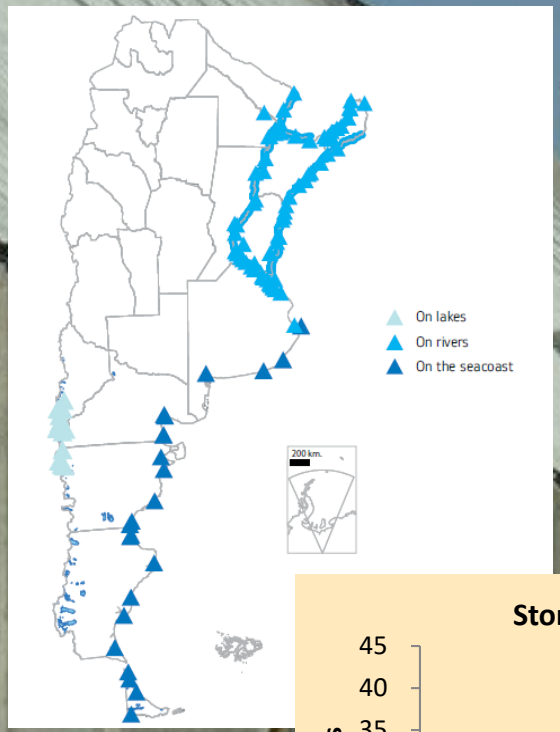
Small scale biorefineries

http://www.minidest.com.ar/eng/

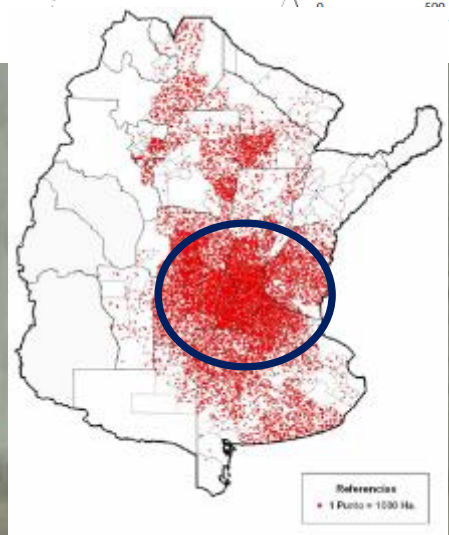
Microdestileries en Argentina

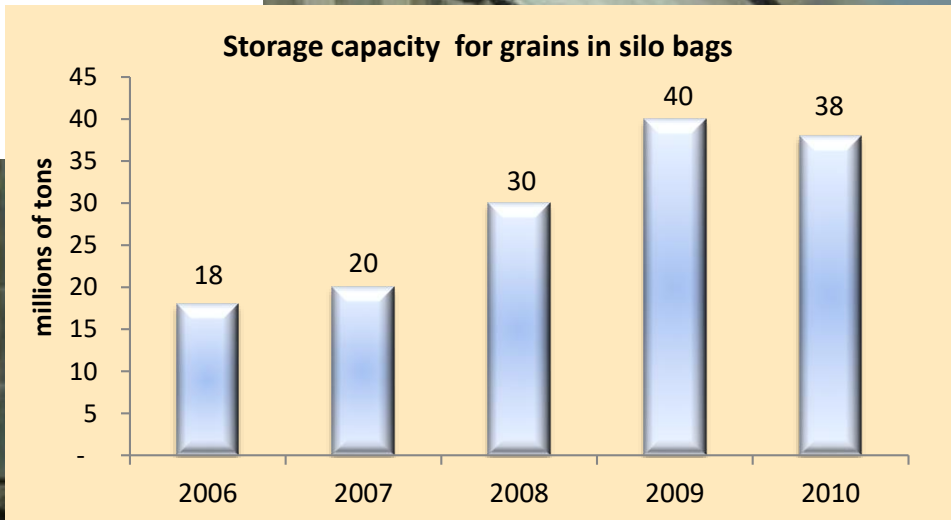
Infraestructure demands of the agroindustrial complex Bio refineries growth is based on these advantages





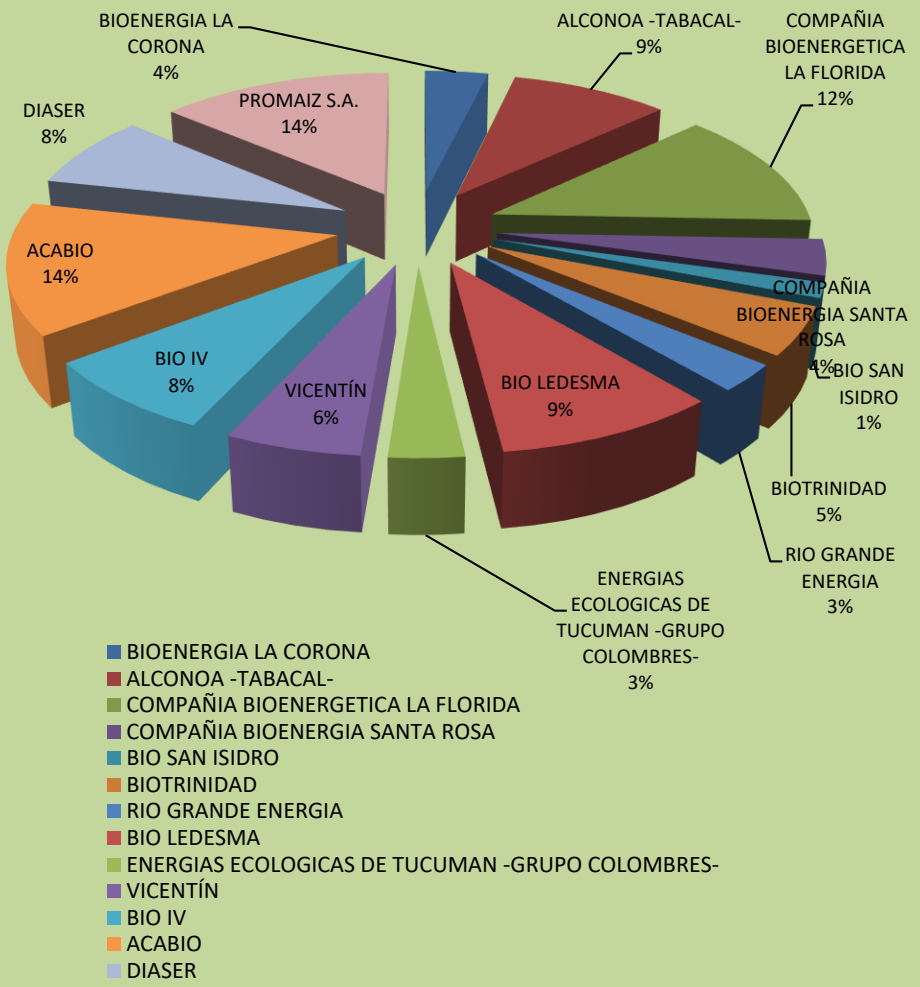
- Trains
- Roads
- Ports
- Storage capacity
- Feed industry



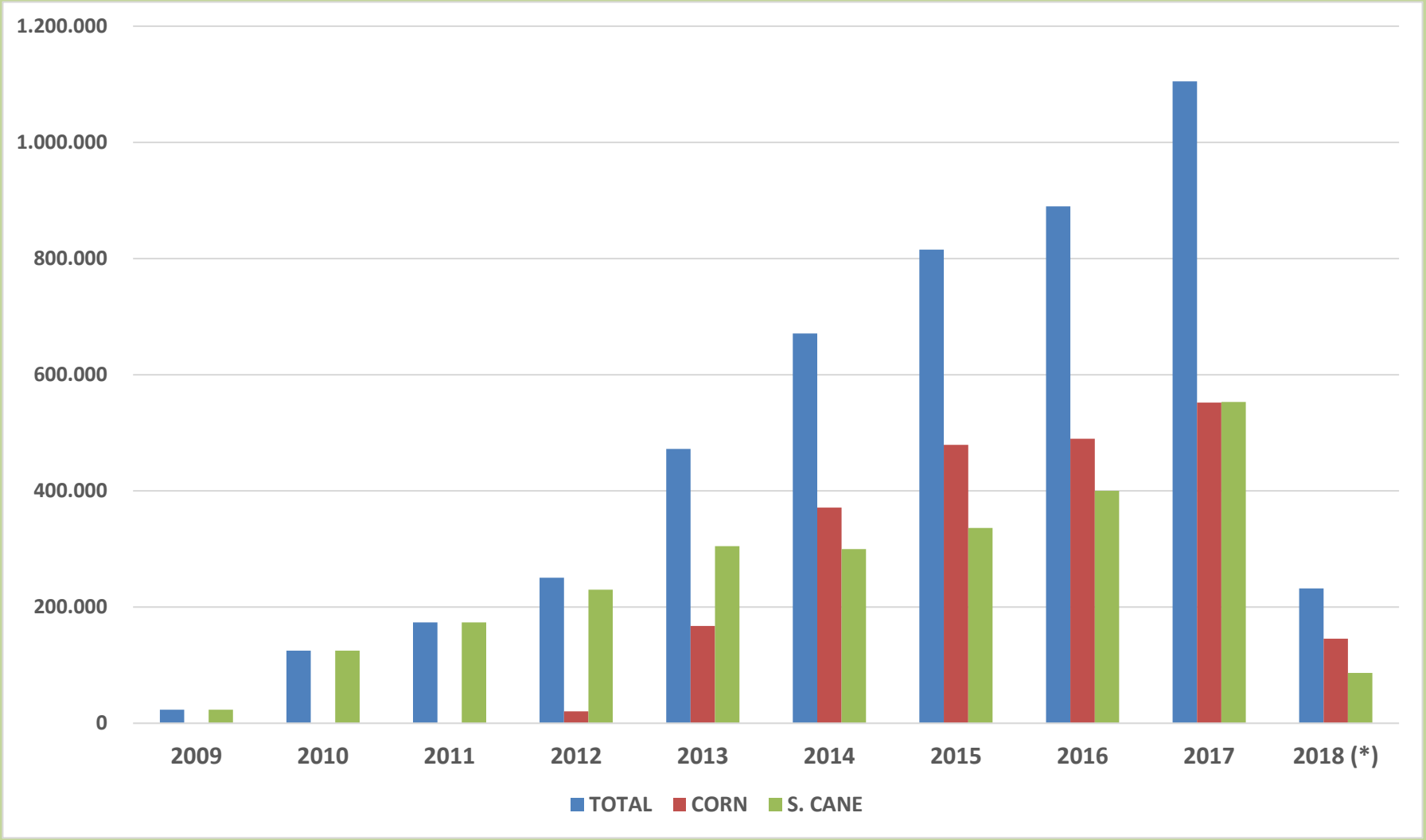


Installed bioethanol capacity sugar cane plus starch corn bioethanol

CAPACIDAD DE PRODUCCIÓN	m3/día	m3/año
BIOENERGIA LA CORONA	120	39.600
ALCONOA -TABACAL-	300	99.000
COMPAÑIA BIOENERGETICA LA FLORIDA	400	132.000
COMPAÑIA BIOENERGIA SANTA ROSA	120	39.600
BIO SAN ISIDRO	50	16.500
BIOTRINIDAD	160	52.800
RIO GRANDE ENERGIA	90	29.700
BIO LEDESMA	300	99.000
ENERGIAS ECOLOGICAS DE TUCUMAN - GRUPO COLOMBRES-	100	33.000
VICENTÍN	180	60.000
BIO IV	250	82.500
PROMAIZ S.A.	440	145.000
ACABIO	440	145.000
DIASER	250	82.500
SUBTOTAL	3.200	1.056.200

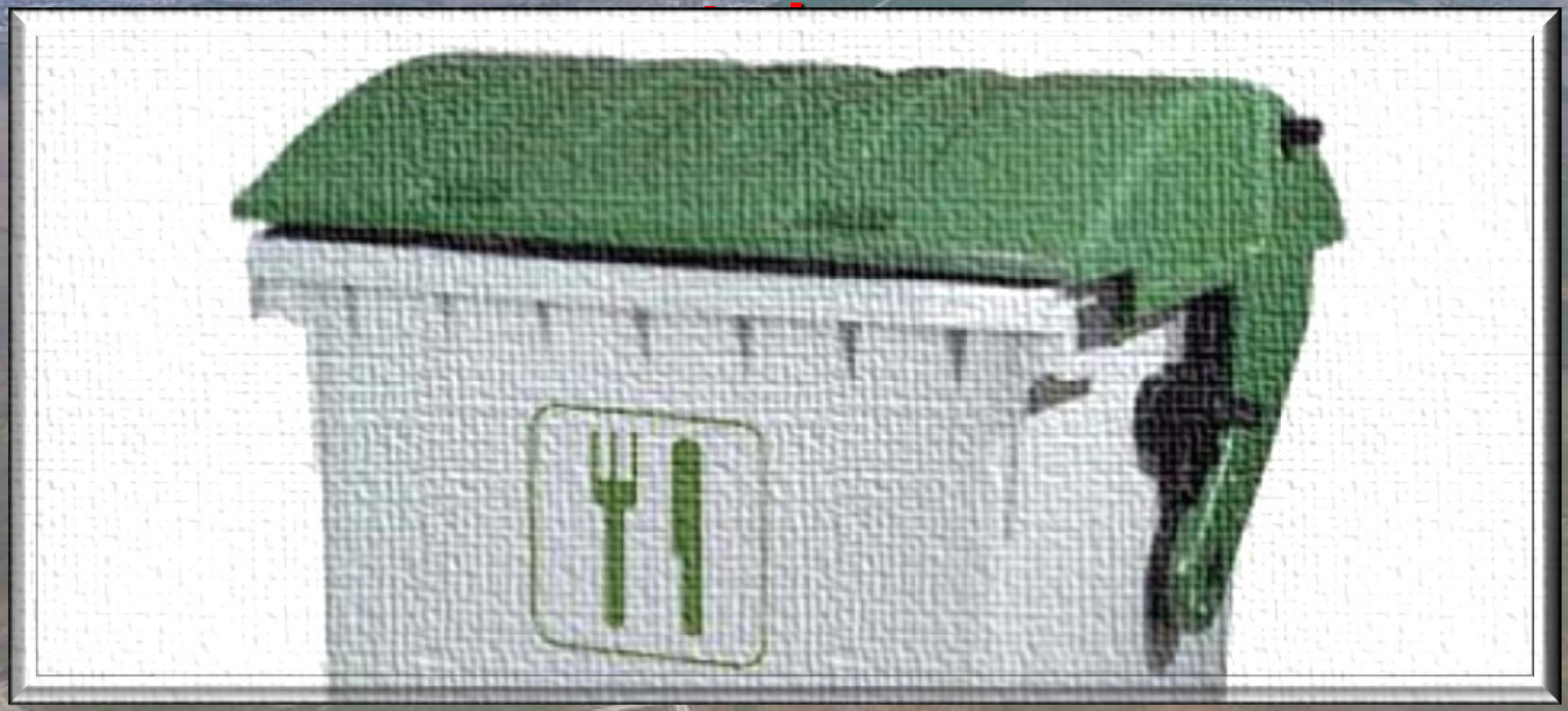


Bioethanol production (m3)

