INTERNATIONAL WORKSHOP

"SUSTAINABILITY IN GLOBAL TRADE OF BIOFUELS AND BIOPRODUCTS"

Biofuel Production from Soy in Argentina

Ministerio de Agricultura, Ganadería y Pesca
Presidencia de la Nación

is a public decentralized body subordinated to the Ministry of Agriculture, Livestock and Fisheries 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)

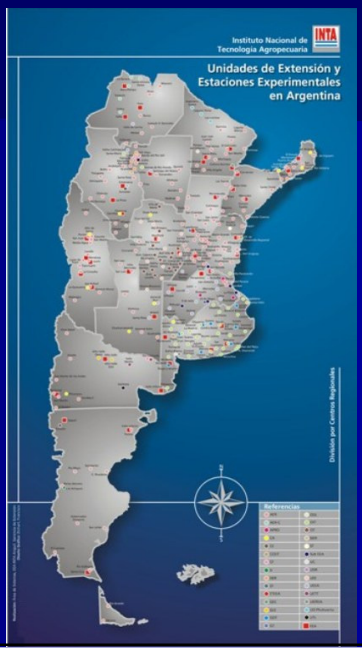
NATIONAL STRUCTURE

- Central office B.A.
- 15 Regionales centers
- 47 Experimental stations
- 4 Research centers
- 13 Research institutes
- 240 Extension units
- 9 Innovation parks
- INTA group members:
  - Foundation ArgenINTA
  - Private company INTEA S.A

7300 EMPLOYEES

Year budget 250 M dollars

http://www.inta.gov.ar



ARGENTINA: FACTS AND FIGURES

Official name: Argentine Republic

Chief of state: Cristina FERNANDEZ DE KIRCHNER

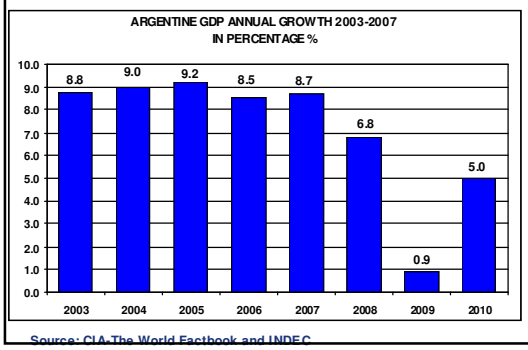
Capital: Buenos Aires

Area: 2.8 million sq km

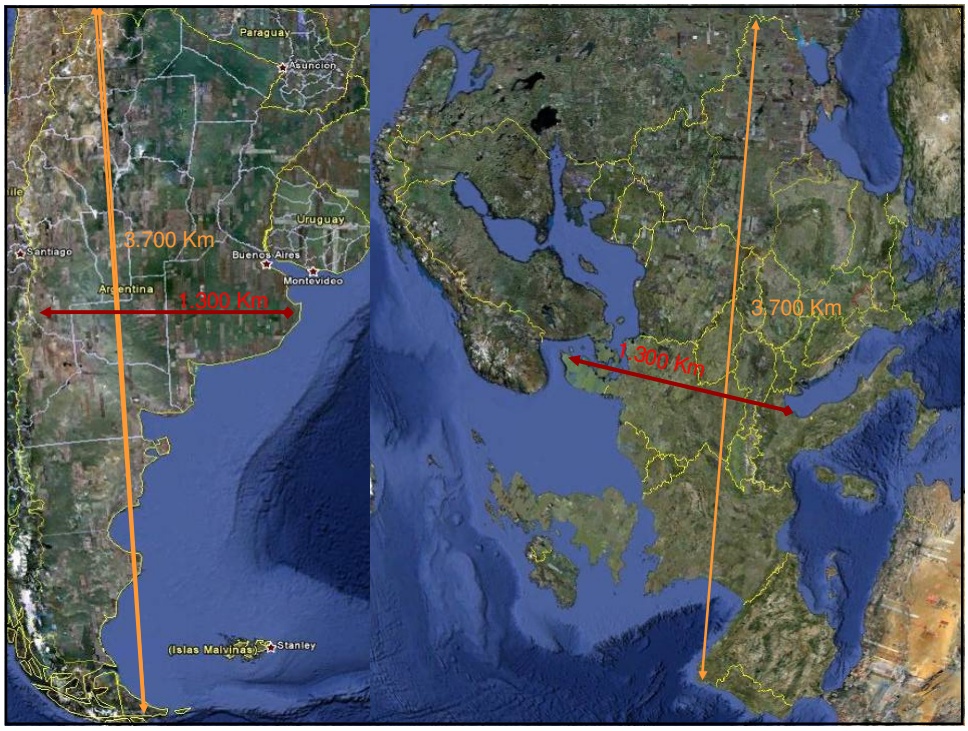
Population: 40 million inhabitants

GDP (purchasing power parity): US$ 560 billion

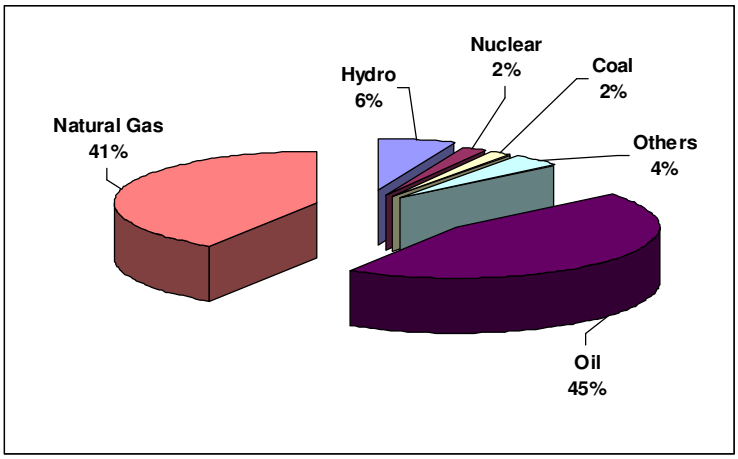
GDP - per capita (PPP): US$ 14,000



Source: CIA-The World Factbook and INDEC

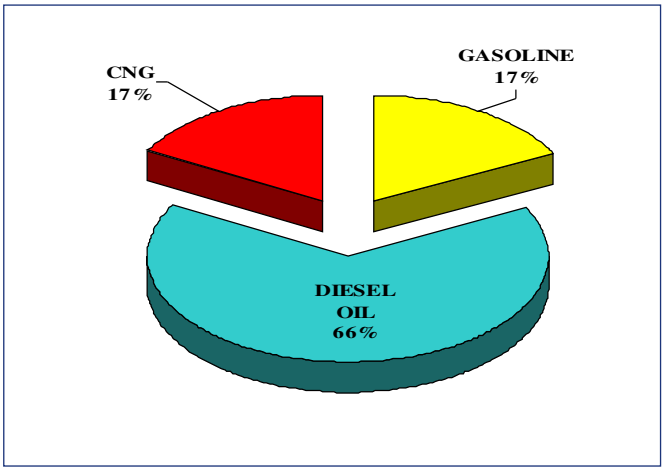


ARGENTINE ENERGY CONSUMPTION BY SOURCE



Source: Department of Energy, Argentina

LIQUID FUELS - CONSUMPTION



Argentina imports 3 to 4% of total diesel oil

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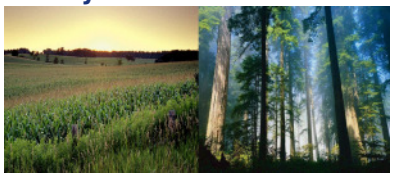
ARGENTINA