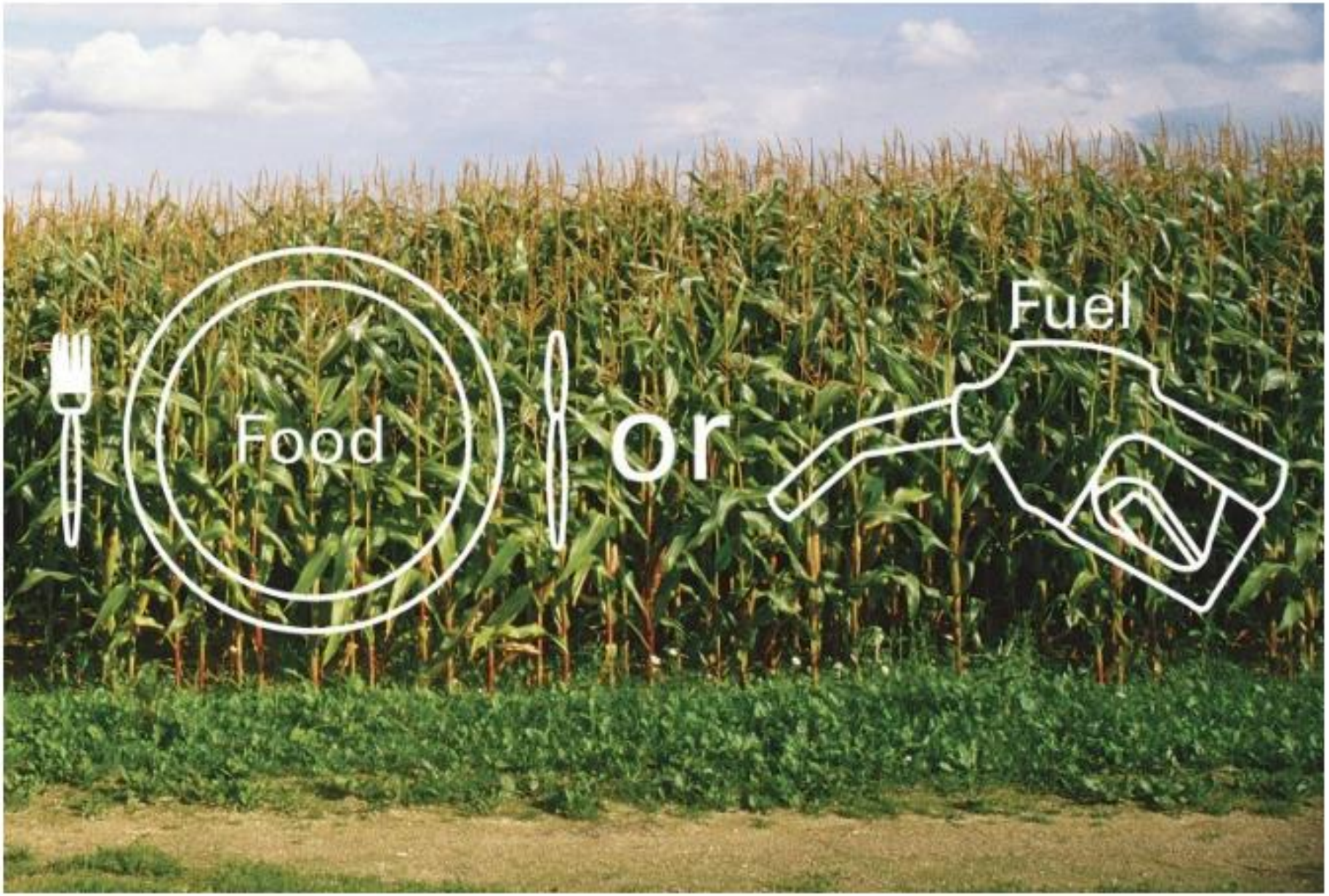


FOOD CONTROVERSY ??

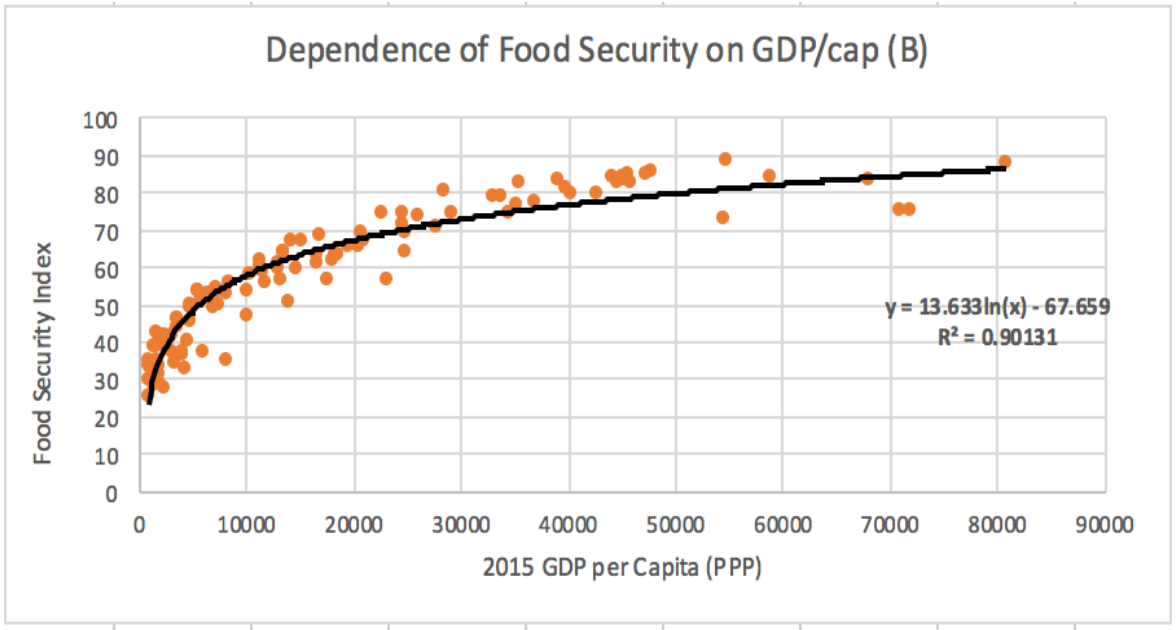
1/3 of food is thrown in the world according to FAO 2011

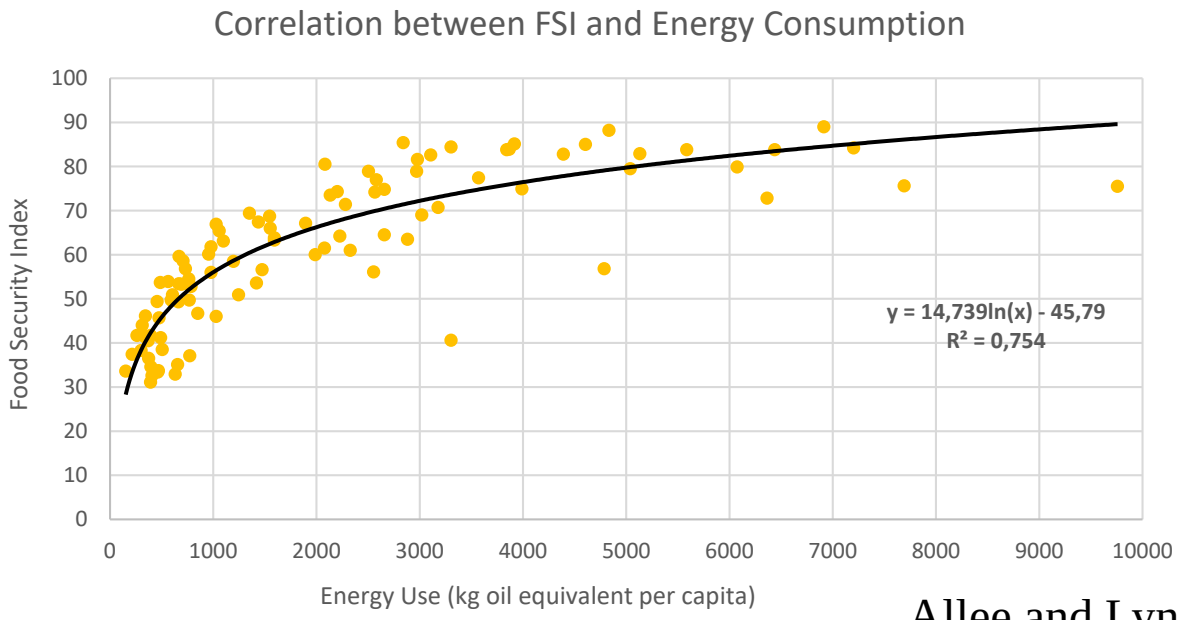


1.300 millones tons per year

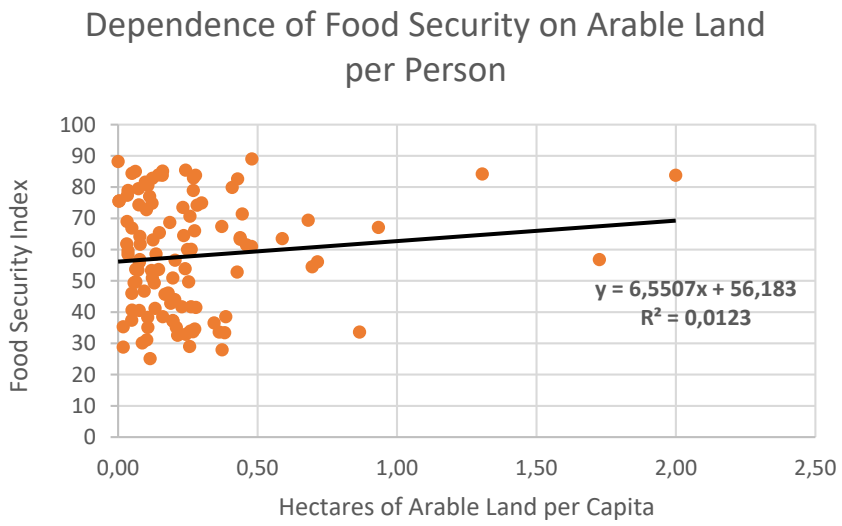


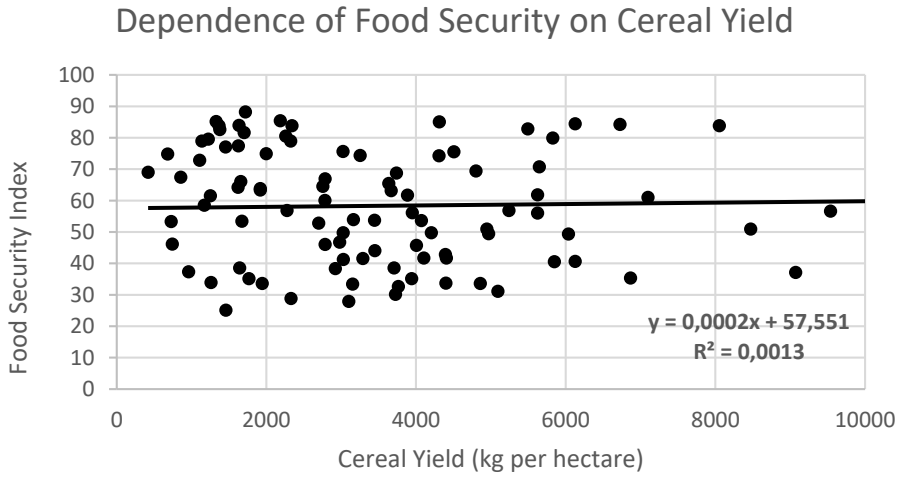
Biofuels: FAO asks to finish "food vs fuel" debate

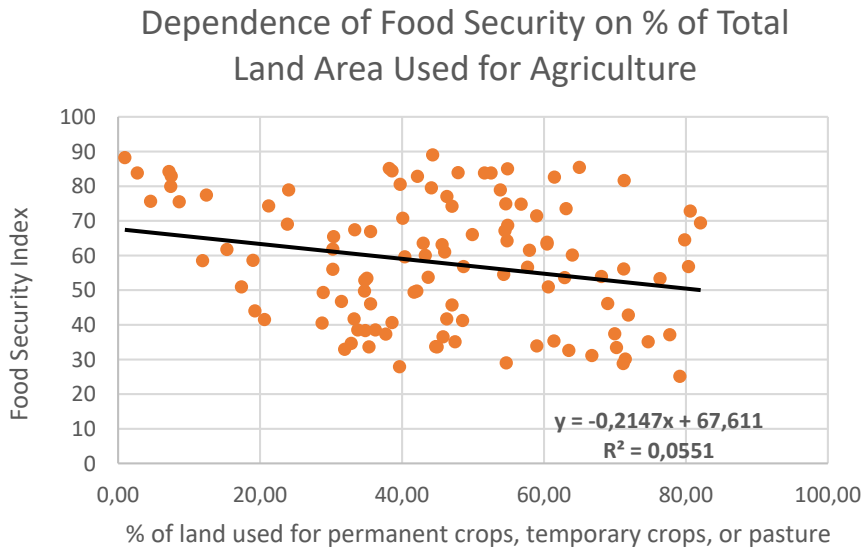


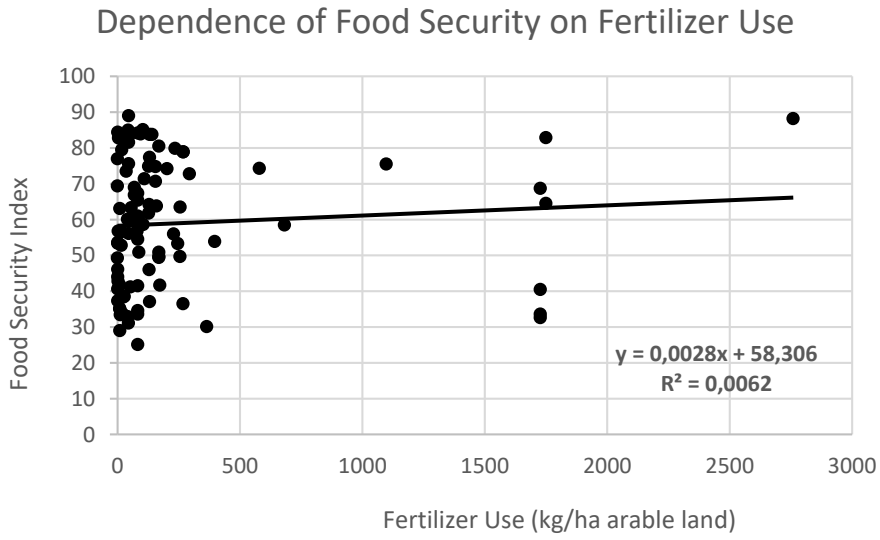


Allee and Lynd, in preparation









Allee and Lynd

Overweight and obesity

Food consumption increase as a world business

- **In 2010, 43 millon children presented overweight**.
- Since 1980, obesity has duplicated in the world
- **En 2008, 1500 millon adults (20 years (and over) were overweight**. **Within this group, 200 million men and 300 million women showed signs of obesity.**
- **In general terms, in 2008 more than one in ten adults worldwide were obese.**
- Each year more than 2,8 million people die from obesity or overweight.
- **The World health organization estimates obesity to rise to 700 million people**

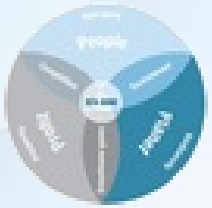

ENVIRONMENTAL
ASPECTS

ENVIRONMENTAL REQUIREMENTS EU & USA

Folowed Strategy

- Develop and implement a specific segregation standard to comply with EPA requirements
- Develop a EU scheme not adopted – use approved EU standards 2Bs ISCC
- Develop own calculations for industry transport & crop

From the 13 schemes recognized by the EU three are used in Argentina



What is the scope?

B+O **Benefits and Opportunities**

I Better Business Management

The systematic application of the set of GAP´s, together with the measurement of soil chemical and physical indicators and the ordered registry of all the information, constitute a true "control panel" of the agronomic and business management.

- It orders and facilitates the decision-making process related to the agronomic management;
- It allows to evaluate the system evolution, and ensures a continuous improvement of production; and
- It promotes the investments on adequate technologies and infrastructure as well as the demand of qualified services, which contributes to the dynamics and development of networks.

II Higher Agronomic Efficiency

AC seeks a sustainable and a more efficient use of natural resources.

- Higher water use efficiency.
- Higher nutrient use efficiency.
- Energy efficiency in the productive system.

III A World of Opportunities

AC falls within an increasing global demand for food, which also requires guarantees of environmental and social sustainability. Because of that, new opportunities for agribusinesses arise:

- Differential contracts and agreements with companies whose products get to the consumer (certified production);
- Development of a "Country Brand" related to a Differential production;
- Added Value products;
- Preferential access to specific markets; and
- New markets.

After obtaining the certification, what are its potential uses?

- As an owner's requirement or as the tenant's differentiation in leasing agreements; and
- As a testimony of the agronomic history when buying-selling farms.

- To get tax relief.

- As a reference when asking for loans (environmental and productive balance); and
- To access the Carbon Credits Market.

AMI Agronomic Management Indicators

They allow to evaluate the productive management with scientific support and to observe the recent changes in the management and their impact on the system. They constitute a tool to integrate soil properties and to interpret complex processes.

Some scientific evidences correlate the soil health indicators with the GAP´s.

F Soil Physical Conditions

The soil should have optimum physical conditions for the development of the crops, which means:

- Stable structure;
- Good water storage capacity and distribution, apart from soil aeration; and
- Absence of limiting factors for the development of roots.

Q Chemical Conditions

They allow knowing the supply of nutrients and other soil chemical characteristics that facilitate the normal growth and development for plants.

LCEA challenges

- How to deal with a by product when the driver force of the crop comes from other sector
- Emitions
  - Baseline substraction ??
  - Emition factor specially N2O +- 300 % ??
  - How we can evaluate agric. systems with crop rotations and not single crops
  - Land use change
  - Positive rather than negative effects of new agricultural techniques

Biodiesel Bioethanol & Biogas Green House Gases default value

ARGENTINA CASE STUDY

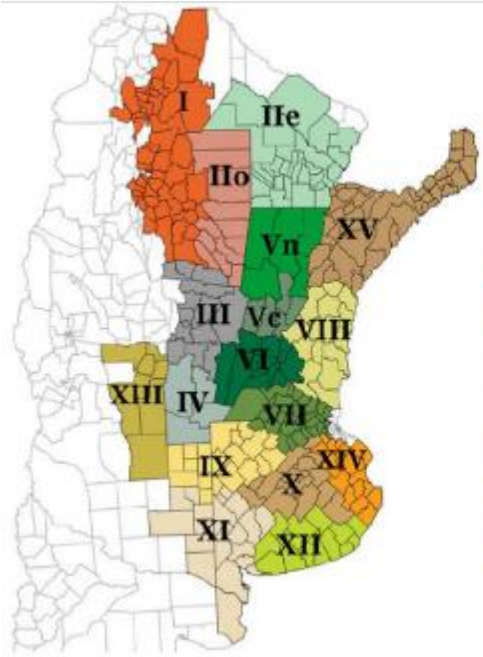
Agriculture phase

Industrial phase

Transport phase

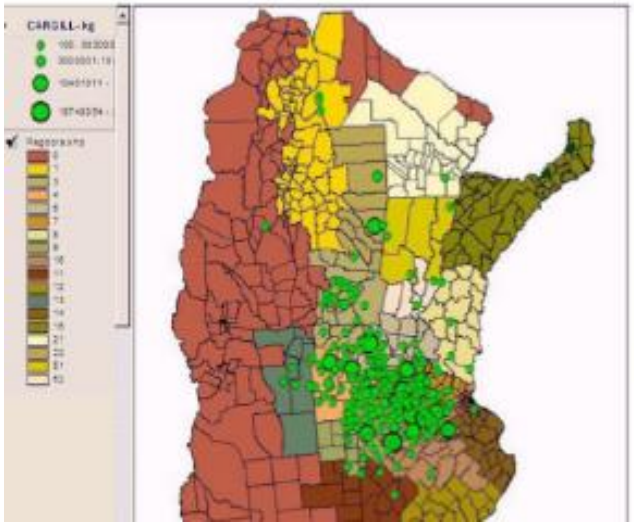
INTA

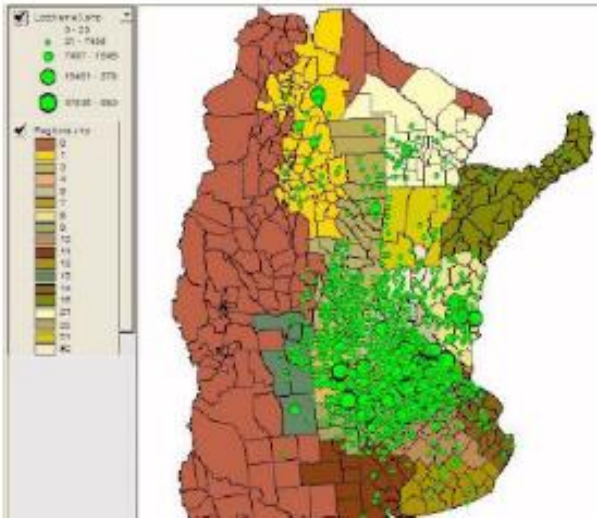
Introducing regional studies BECS



ZONAS RELEVADAS		
Color	Número	Nombre
	I	NOA
	IIe	NEA Este
	IIo	NEA Oeste
	III	Centro-Norte de Córdoba
	IV	Sur de Córdoba
	Vn	Santa Fe Norte
	Vc	Santa Fe Centro
	VI	Núcleo Norte
	VII	Núcleo Sur
	VIII	Centro-Este de Entre Rios
	IX	Norte de La Pampa - Oeste de Buenos Aires
	X	Centro de Buenos Aires
	XI	Sudoeste de Buenos Aires - Sur de La Pampa
	XII	Sudeste de Buenos Aires
	XIII	San Luis
	XIV	Cuenca del Salado