REASONS FOR THE DEVELOPMENT OF BIOFUELS IN ARGENTINA

- Comparative advantages of Argentina in the production of oil crops: large and fertile extensions of land available for oilseed production.

- Flexibility for the implementation of oilseed crops from natural and artificial irrigation.

- Great number of varied ecosystems that allow for the growth of a diversity of crops.



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REASONS FOR THE DEVELOPMENT OF BIOFUELS IN ARGENTINA

WORLD SOYBEAN PRODUCTION 2008:

Country	Production	Share
	million tons	%
USA	72.9	33%
BRAZIL	61.0	28%
ARGENTINA	46.2	21%
CHINA	14.0	6%
SUBTOTAL	194.1	88%
REST	26.4	12%
TOTAL	220.5	100%

Source: SOYSTAT- USDA

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REASONS FOR THE DEVELOPMENT OF BIOFUELS IN ARGENTINA

- One of the main exporters of vegetable oil in the world.
- The oil industry in Argentina is export- oriented, sending 95% of its production to the foreign market.

(2008 crushing capacity : 160,000 tons/day).

SOY OIL	6.1 Million Tons
SUNFLOWER OIL	1.7 Million Tons
OTHERS	0.1 Million Tons
TOTAL	7.9 Million Tons

Source: CIARA

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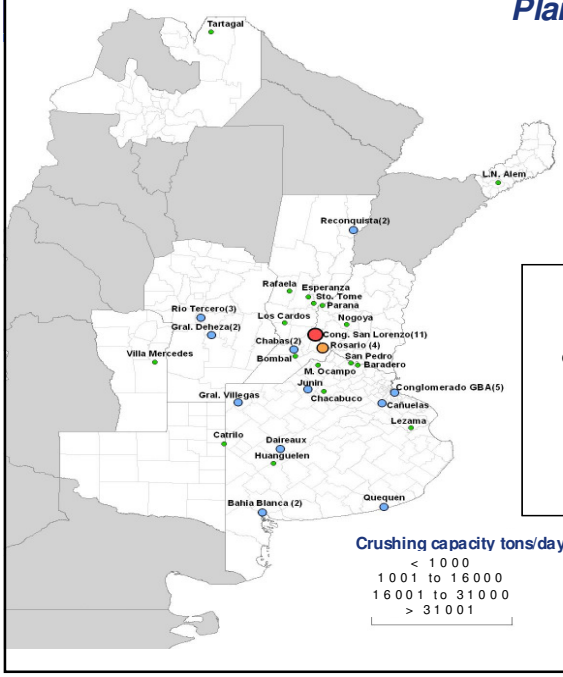
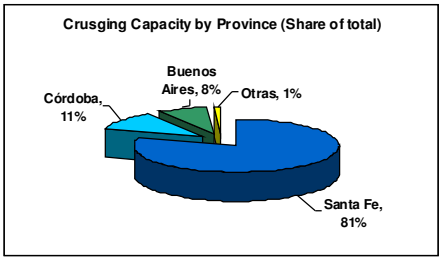
Plants by crushing capacity





Crushing capacity tons/day

< 1000
1001 to 16000
16001 to 31000
> 31001

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MAIN TOOL FOR THE DEVELOPMENT OF BIOFUELS IN ARGENTINA

- **The creation of a legal framework for the development of this new industry.**

  - **The Argentine Congress approved on April 19th, 2006 a law aimed to promote the use and production of biofuels in the country. The biofuels involved are: biodiesel, bioethanol and biogas.**

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AVAILABILITY OF RAW MATERIAL FOR BIODIESEL PRODUCTION IN ARGENTINA

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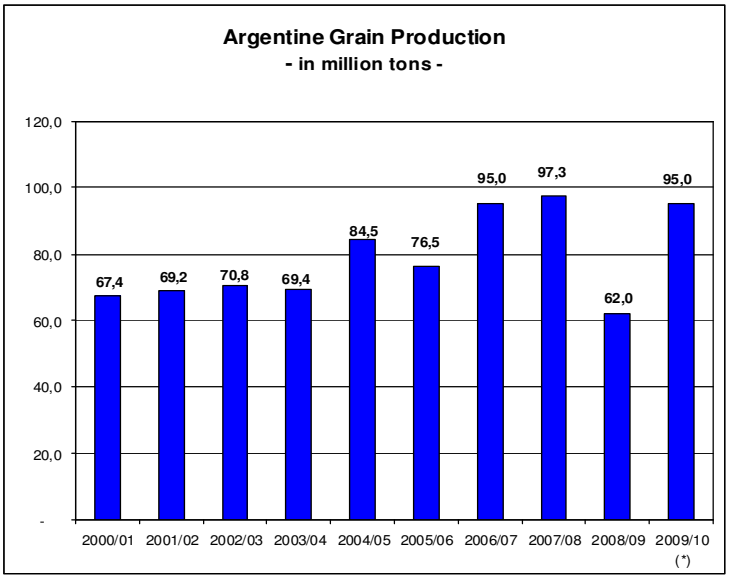
ARGENTINE GRAIN PRODUCTION



Source: Ministry of Agriculture, livestock and fisheries of Argentina
(*) Estimated

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ARGENTINA

ARGENTINE GRAIN PRODUCTION

Argentine total grain production for the 2007/2008 reached 95,0 million tons.
SOY, CORN and WHEAT account for almost 90% of total grain production.