THE NEW STUDY INCLUDED
3 YEARS
26 MILLION TONS OF SOYBEANS &
2,2 M TONS OF BIODIESEL

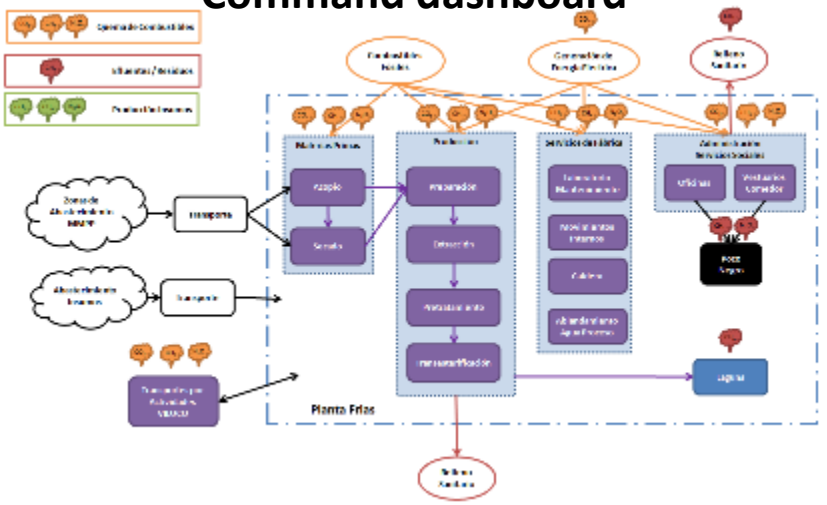




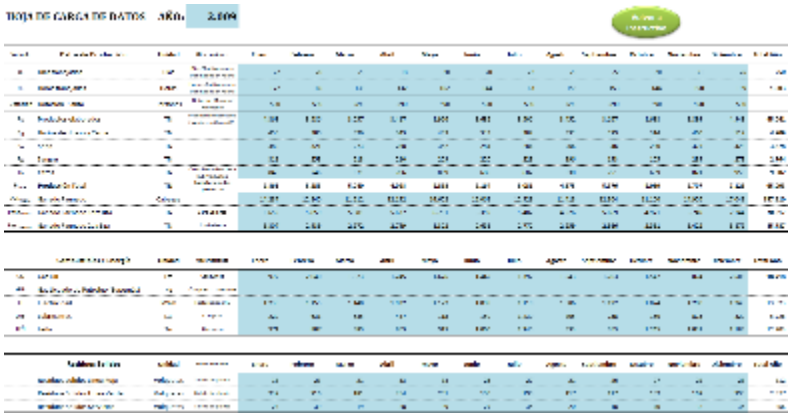
Carbon calculator as a mean of approach

Instructions

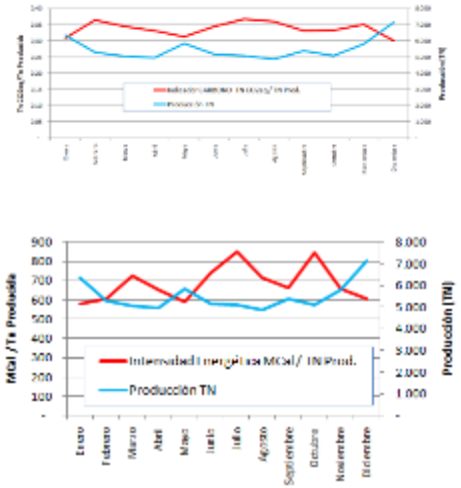
Command dashboard



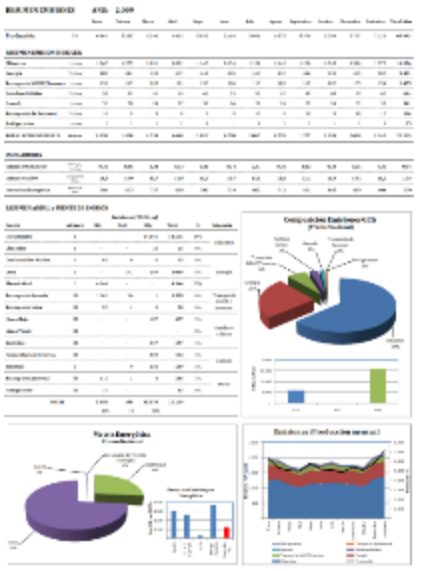
Data entry



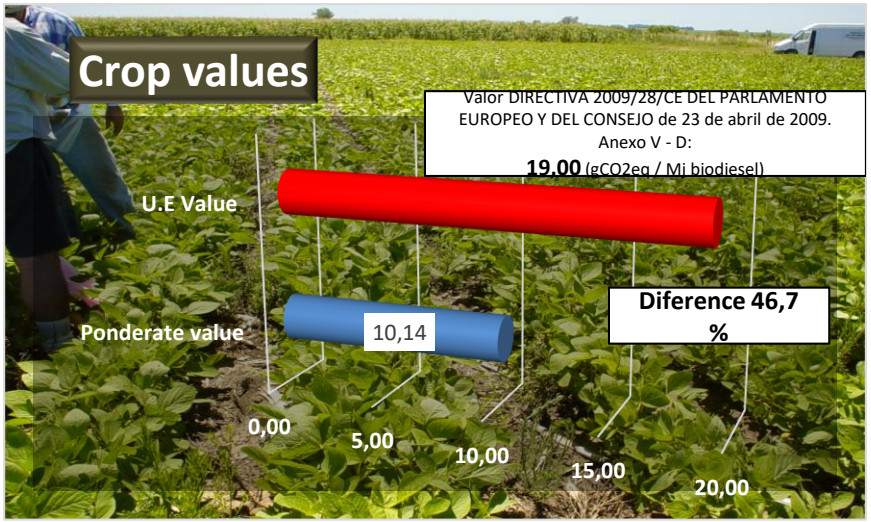
Indicators

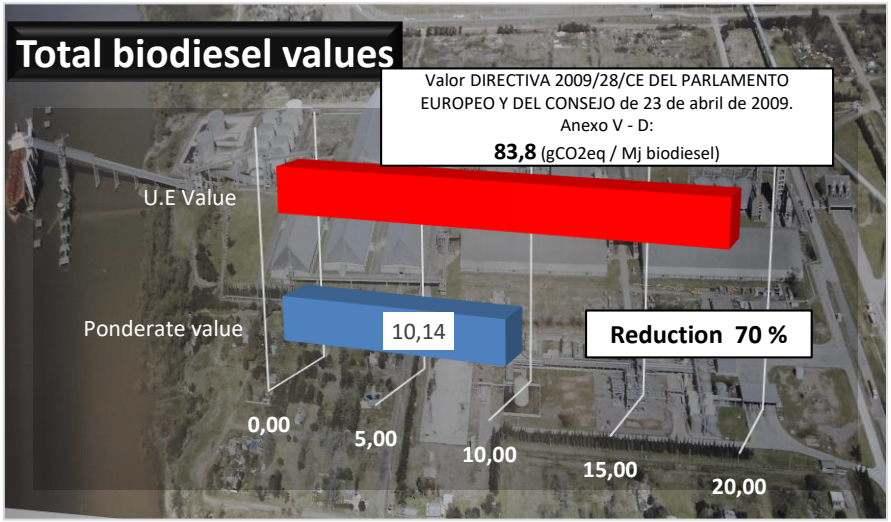


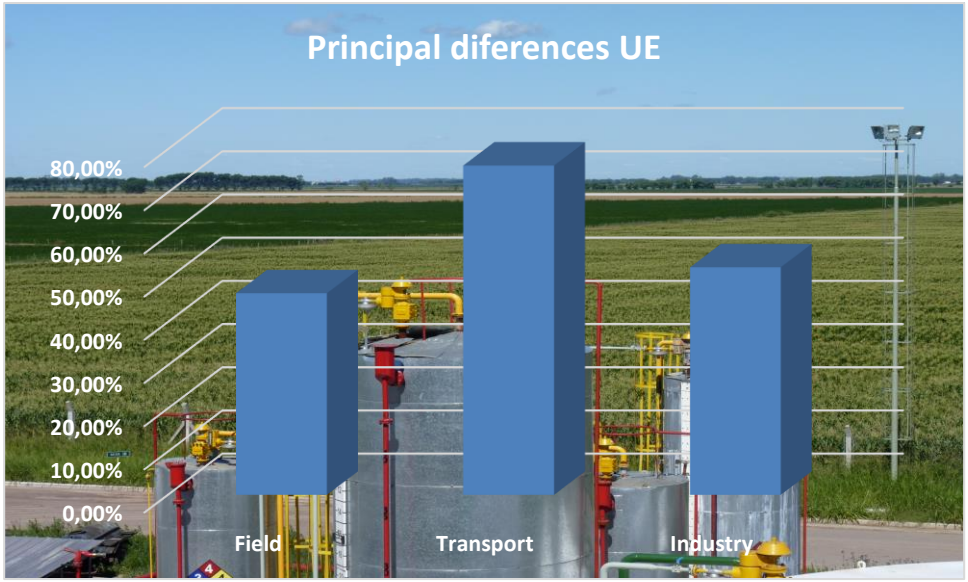
Result sheet

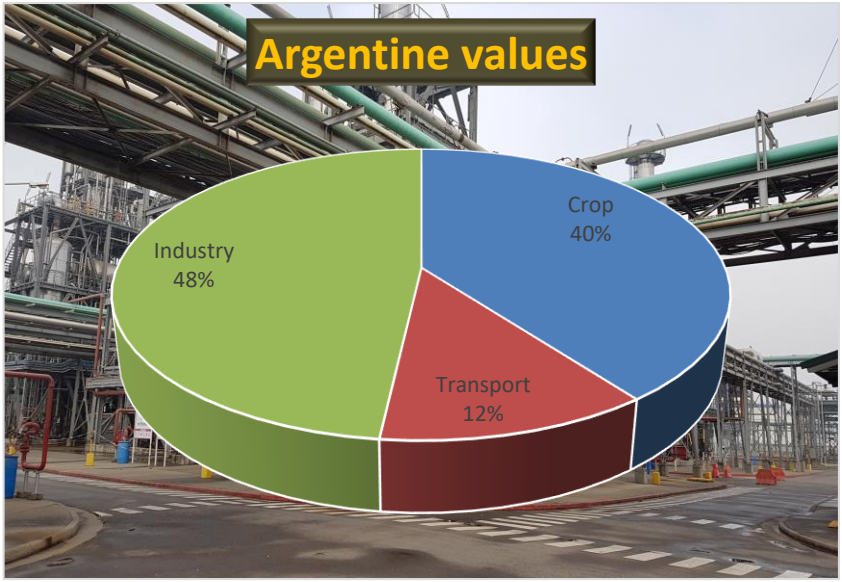


New 2018 studies

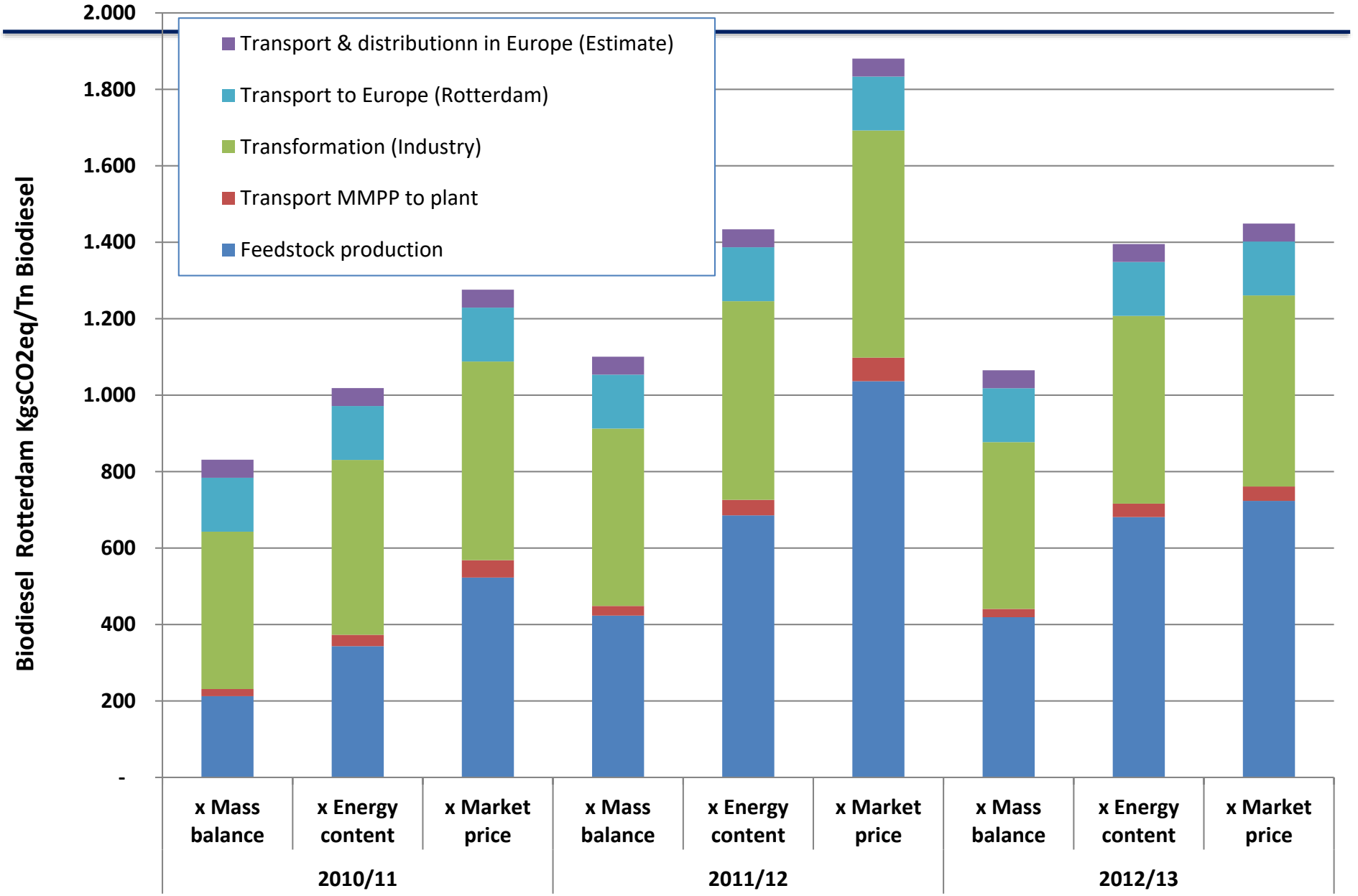








Interanual variation



LCA FOR II GENERACIÓN

- Boundaries of the studies
- Alocation critera and factors
- Valorization criteria of each product and product
- Methodology
- Energy value of each feedstock
- Logistic considerations

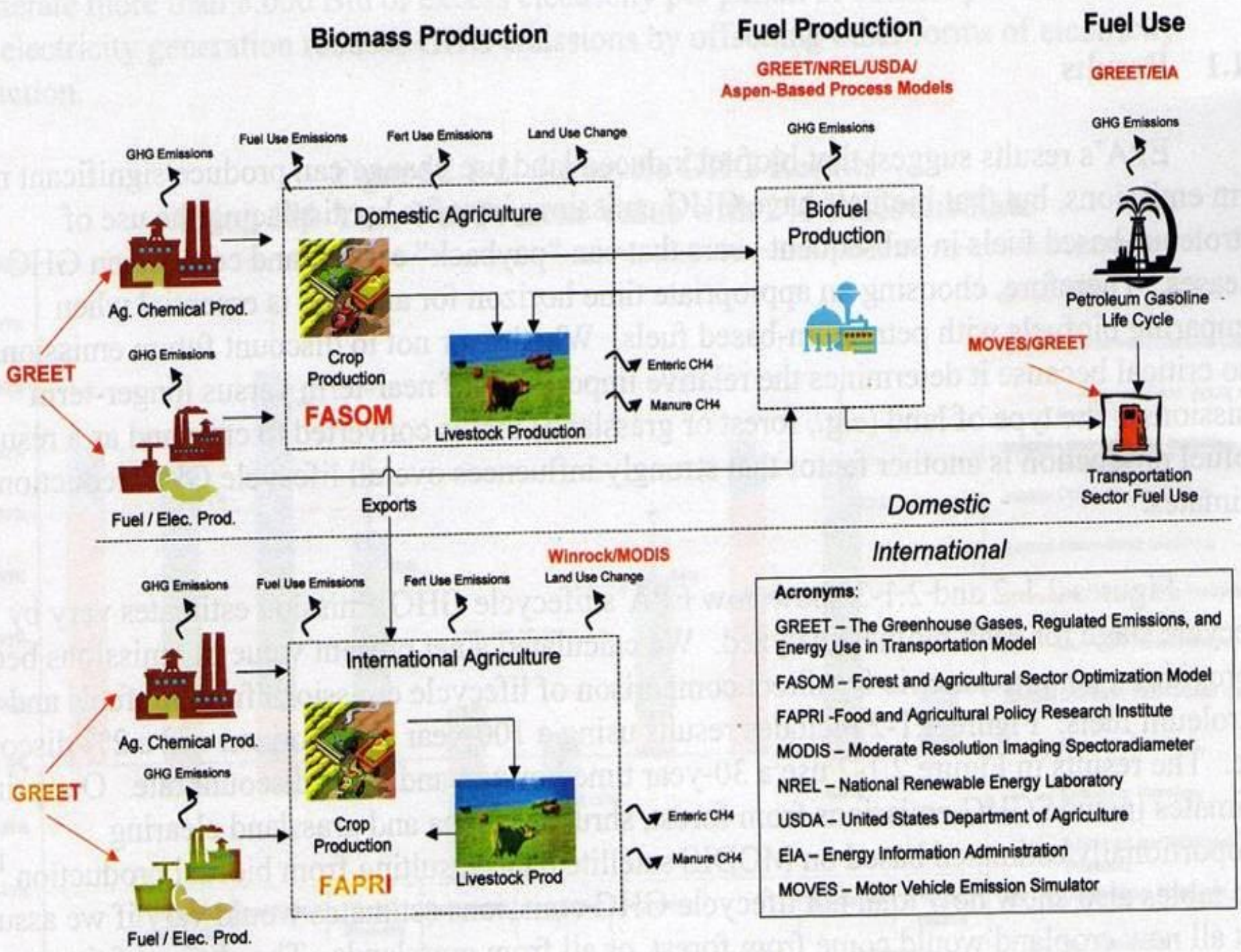
ENERGY EFFICIENCY

Energy efficiency (MJ consumed/MJ produced)	**0.49 (0,51)**	**0.48**	**0.60**
Energy efficiency (MJ consumed/MJ produced) NO COPRODUCTS	**2,11 (2,22)**	**1,71**	**1,07**
Energy efficiency (MJ consumed/MJ produced) SUGAR CANE	**0,16 a 0,12**		

Economic model and output that affects LCA economic allocation results

	Material delulosico	Bagazo de agave		Rastrojo de maiz		Rastrojo de cebada	
VENTAS	Ingresos	Ingreso anual	% del total	Ingreso anual	% del total	Ingreso anual	% del total
	Etanol	3.194.490	30%	3.392.708	22%	2.871.441	19%
	Fertilizante P		0%	1.616.112	11%	2.585.780	17%
	Fertilizante K		0%	3.723.491	25%	2.606.444	17%
	Fertilizante organico liquido (33,2% Brix)	7.184.994	67%				
	Ventan de metano		0%	6.384.874	42%	6.937.196	46%
	Electricidad generada	344.335	3%		0%		0%
	Total de ventas	**10.723.819**	**100%**	**15.117.185**	**100%**	**15.000.860**	**100%**

Indirect impacts weakness and risks



Acronyms:

GREET – The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model

FASOM – Forest and Agricultural Sector Optimization Model

FAPRI -Food and Agricultural Policy Research Institute

MODIS – Moderate Resolution Imaging Spectoradiameter

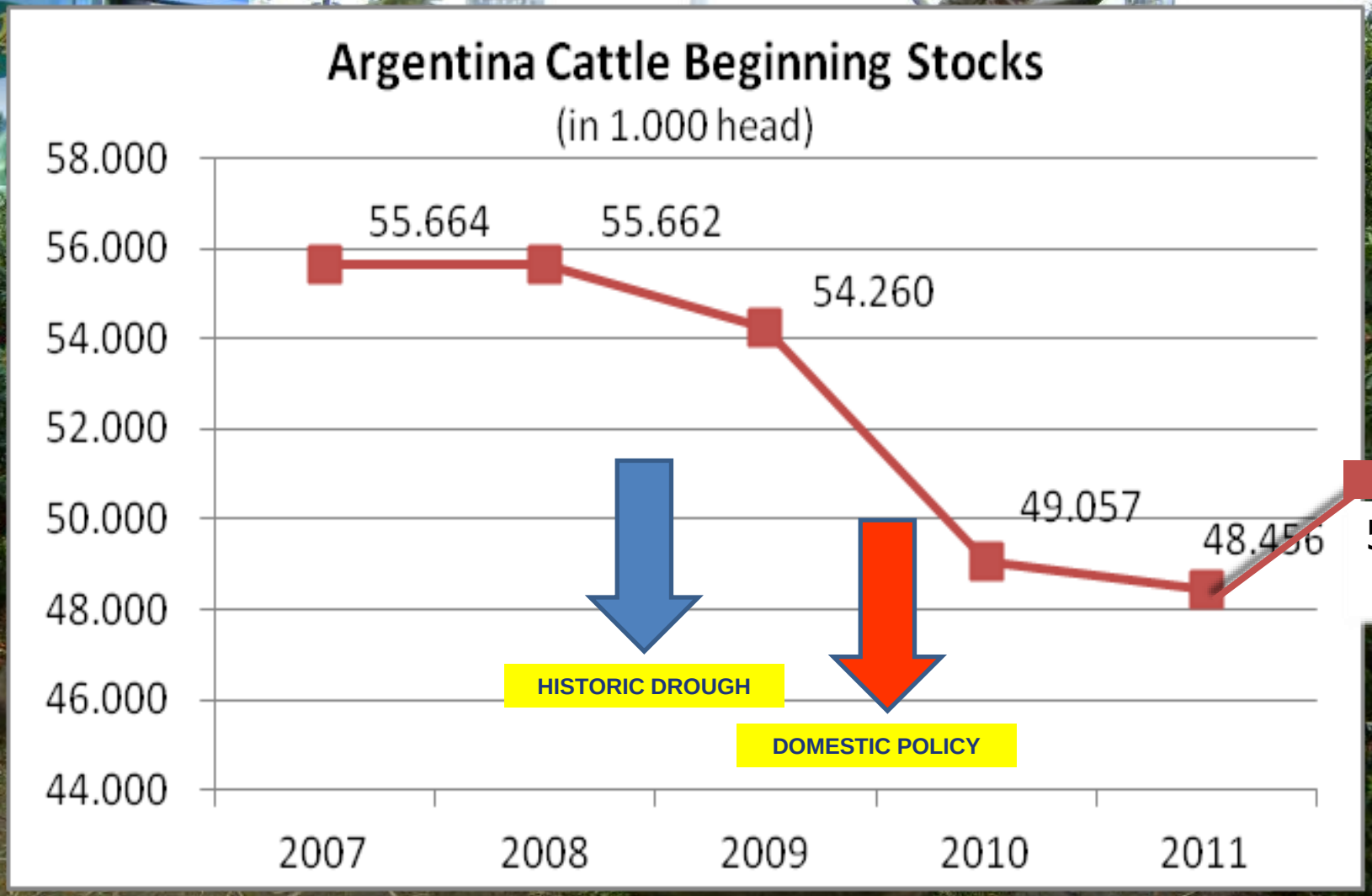
NREL – National Renewable Energy Laboratory

USDA – United States Department of Agriculture

EIA – Energy Information Administration

MOVES – Motor Vehicle Emission Simulator

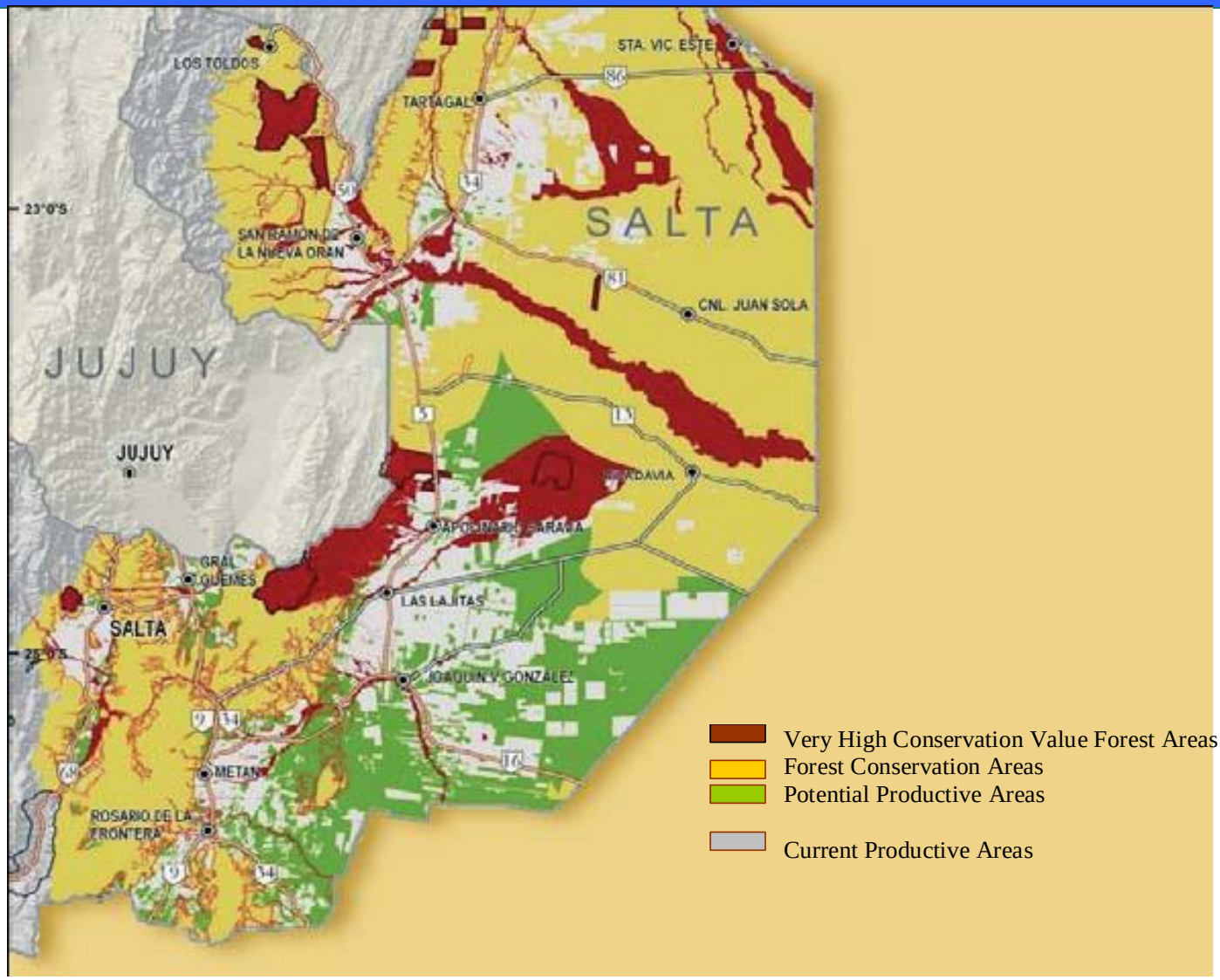
LUC & ILUC
EXTERNAL FORCES ACTING OVER THE SYSTEMS

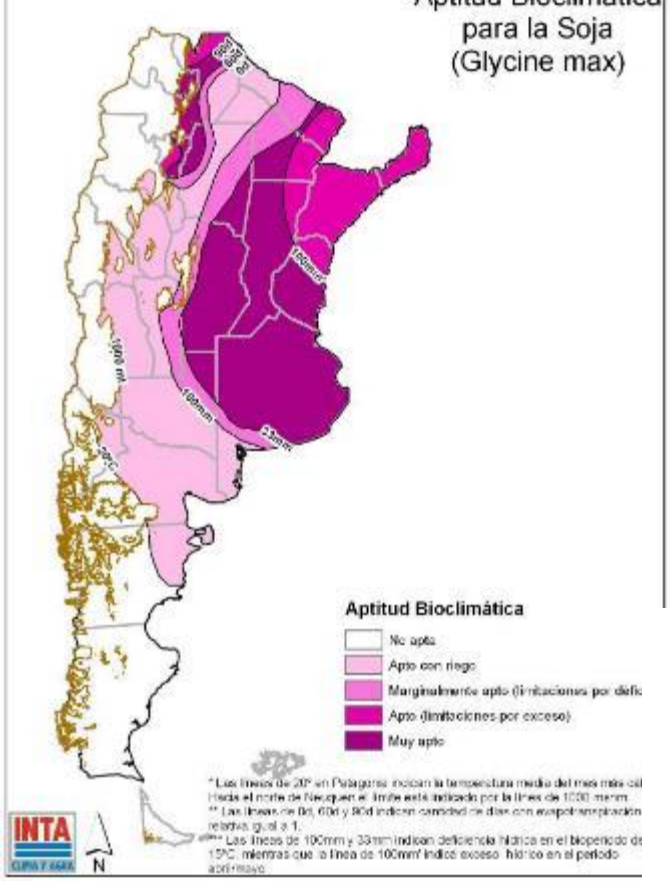


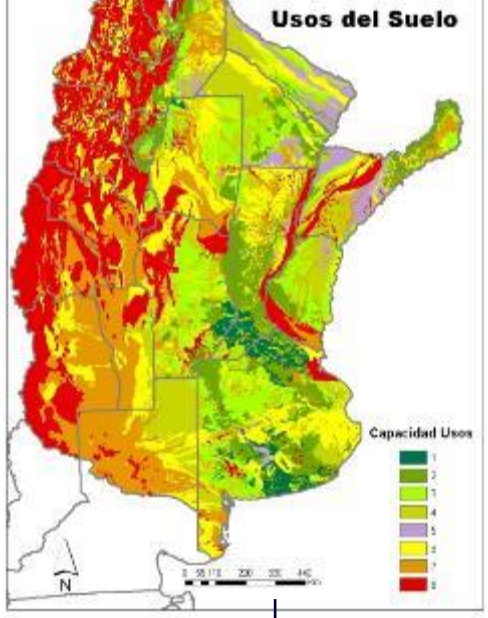
LAND USE CHALLENGE

FOREST LAW No. 26331 – November 2007

Argentine provinces have begun enacting land zoning policies under the Forest Law's land management provisions, laying out areas where agricultural expansion is banned due to environmental concerns and areas where agricultural expansion is permissible.







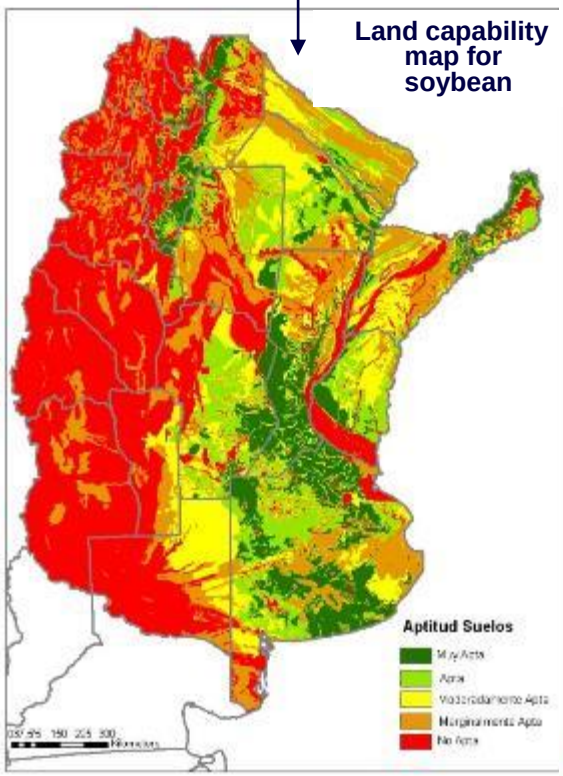
→ **Land capability map (I to VIII)**

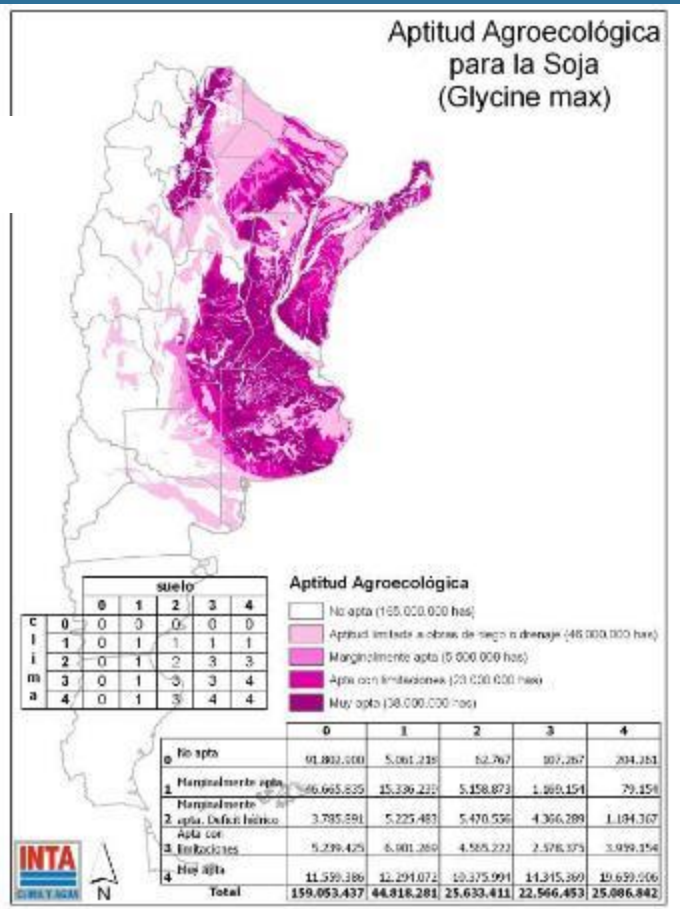
Bioclimatic aptitude map

FAUBA

INTA

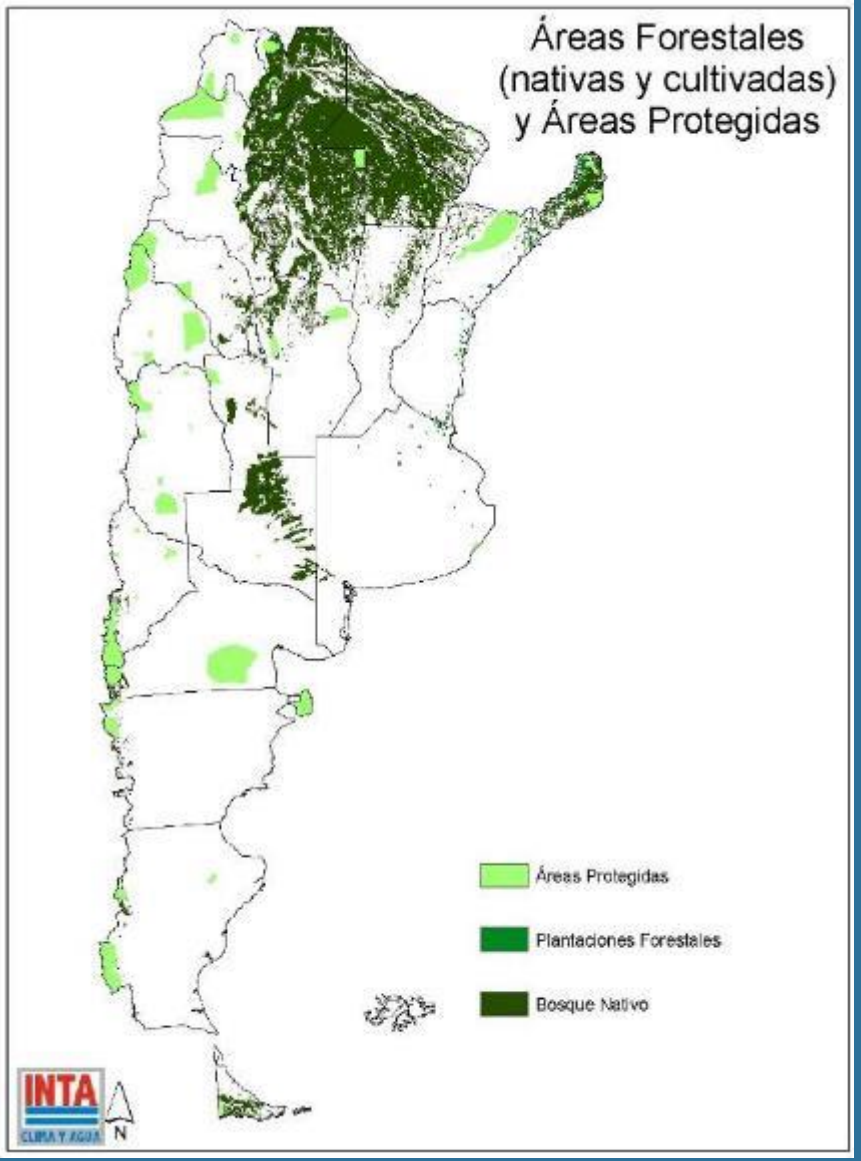
Land capability map for soybean



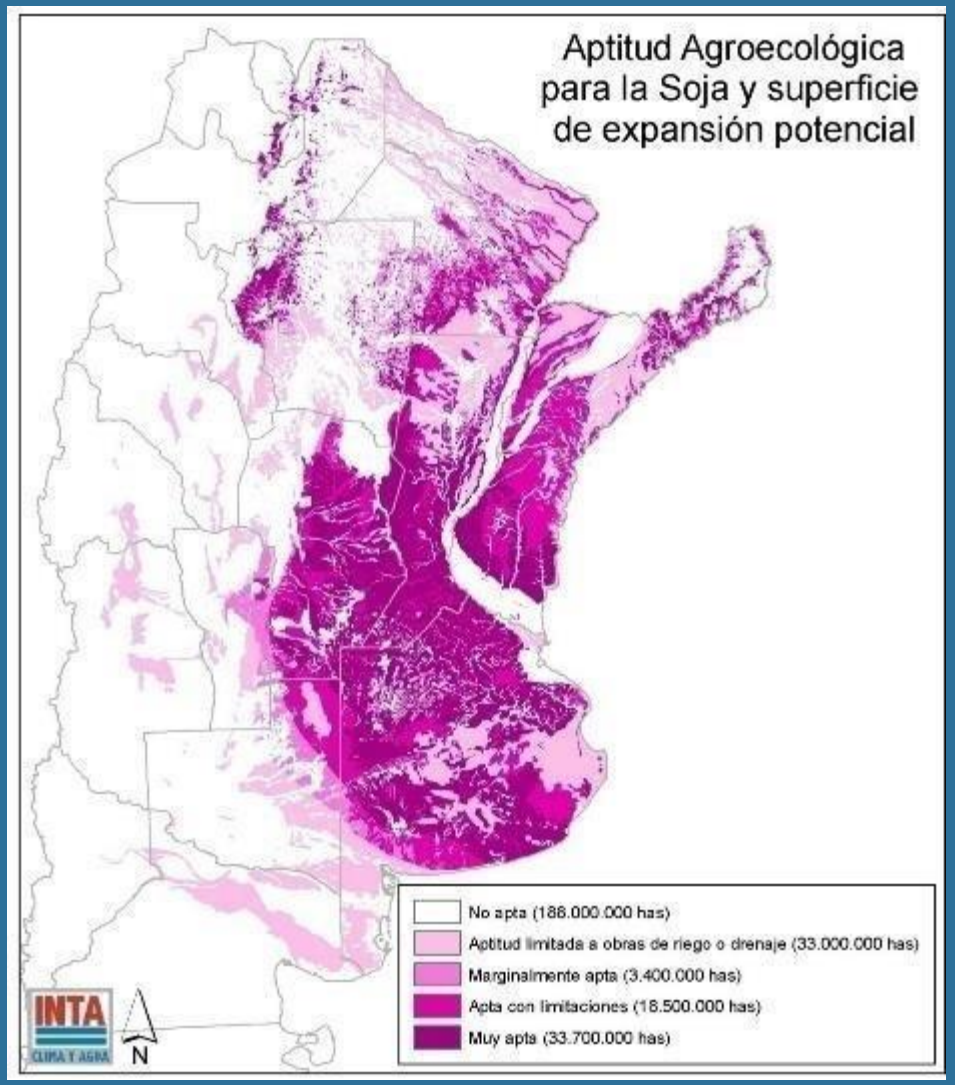


	0	1	2	3	4
0	0	0	0	0	0
1	0	1	1	1	1
2	0	1	2	3	3
3	0	1	3	3	4
4	0	1	3	4	4

	0	1	2	3	4
0 No apta	91.802.000	5.061.239	62.767	107.267	204.161
1 Marginalmente apta	46.665.635	15.339.233	5.158.873	1.869.154	79.154
2 Marginalmente apta. Deficit hídrico	3.785.591	5.225.483	5.470.536	4.366.289	1.184.367
3 Apta con limitaciones	5.239.425	6.901.269	4.565.222	2.578.375	3.999.354
4 Muy apta	11.559.386	12.291.072	10.375.991	14.315.369	19.659.006
Total	159.053.437	44.818.281	25.633.411	22.566.453	25.086.842