Total Grain Production 2007/2008 season:

Grain	Planted area	Production	Share
	million hectares	million tons	%
SOY	16.6	46.2	47%
CORN	4.2	22.0	23%
WHEAT	6.0	16.3	17%
SUNFLOWER	2.6	4.7	5%
SORGHUM	0.8	2.9	3%
OTHERS	1.8	5.2	5%
TOTAL	32.0	97.3	100%

Source: Ministry of Agriculture, Livestock and Fisheries - Argentina

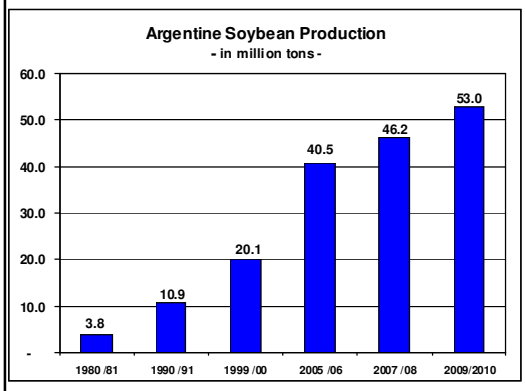
Ministry of Agriculture, Livestock and Fisheries National Presidency
ARGENTINA

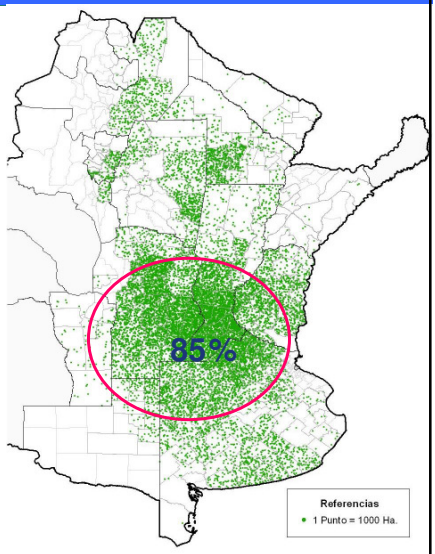
ARGENTINE GRAIN PRODUCTION

Soybean Production

Campagne
2007 – 2008

46.2 million tons





Source: Ministry of Agriculture, livestock and fisheries of Argentina- 2009/2010 projected

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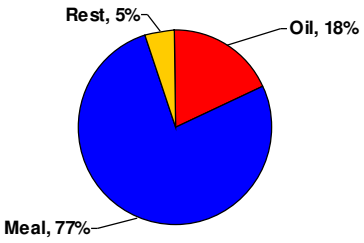
MAIN IMPACTS EXPECTED FROM THE LAW

With the implementation of the 5% mandatory use of biofuels, the needed production is:

- **Biodiesel: 800,000 tons**
- **Vegetable oil: 830,000 tons. (10% of total current production).**
- **Soybean seed contains 18% oil, and 77% protein meal**



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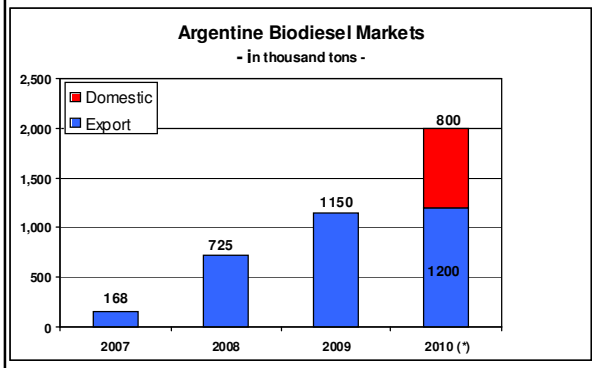
RECENT DEVELOPMENTS

23 Biodiesel plants

Total production capacity : 2,5 million tons.

Total Investments: US$ 500 million



Source: Department of Energy and CARBIO
(*) Projected

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National Presidency
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FOREST LAW No. 26331 – December 2007

The law establishes:

- **A moratorium on any natural forest cutting until each province produces a Native Forest Land Inventory and Land Management Plan.**

- **An obligation to produce an environmental impact study and hold a public hearing before approving any clearing.**

- **Respect for the rights of indigenous and rural communities over forests they use.**

- **A prohibition on open burning of forest cuttings waste.**

http://www.infoleg.gov.ar/infolegInternet/anexos/135000-139999/136125/norma.htm

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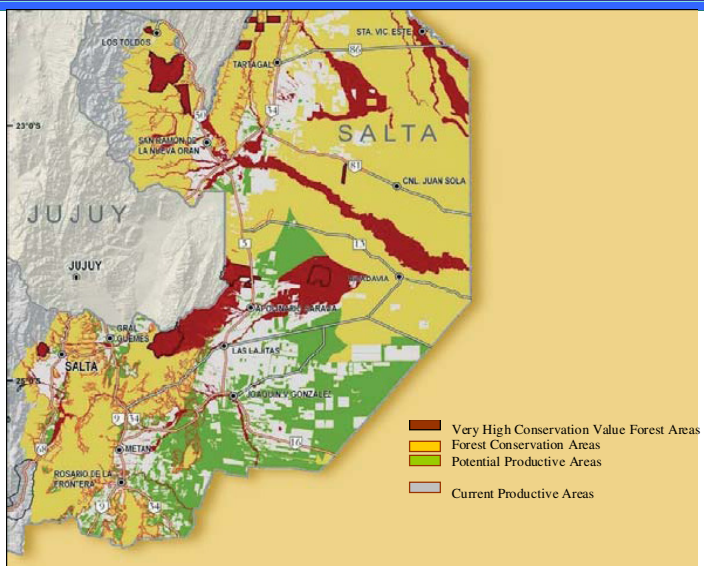
FOREST LAW No. 26331 – November 2007

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.



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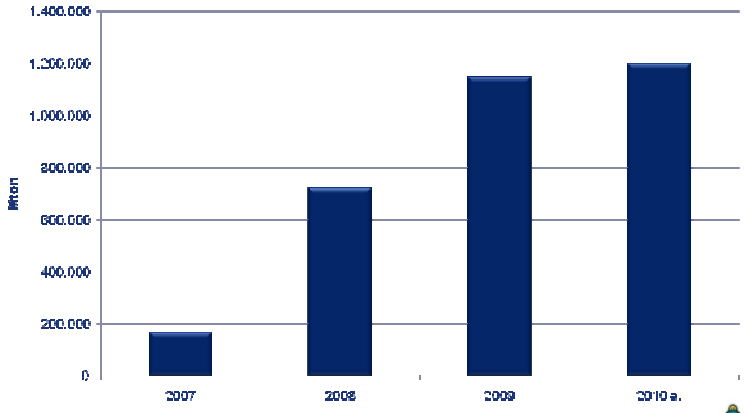
Argentine Biodiesel Exports, by year



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Crushing plants in Argentina have the largest capacity in the world