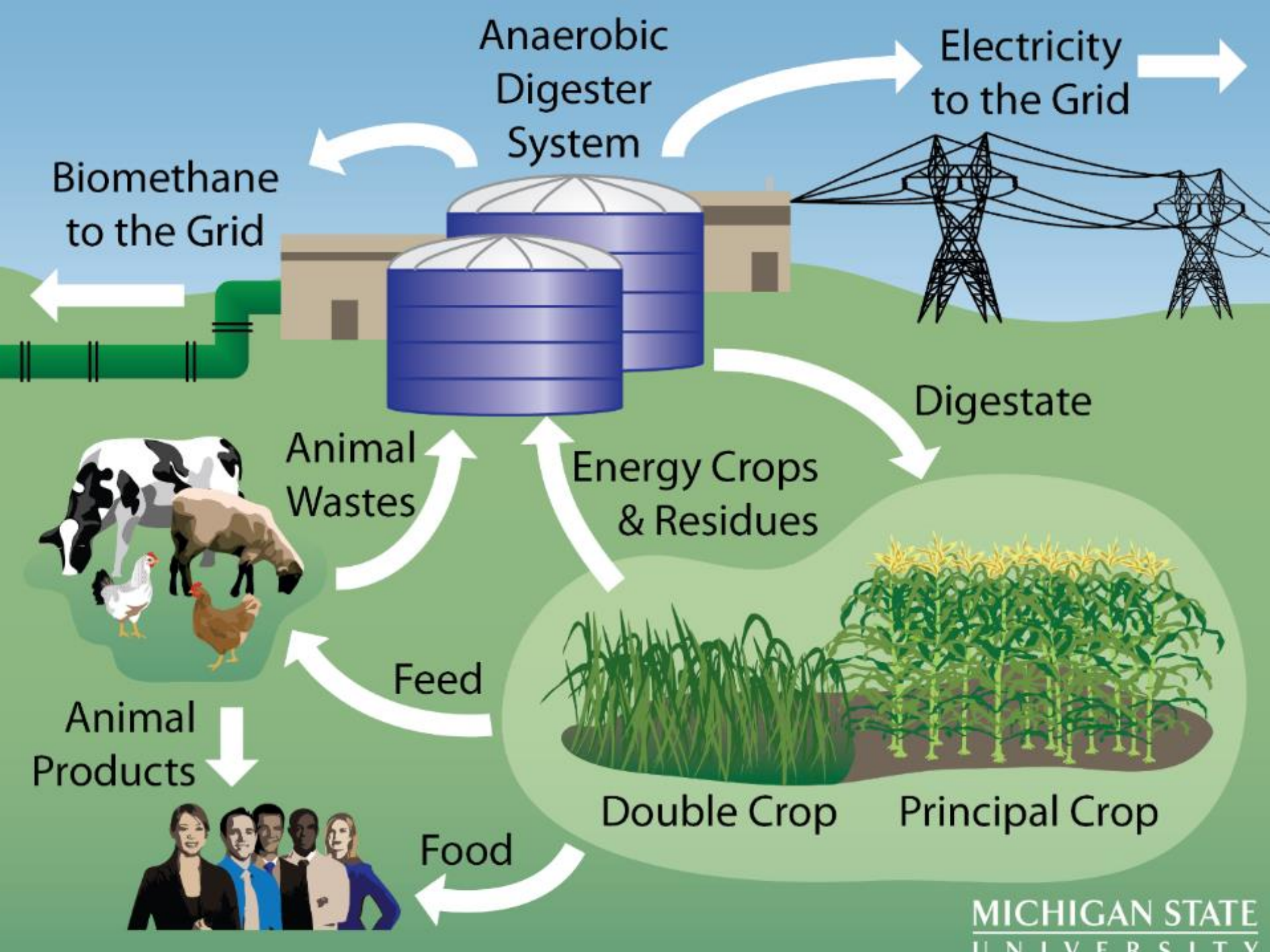


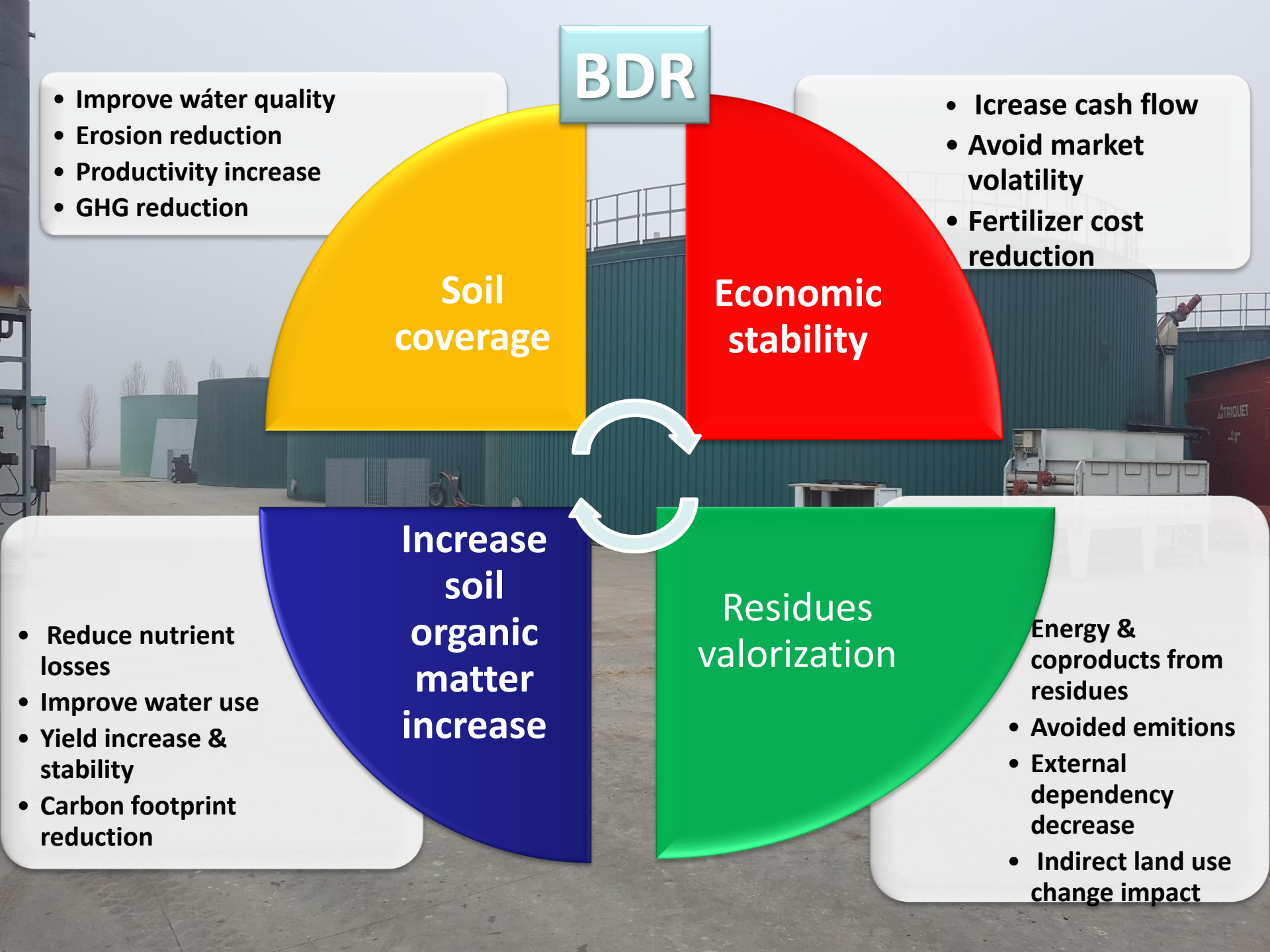
Restricted Areas to agriculture under biodiversity and legal consideration

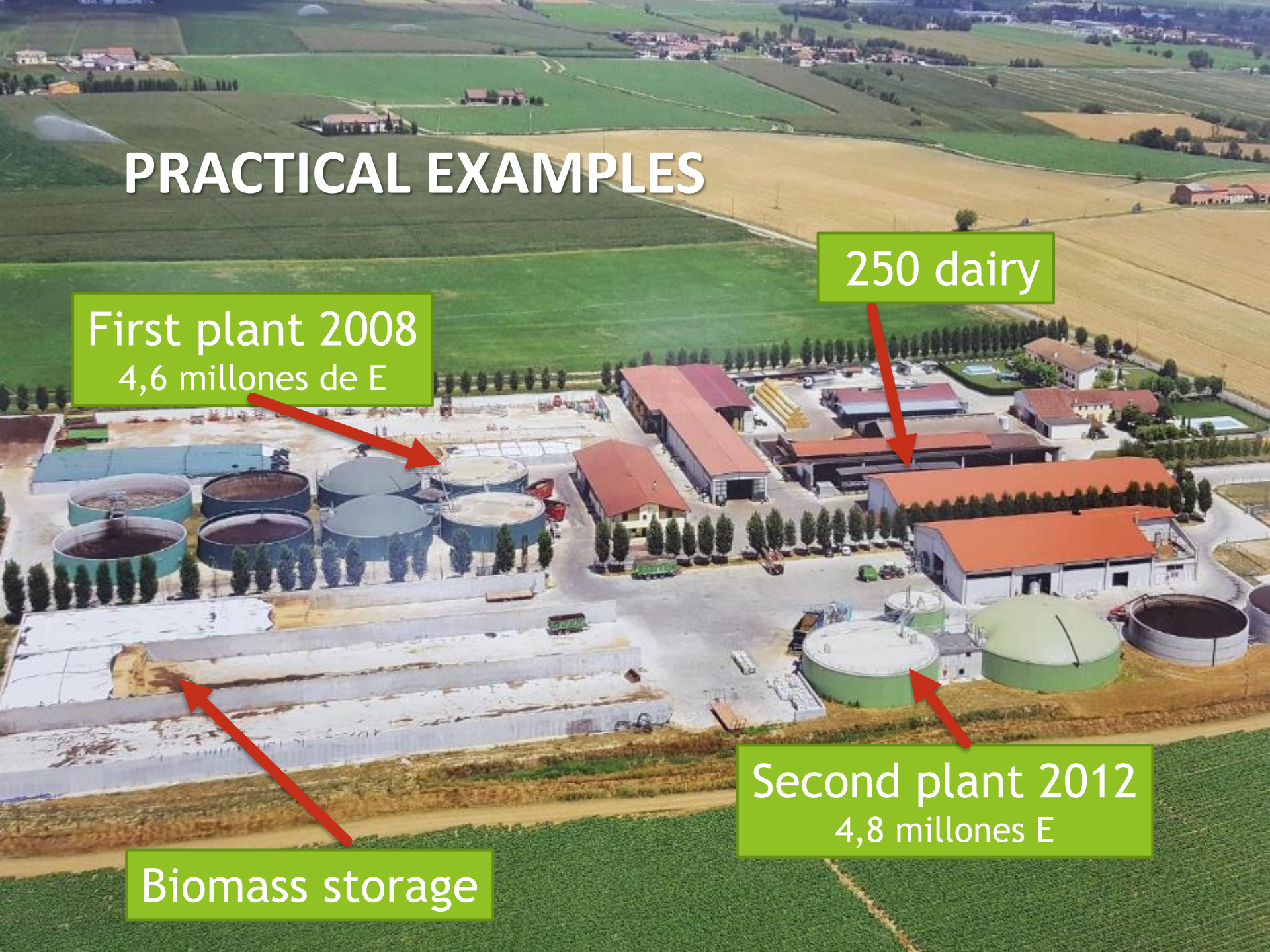


Agroecological Aptitude for soybean under biodiversity and legal considerations.


IN COLLABORAZIONE CON
ECOMONDO
KEY ENERGY
UN PROGETTO
CIB
CONSORZIO ITALIANO BIOGAS
Biogasdoneright™
BIOGASITALY
Roma, 23-24 febbraio 2017


Anaerobic Digester System
Electricity to the Grid
Biomethane to the Grid
Digestate
Animal Wastes
Energy Crops & Residues
Feed
Animal Products
Food
Double Crop
Principal Crop
MICHIGAN STATE


BDR
Soil coverage
Economic stability
Increase soil organic matter increase
Residues valorization
• Improve wáter quality
• Erosion reduction
• Productivity increase
• GHG reduction
• Icrease cash flow
• Avoid market volatility
• Fertilizer cost reduction
• Reduce nutrient losses
• Improve water use
• Yield increase & stability
• Carbon footprint reduction
Energy & coproducts from residues
• Avoided emitions
• External dependency decrease
• Indirect land use change impact


PRACTICAL EXAMPLES
First plant 2008
4,6 millones de E
250 dairy
Second plant 2012
4,8 millones E
Biomass storage

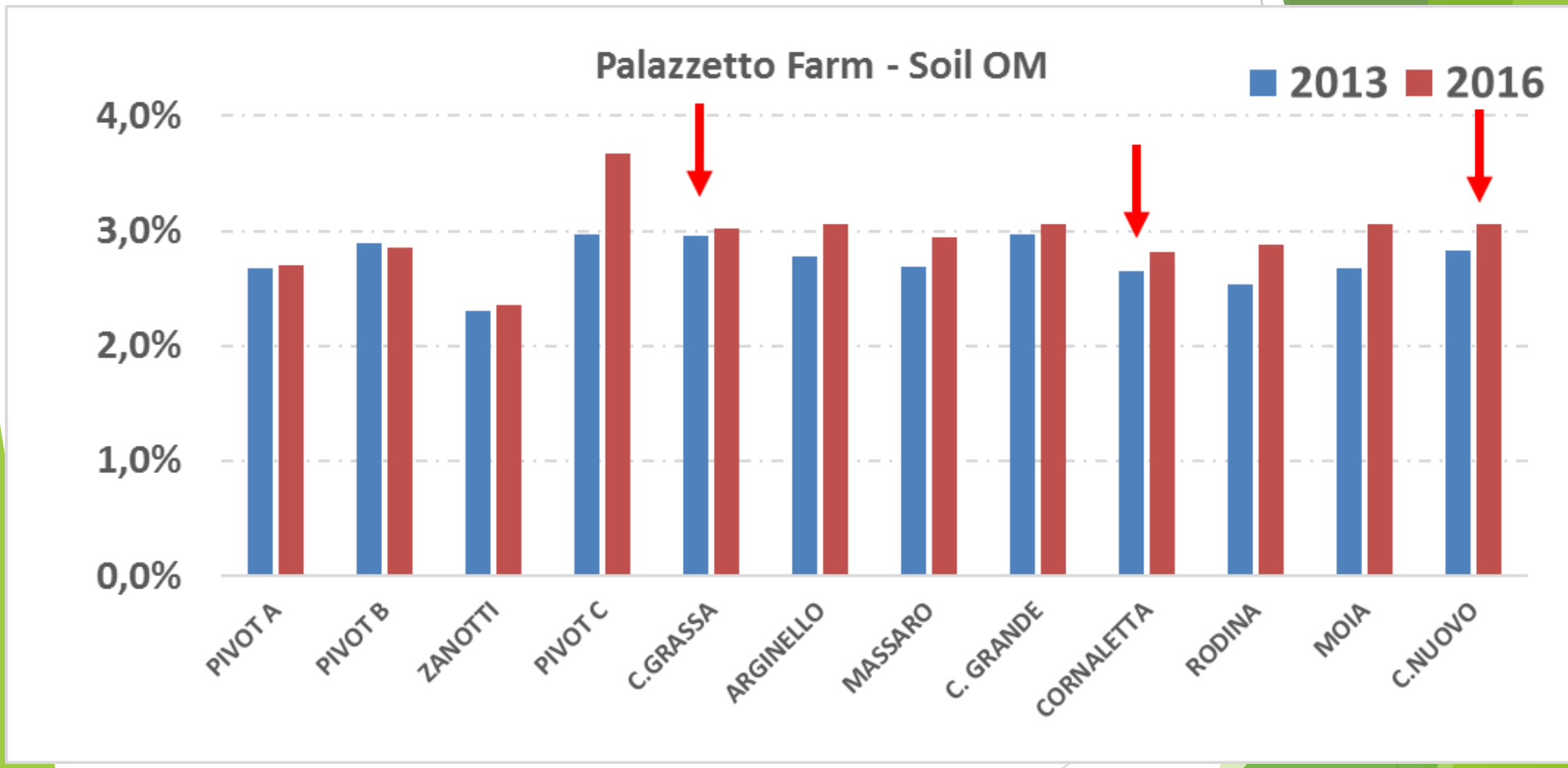
Soc. Agricola Cazzola Francesco Luigini

- 250 dairy farm
- Products
  - Milk68 l/day
  - Pasteurized animal bedding
  - Digestate
  - Concentrated liquid fertilizers
  - Round bale forage drying service
  - Electricity 2 Mw (2 biogas plants)
  - Cash flow increase 600.000 to 12 millon Euro

Use of Presition ag and ridge tilling form digestate application

Organic matter improvement

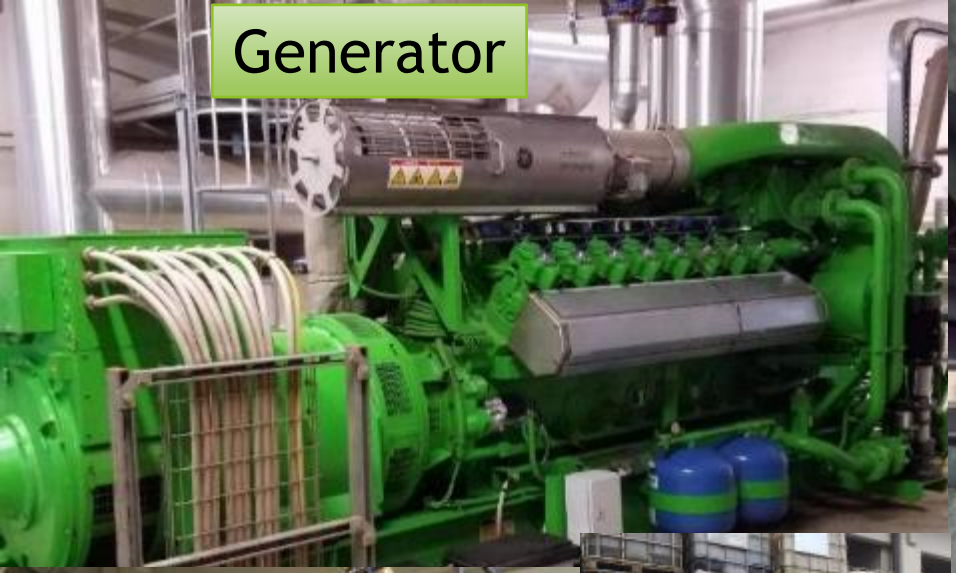
Az. Palazzetto




Heat & electricity


Round bales drying

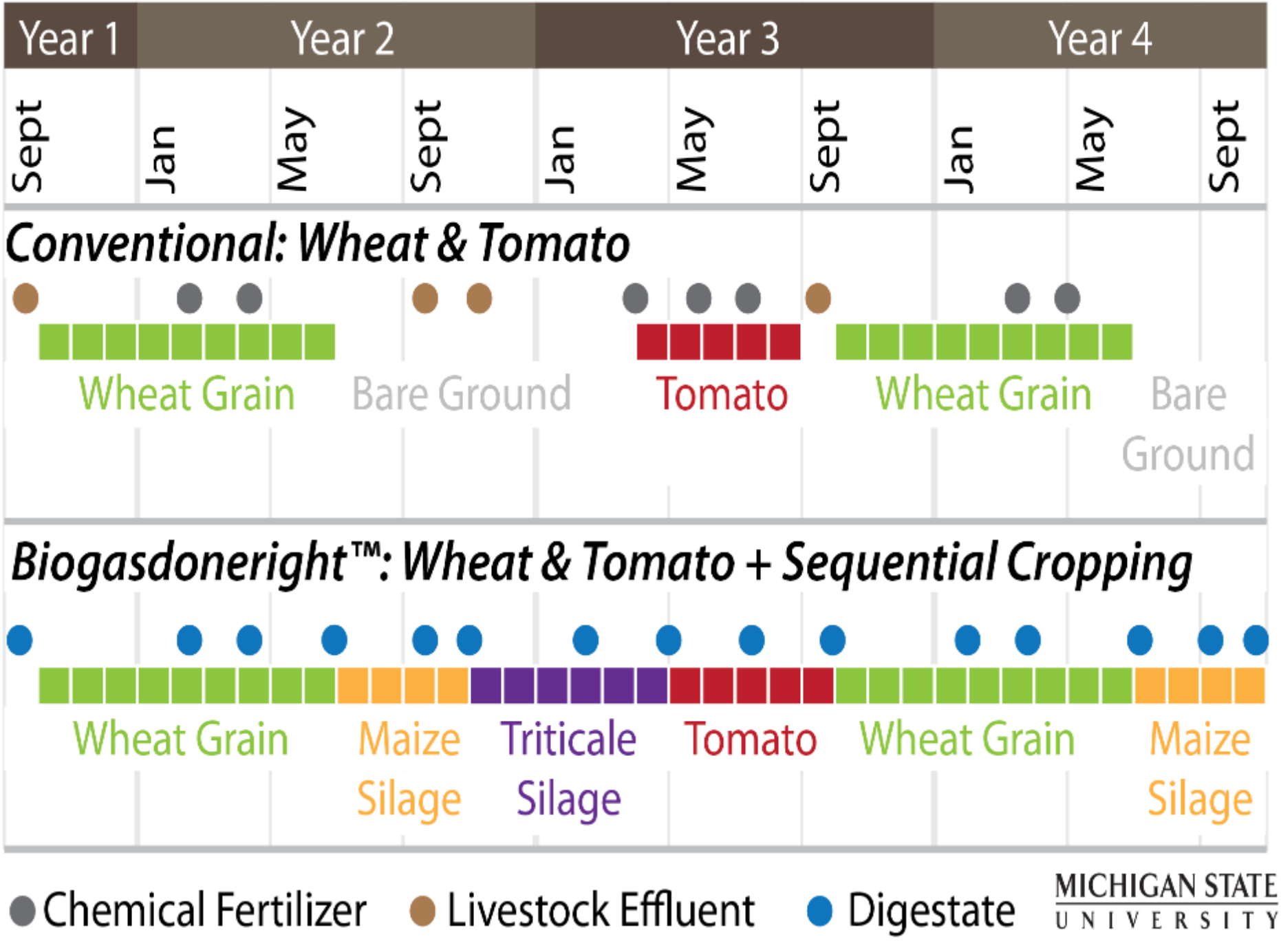

Pasterurized bedding



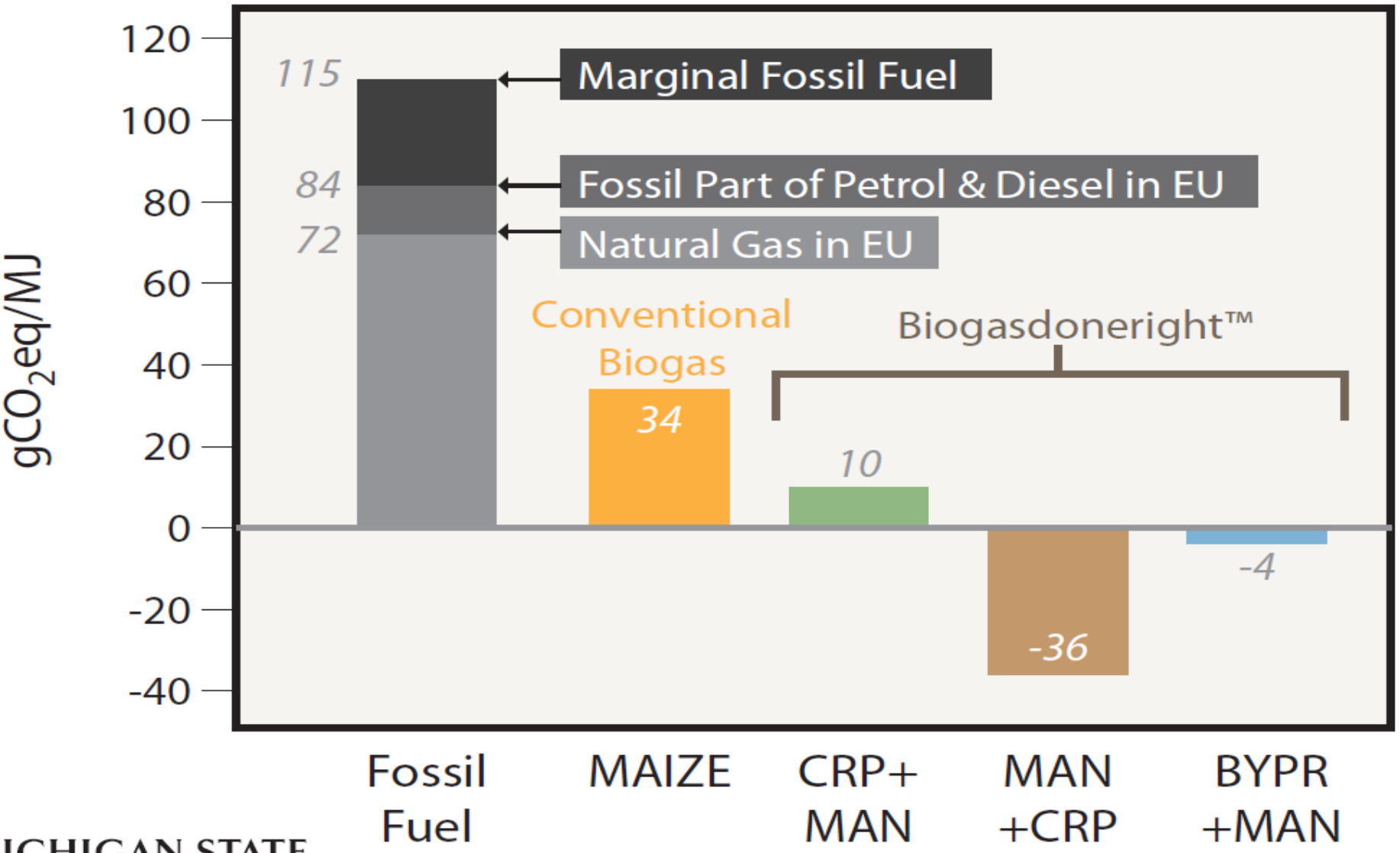
Generator

Liquid fertilizer production

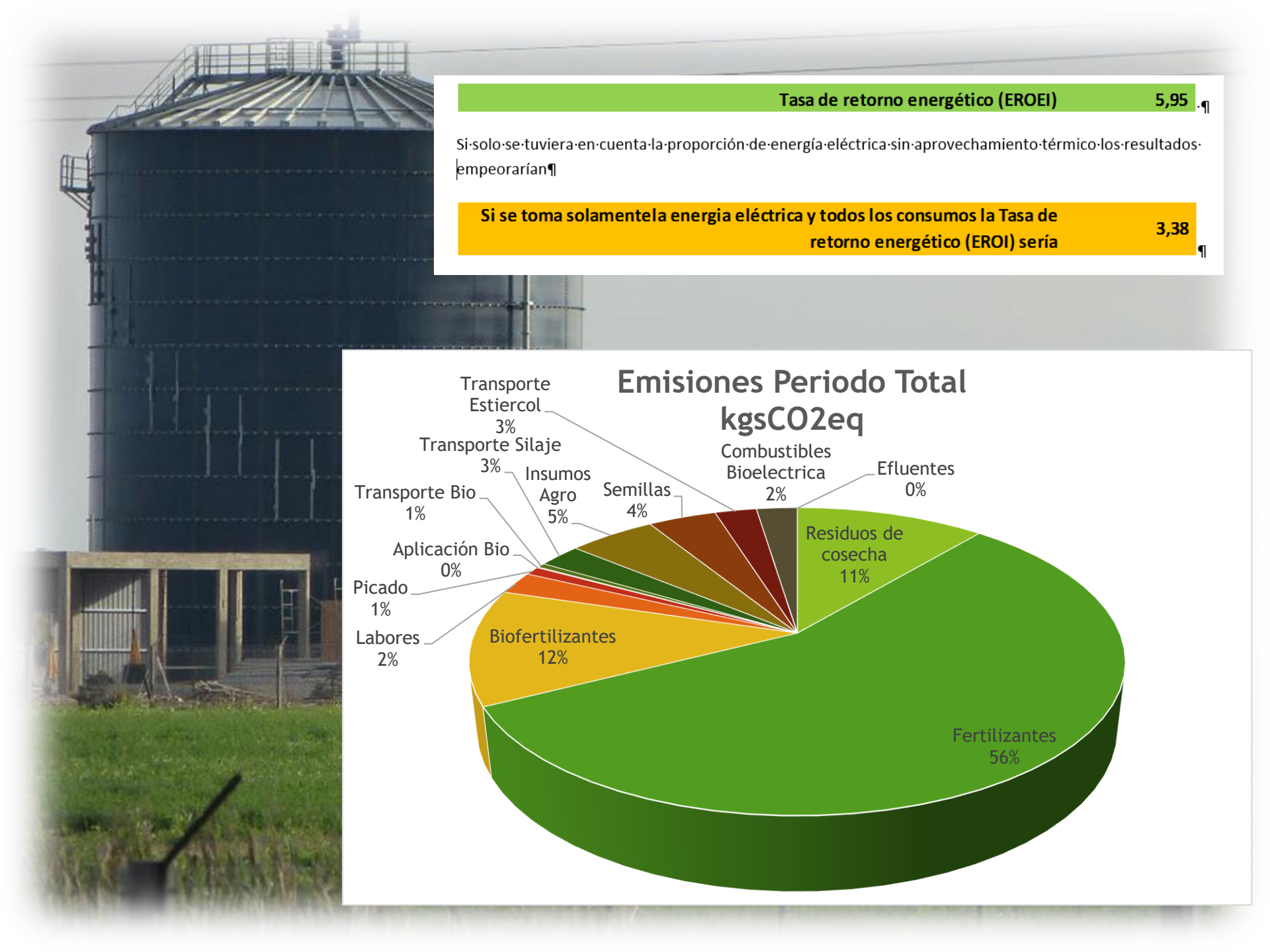
Bale drying


Year 1
Year 2
Year 3
Year 4
Sept
Jan
May
Sept
Jan
May
Sept
Jan
May
Sept
Conventional: Wheat & Tomato
Wheat Grain
Bare Ground
Tomato
Wheat Grain
Bare Ground
Biogasdoneright™: Wheat & Tomato + Sequential Cropping
Wheat Grain
Maize Silage
Triticale Silage
Tomato
Wheat Grain
Maize Silage
Chemical Fertilizer
Livestock Effluent
Digestate
MICHIGAN STATE UNIVERSITY