COUNTRY	Installed Capacity		Plants	Installed Capacity	5 largest plants
	Per day Mton	Annual MM Mton	Number	Average per plant (Mton/day)	Average per plant (Mton/day)
ARGENTINA	152.000	50.16	50	3.040	7.900
USA	154.827	51,09	71	2.181	2.350
BRAZIL	143.515	47.36	101	1.421	2.200
CHINA		42.00			

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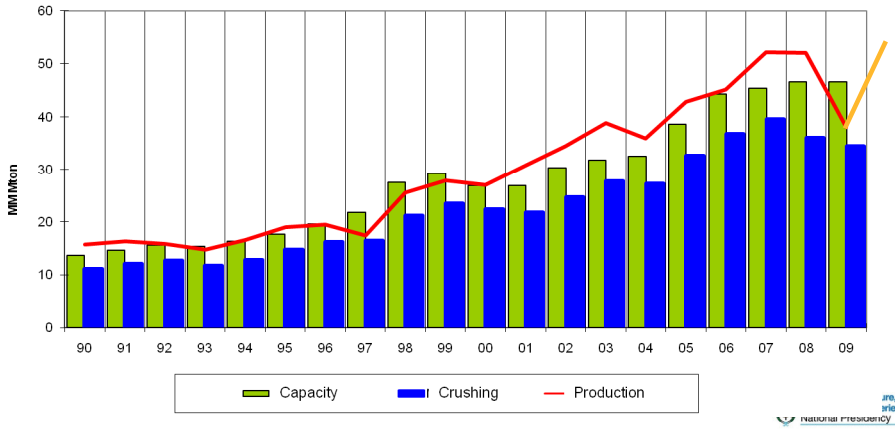
Evolución de la Producción, Molienda y Capacidad instalada

Argentine soybean production, crushing and crushing capacity



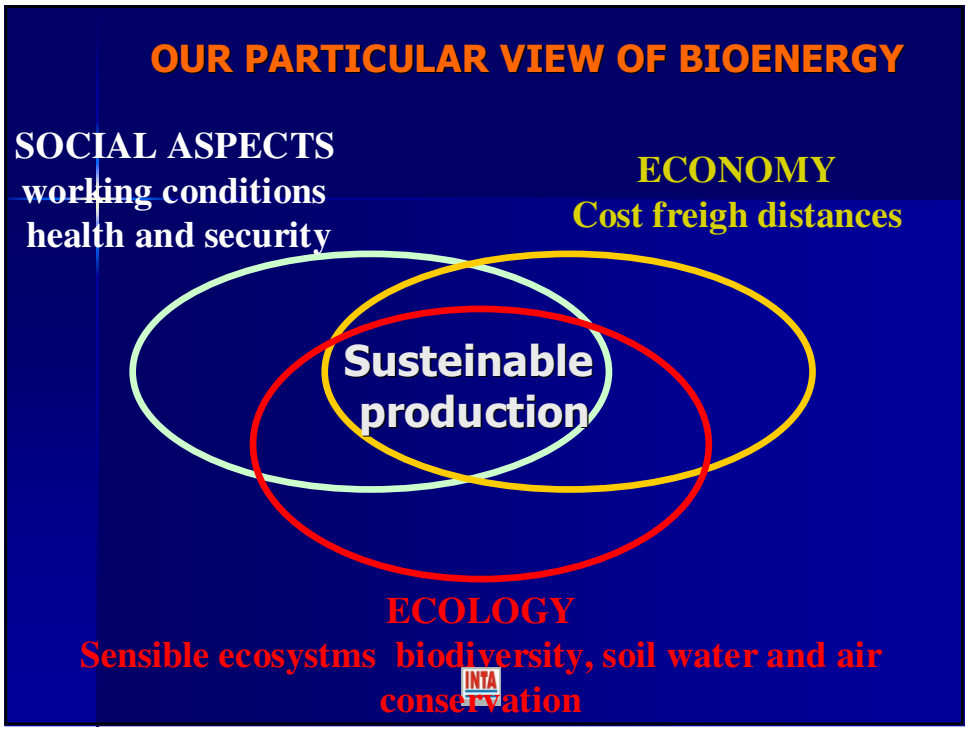
ARGENTINA

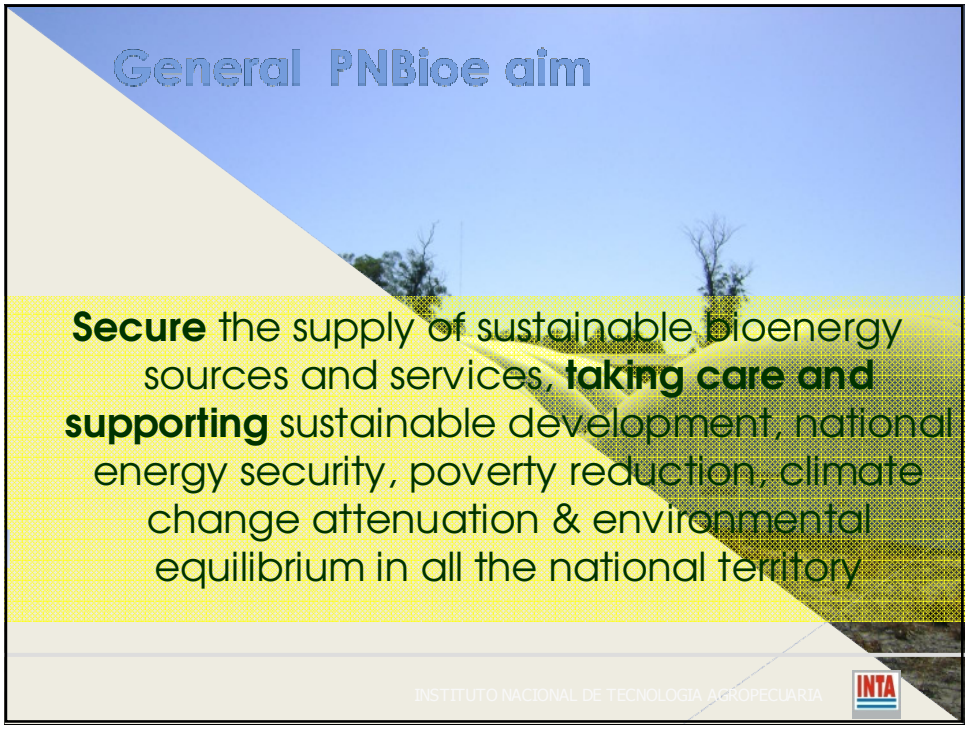
Our plants

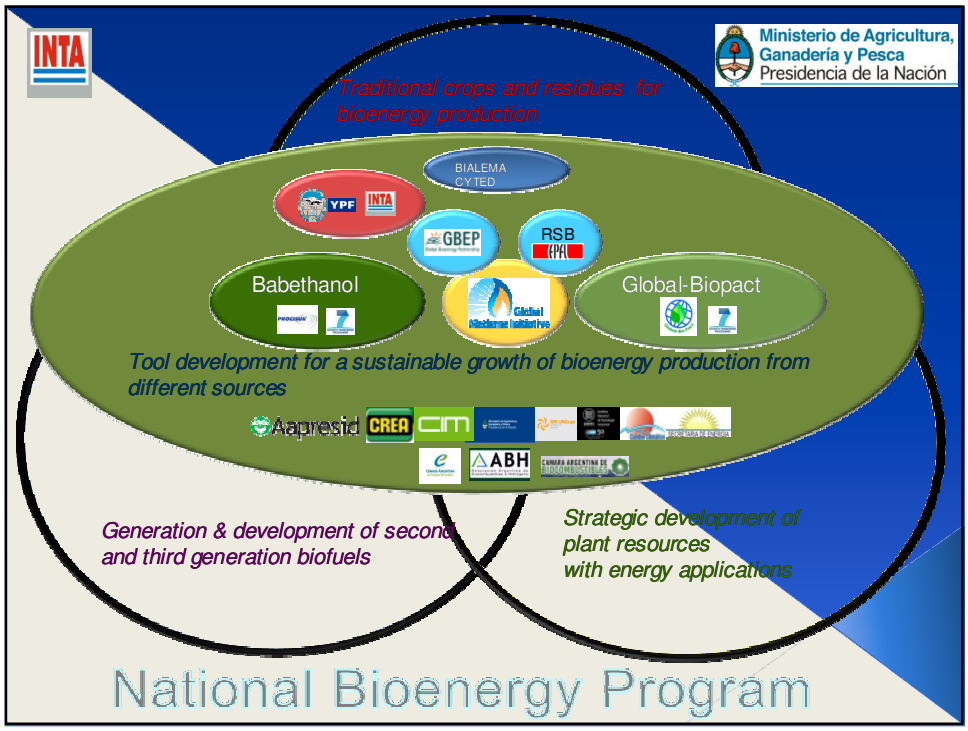
ARGENTINA

Our plants

	Company	Ton/yr.	Technology	Location	Openn.
AGD ALIMENTOS NATURALES BUNGE	**AGD & Bunge**	200.000	Desmet + Lurgi	Santa Fe	2007
EXPLORA	**Explora**	100.000	Local technology	Santa Fe	2009
LDC Argentina	**Louis Dreyfus**	300.000	Westfalia	Santa Fe	2008
Molinos	**Molinos**	100.000	Desmet Ballestra	Santa Fe	2008
PATAGONIA BIOENERGIA	**Patagonia Bioen.**	250.000	Desmet Ballestra	Santa Fe	2008
Renova	**Renova**	440.000	Desmet + Lurgi	Santa Fe	2007
unitecbio	**UnitecBio**	200.000	Desmet + Lurgi	Santa Fe	2008
Vicentin S.A.I.C.	**Vicentín**	78.000	Local technology	Santa Fe	2007
AG-ENERGY @ VILUCO SA	**Viluco**	200.000	Crown Iron Work	S.del Estero	2010


OUR PARTICULAR VIEW OF BIOENERGY
SOCIAL ASPECTS
working conditions
health and security
ECONOMY
Cost freigh distances
Susteinable production
ECOLOGY
Sensible ecosystms biodiversity, soil water and air conservation


General PNBioe aim
Secure the supply of sustainable bioenergy sources and services, taking care and supporting sustainable development, national energy security, poverty reduction, climate change attenuation & environmental equilibrium in all the national territory
INSTITUTO NACIONAL DE TECNOLOGIA AGROPECUARIA


INTA
Ministerio de Agricultura, Ganadería y Pesca
Presidencia de la Nación
Traditional crops and residues for bioenergy production
BIALEMA
CYTED
YPF
INTA
GBEP
RSB
Babethanol
Global-Biopact
Tool development for a sustainable growth of bioenergy production from different sources
Aapresid
CREA
CIM
ABH
Generation & development of second and third generation biofuels
Strategic development of plant resources with energy applications
National Bioenergy Program


Castelar National Research Centre
National Bioenergy Program
Office & research groups
Centro de Investigación de Agroindustria
Instituto de Tecnología de Alimentos
Instituto de Ingeniería Rural
Instituto de Biotecnología
Instituto de Microbiología y Zoología Agrícola
Instituto de Clima y Agua
Image © 2008 DigitalGlobe
Google

INTA
National Bioenergy Activities

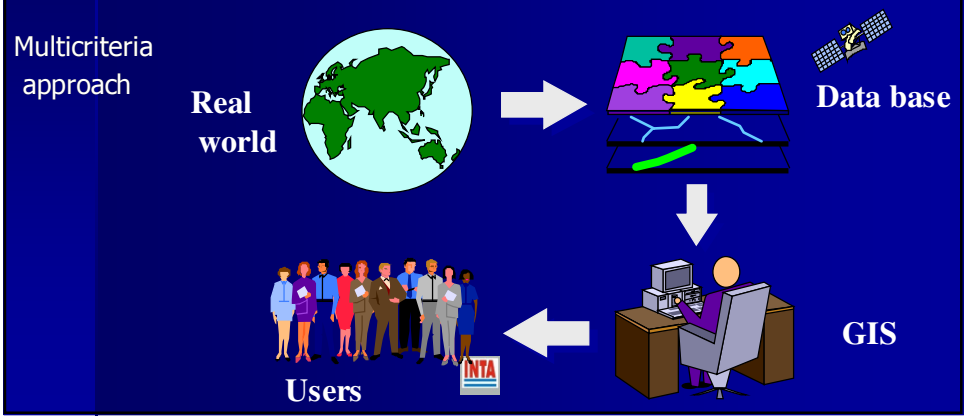
http://www.inta.gov.ar/info/bioenergia/bio.htm

Geographical analysis of potential biofuel crops

ATLAS

Aim: Construction of a geographical bioenergy information system considering agronomical ecological economical and social aspects