Sustentabilidad respecto a los fósiles



MICHIGAN STATE UNIVERSITY



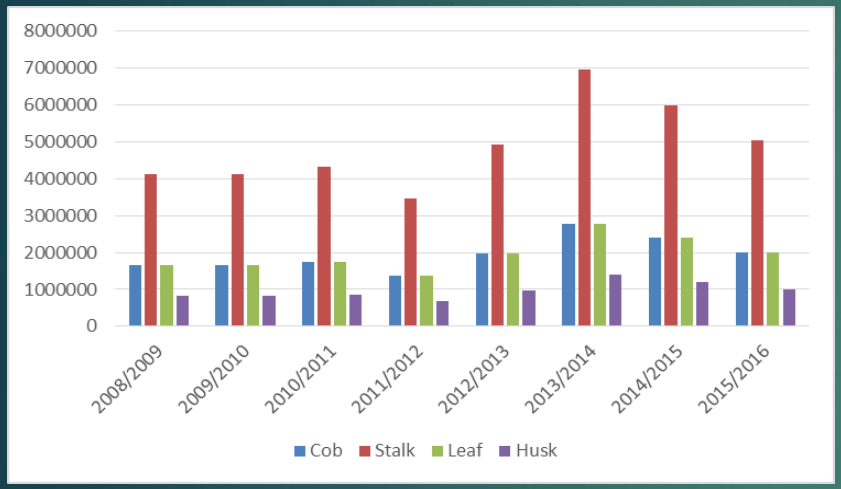
Tasa de retorno energético (EROEI)	**5,95**

Si·solo·se·tuviera·en·cuenta·la·proporción·de·energía·eléctrica·sin·aprovechamiento·térmico·los·resultados·empeorarían¶

Si se toma solamentela energia eléctrica y todos los consumos la Tasa de retorno energético (EROI) sería	**3,38**

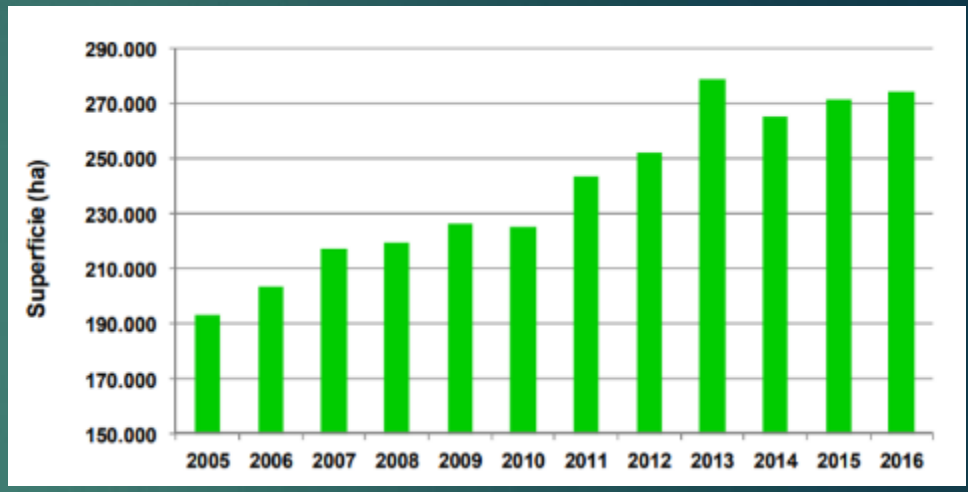
ARGENTINA HAS 100 DIGESTERS AND AN ENORMOUS POTENTIAL

Biorefinery potential sites should start with an Initial choice of biomasses and theoretical quantities



Theoretical biomass potential varied in the past 7 years between 700,000 t and 1,400,000 t.

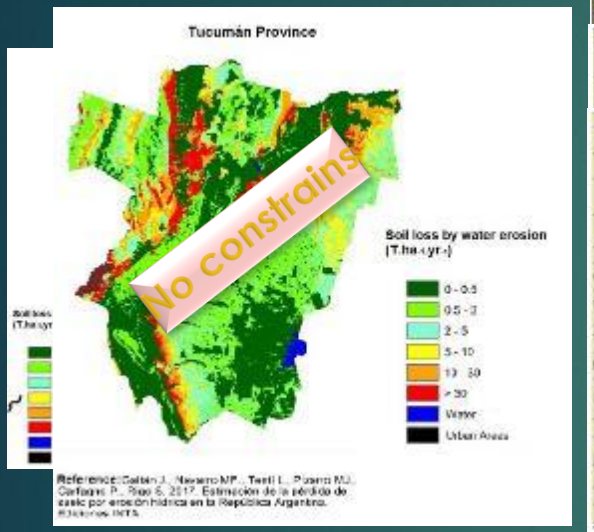
Figure shows theoretical biomass potential variation fractions were calculated from an average distribution of: 50% stalks, 20% leaves, 20% cobs and 10% husks or spathes.



Experts, fixed a potential of collection of the residue in 5 t / ha / year.With such yield the theoretical biomass potential for sugarcane crop residues in 2016 estimate of 1.3 Mt. Departments which could provide the greatest amount were Leales, Cruz Alta, Simoca and Burruyacú, sugarcane production ranging between 57 and 75 t / ha / year.

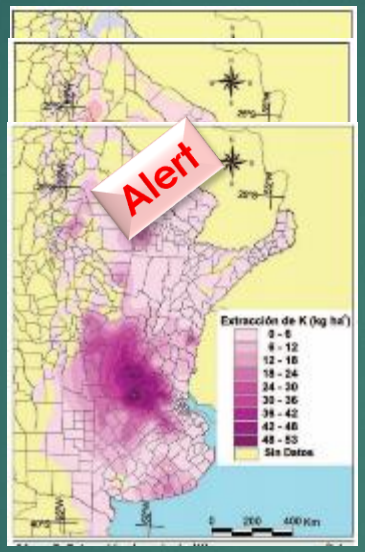
Agronomic potential

Soil erosion



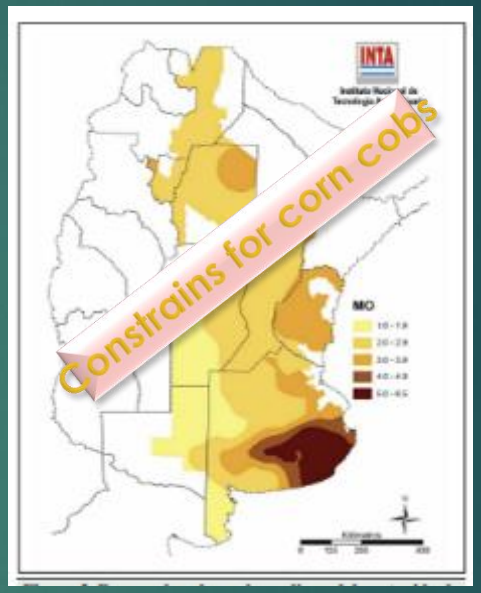
Risk areas to be avoided a recent study of INTA Gaitan et al 2017 on national soil erosion was used. This study estimates the intervening factors in the Universal Soil Loss Equation (USLE) for the estimation of water erosion, integrates all the factors that intervene in the equation, through Geographic Information Systems (GIS) and obtained the map with the rate of soil loss due to water erosion for the entire territory of the Argentine Republic

Nutrient balance



There is a low nutrient reposition in Argentina that can be seen in the work done by Cruzate and Casas when mapping nitrogen, potassium and phosphorus balance only considering the grains extraction of the fields

Soil organic matter



INTA Pergamino experimental station soil specialists performed a series of studies for the project regarding soil carbon balance and projections (Irizar, A.; Milesi Delaye; L.; Andriulo, A.). To simulate the evolution of the SOC, the AMG model for predicting the evolution of SOC The model runs on an annual basis and assumes that fresh organic matter is mineralized or humified in the soil after one year.

Biodiversity

A specific survey was made on the two provinces under study. Different layers of maps were used in order to verify if there was any conflict between the potential feedstock supply areas and environmental restriction or protections.

Technical potential

CONFIDENTIAL DOCUMENT

The losses during the supply chain can be estimated from 10 to 20%. So it can be concluded that the technical potential is 80 to 90%.

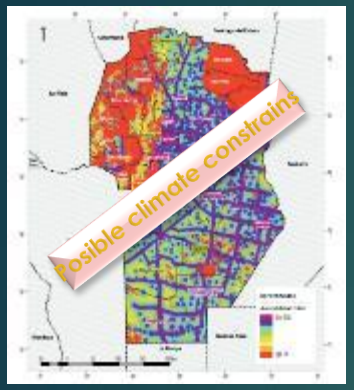
The losses during the supply chain can be estimated from 10 to 20%. So it can be concluded that the technical potential is 80 to 90%.

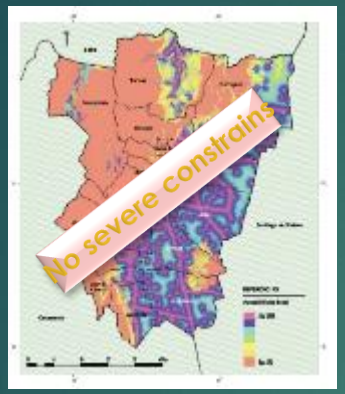
Non competitive potential

- Corn cobs are not extensely collected. Machinery technology is not available. Increasing harvesting costs and time will be critical. Price will be over 25 €/t. There is a need to develop the whole chain including a densification process. The use of cobs as food for livestock will not be competitive at that price. So the non-competitive potential is estimated to 100%.

- Sugarcane crop residues were either left to decompose or burned in the fields. There are new projects being presented for heat & electricity. Two contractors pick them up and sell them for forage or fuel for boilers. Trade price of such biomass between 17 and 20 €/t . The part of exportable sugarcane crop residues that is used as complementary fuel with bagasse is estimated to 10%. Therefore, currently the non-competitive potential is estimated at 90%

Logistics and operational costs of the preselected biomasses





50 % reduction in corn combine speed, increase to 141 $/ha, and the additional cost for harvesting the cob would be 48 $/ha (Maung & Al 2011). Machinery not available.

So the overall cost for harvesting and separating the cob in one pass would be 119 $/ha (141-71+48) or 102 $/t (82 €/t 02/18 conv.rate) using an average yield for cob of 0.86 t/ha.

The analysis of the road network was carried out using the vector layer corresponding to the SIG250 of the National Geographic Institute (IGN). It was encoded based on specific bibliography on relations between the type of road and the difficulty of displacement (World Bank, 1995). Of this mode, to perform the spatial analysis was weighted accessibility according to the characteristics of the road network and, considering the attributes

Sugar cane residue total cost of supply including swathing, baling, field transport, transport to storage facility, loading to plant and the cleaning prior to processing in the factory ranged from 36 to 43 €/t.

PAN AMERICAN BIOFUELS AND BIOENERGY SUSTAINABILITY - AN NFS RESEARCH COORDINATION NETWORK

PAN-AMERICAN BIOFUELS & BIOENERGY SUSTAINABILITY

2ª RCN Conferencia Panamericana sobre
Sustentabilidad en Biocombustibles y Bioenergía
Buenos Aires, Argentina - Septiembre 13-16, 2016

10 bullet points regarding bioproducts and bioenergy production from biomass

- To achieve sustainable development goals modern bioenergy derived from the Earth's photosynthetic capacity has a great potential to overcome "energy poverty" in the poorest countries. There is a great challenge to increasing its world scale significantly in the next years going from 23 to 93 EJ
- Acceptability of bioproducts is strongly connected with communication to the public and a correct public perception of net sustainability benefits compared to fossil energy.
- Sustainability has become an essential and indivisible part of modern bioproduct production and use.
- Traditional biomass use for energy linked to depletion of natural resources and environmental problems has to be clearly differentiate from modern and sustainable forms of use, which can provide many sustainability benefits such as increased employment, better water quality, reduced greenhouse gases and so forth.

Jorge Antonio Hilbert INTA CIA IIR

- There is an urgent need to enlarge the total photosynthesis capture surface over the earth in order to substantially increase the biomass production for all purposes achieving millennium goals. Catch crops, double cropping and higher efficiency plants are some alternatives. We are facing a new revolution in biomass productivity and transformation by means of C4 plants potential and new transforming technologies. However, the long-term sustainability of these high productivity systems must be assured through continuous monitoring.
- Low energy density and high geographical dispersion implies great challenges for the feedstock supply chain regarding logistics and transport. Satellite assistance and the use of geographical information systems is essential to reach a sustainable development of different forms of biorefineries
- Biomass transformation generates multiple impacts with economic, environmental, and social benefits that must be measured, considered and improved. The transformation of biomass and production of bioenergy must be addressed in a systemic and holistic manner with proper consideration of site-specific manner factors in order to contemplate multiproduct, multimarket and multirequirements.

- There are economic and political reasons underpinning promotion and regulatory actions being implemented by different countries or regions. Consumer and producer initiatives and considerations including farmers and producers of all sizes must be equally taken into account.
- Standards and certification schemes are very useful to encourage sustainability of bioproducts; however, they may not always achieve sustainability improvements. There is a need to improve them in order to consider the ability of small producers to support these mandates. Certification procedures need to be practical, adapted to agriculture particular needs, accessible to small farmers, adapted to local needs, and support continual improvement
- Improvements in productivity and environmental performance are occurring in all bio transformations with sometimes-positive outcomes that have to be deeply studied and promoted.
- Innovations in biorefineries technology at all stages in the pathways are making possible improvements to economic, environmental, and social sustainability.
- Incentives should be placed to continue development and improvements of innovative biorefinery technologies with yield economic, environmental, and social benefits.

¡Muchas Gracias!

Ing.Agr. M.Sc. Jorge A. Hilbert
Instituto de Ingeniería Rural CIA

Mail hilbert.jorge@inta.gob.ar

jorgeantoniohilbert@gmail.com

https://sites.google.com/view/jorge-antonio-hilbert/p%C3%A1gina-principal

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