Multicriteria approach



Spatial study to define the potenti of biofuels production

- Step I

List of potential crops for biofuels

- **Regional bioclimatic maps**

Water requirements

Temperature and radiation

Fotoperiod

Chill resistance – high temperatures

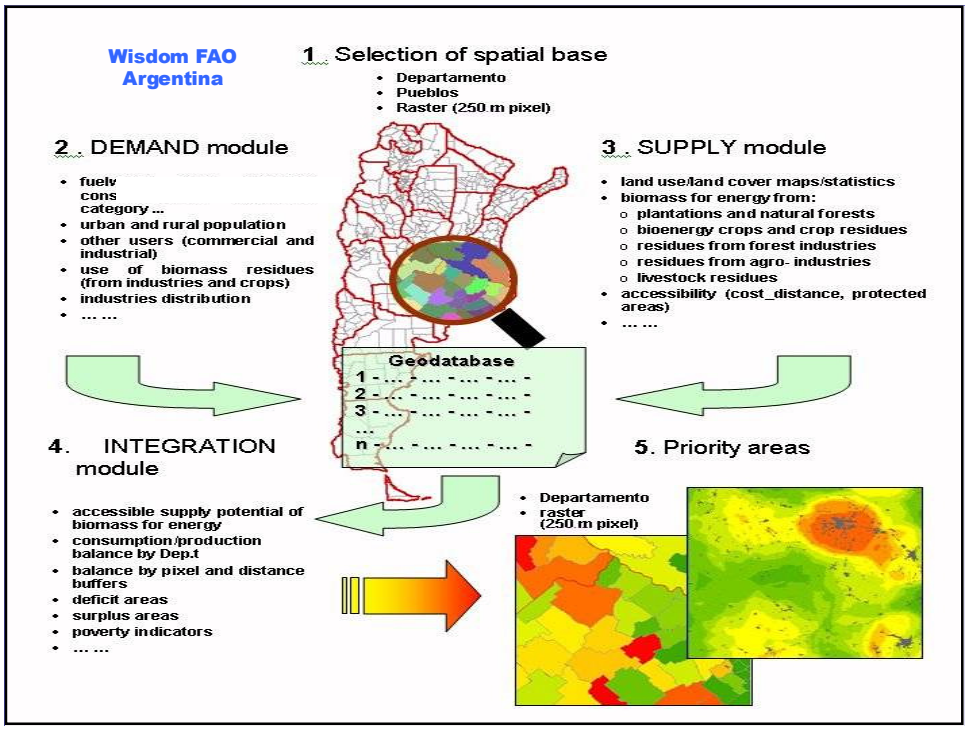
High medium and low potential areas are defined

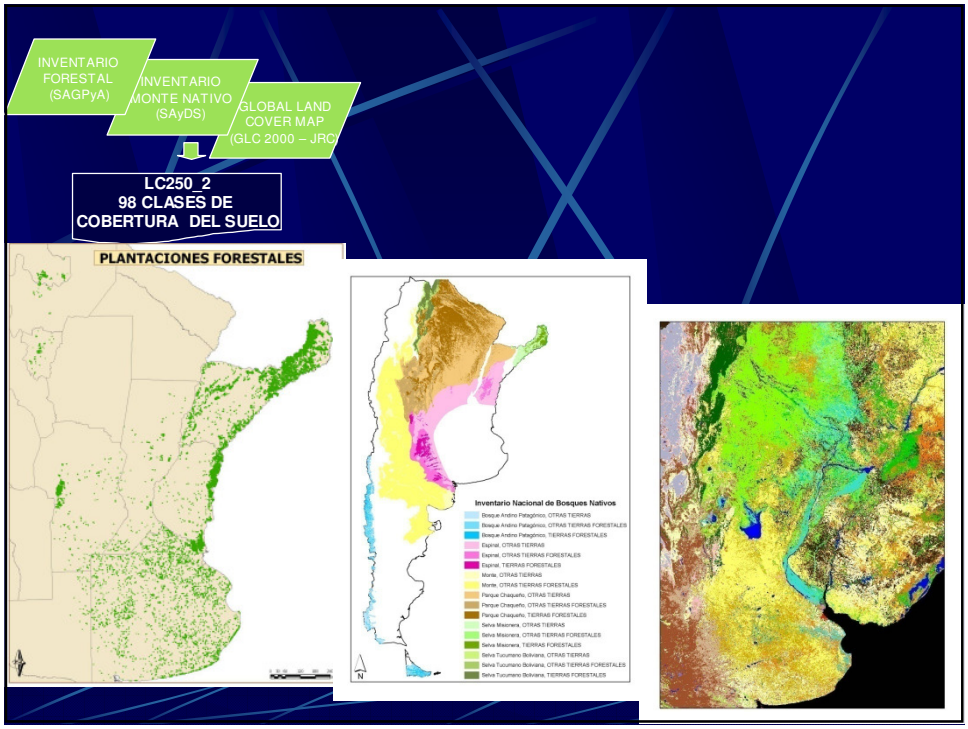
- **Soil use capacity**

(*Mapa INTA escala 1:500.000*)

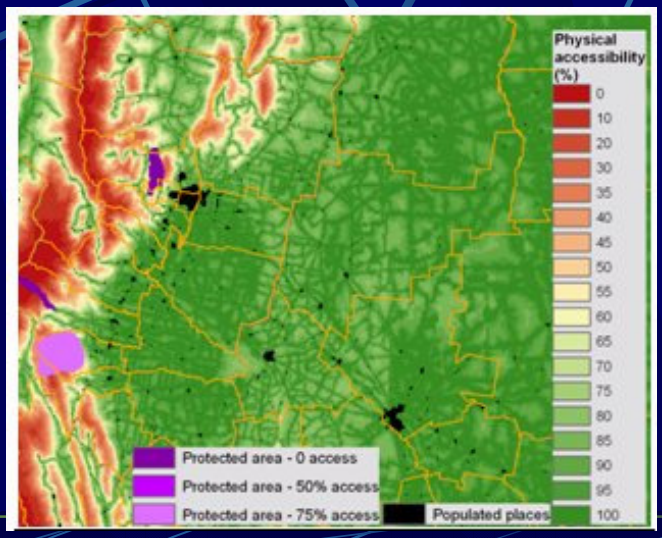
- **(1: 500.000) agroecological maps for each crop GIS**

INTA


Wisdom FAO Argentina
1. Selection of spatial base
Departamento
Pueblos
Raster (250 m pixel)
2. DEMAND module
fuelv cons category ...
urban and rural population
other users (commercial and industrial)
use of biomass residues (from industries and crops)
industries distribution
... ...
3. SUPPLY module
land use/land cover maps/statistics
biomass for energy from:
plantations and natural forests
bioenergy crops and crop residues
residues from forest industries
residues from agro- industries
livestock residues
accessibility (cost_distance, protected areas)
... ...
Geodatabase
1 - ... - ... - ... - ... -
2 - ... - ... - ... - ... -
3 - ... - ... - ... - ... -
...
n - ... - ... - ... - ... -
4. INTEGRATION module
accessible supply potential of biomass for energy
consumption/production balance by Dep.t
balance by pixel and distance buffers
deficit areas
surplus areas
poverty indicators
... ...
5. Priority areas
Departamento
raster (250 m pixel)


INVENTARIO FORESTAL (SAGPyA)
INVENTARIO MONTE NATIVO (SAyDS)
GLOBAL LAND COVER MAP (GLC 2000 – JRC)
LC250_2
98 CLASES DE COBERTURA DEL SUELO
PLANTACIONES FORESTALES
Inventario Nacional de Bosques Nativos

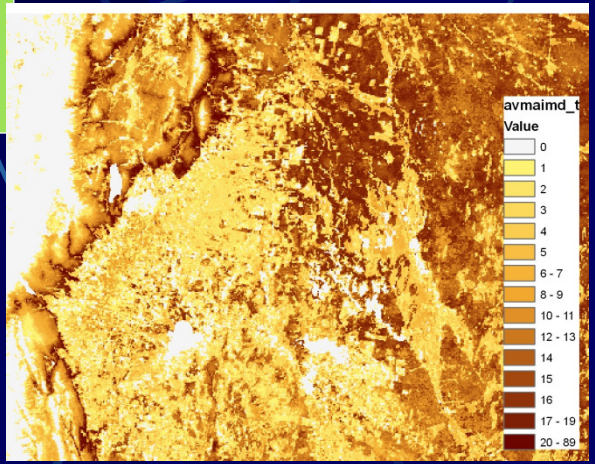
FISICAL & LEGAL ACSESS



ACCESIBLE INCREMENT MAP (máx, med, min)

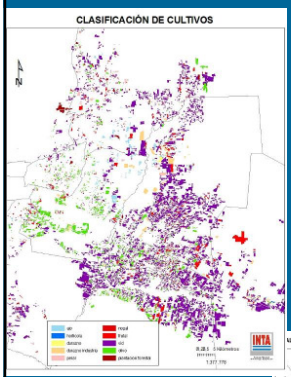
SUBSTRACT OTHER NON ENERGY USESS

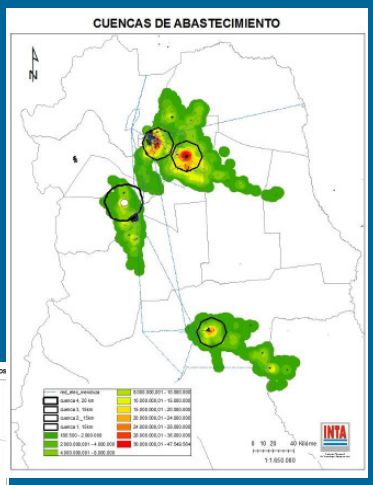
AVAILABLE INCREMENT MAP (máx, med, min)

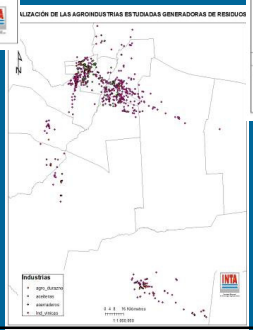


INCREMENT COMMERCIAL AVAILABLE MAP (máx, med, min)

BIOMASS DISPONIBILITY FOR BIOENERGY AT LOCAL LEVEL







For assessing economic aspects of new technologies you need to know where is the available feedstock and in what amount .

Power (MW)	PCI= 4 ter/kg (tm)	Relation Tm/MW
5	40.000	8.000
12	78.000	6.500
25	135.000	5.400

STOCK AVAILABLE INCREMENT ANNUAL MEAN

SPATIAL ANALYSIS OF THE POTENTIAL CROPS FOR THE PRODUCION OF BIOFUELS IN ARGENTINA

Methodology – 1st step

- **Selection of crops with a potential to be used for**
- **biofuel production**

- **Generate the map of bioclimatic aptitude for each crop attending to:**

Water ,temperature and solar radiation requeriments

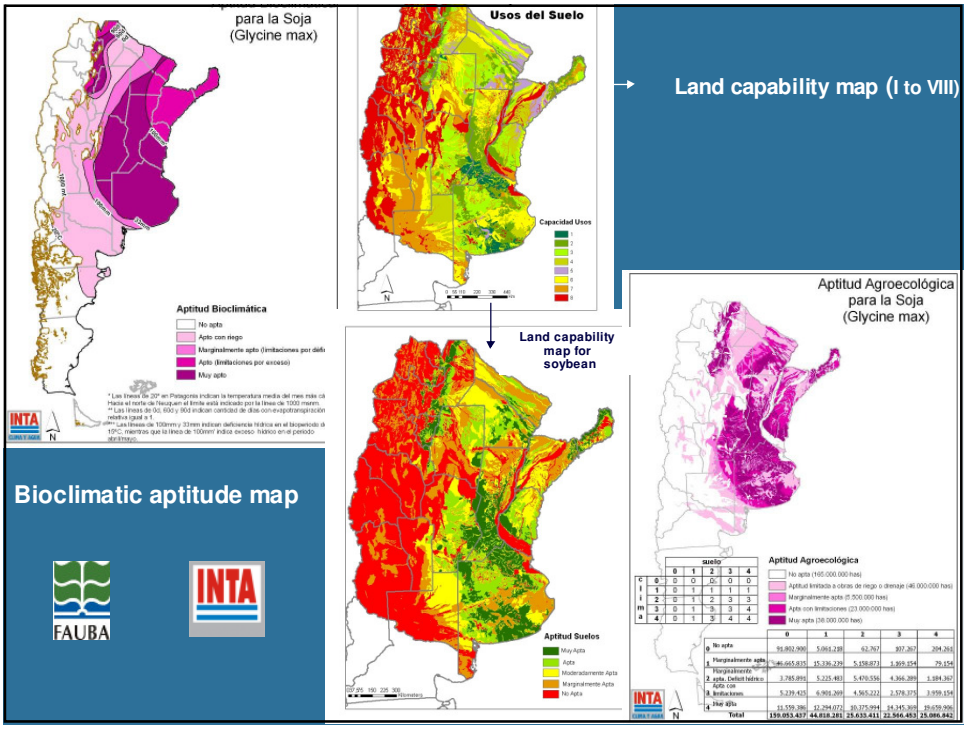
Frost resistence, etc

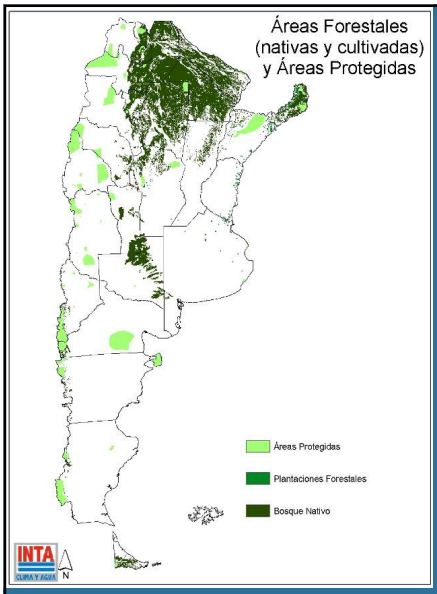
Using SMN and INTA`s weather databases from 1971 to 2000, areas with high, medium, low or marginal climatic aptitude where delimited for each crop.

- **Generate a Soil aptitud map for each crop with four categories**

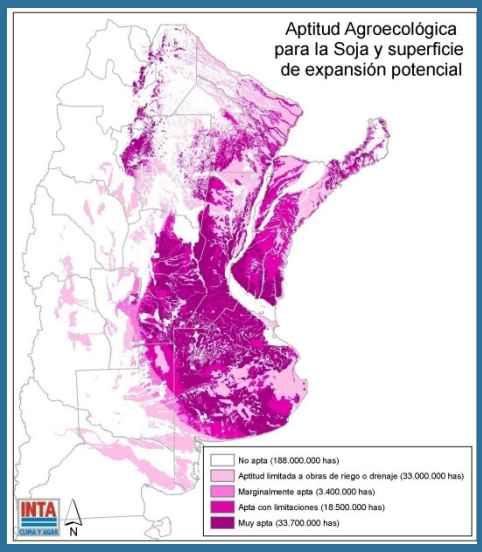
(Based on *INTA`s digital Soil Map 1967- scale 1:500.000*)

Agroecological Map for each crop (1: 500.000)





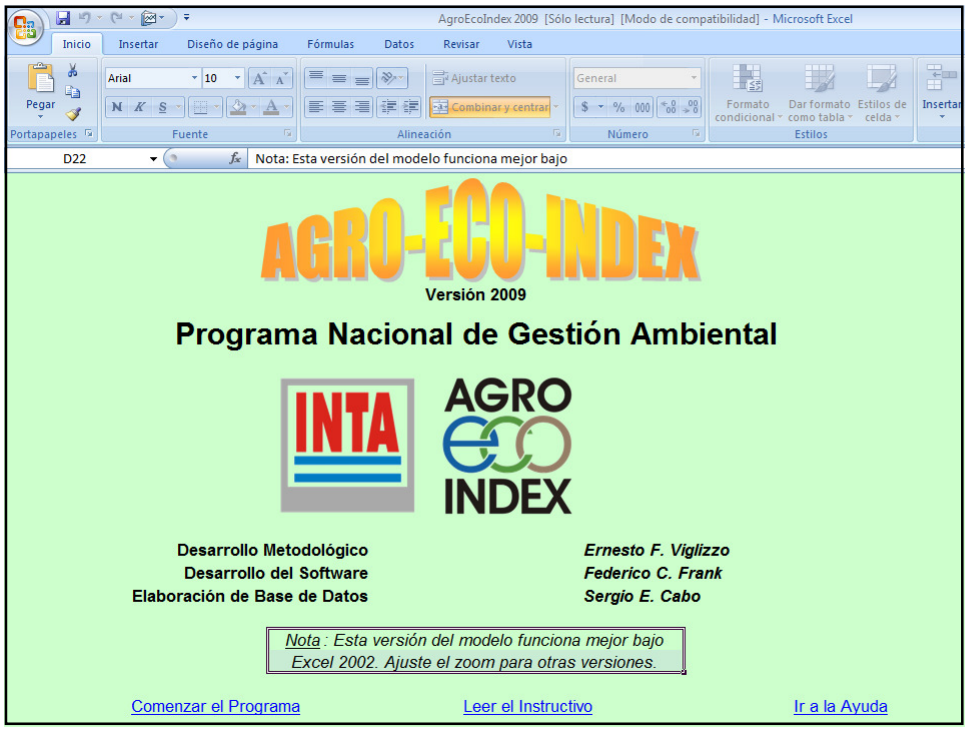
Restricted Areas to agriculture under biodiversity and legal consideration

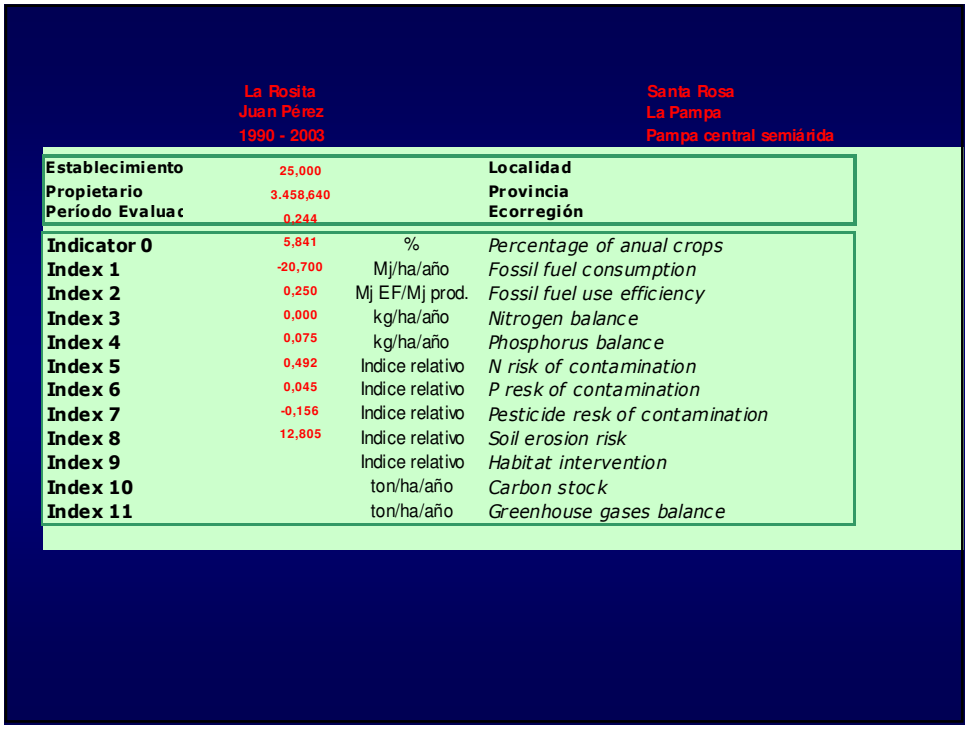


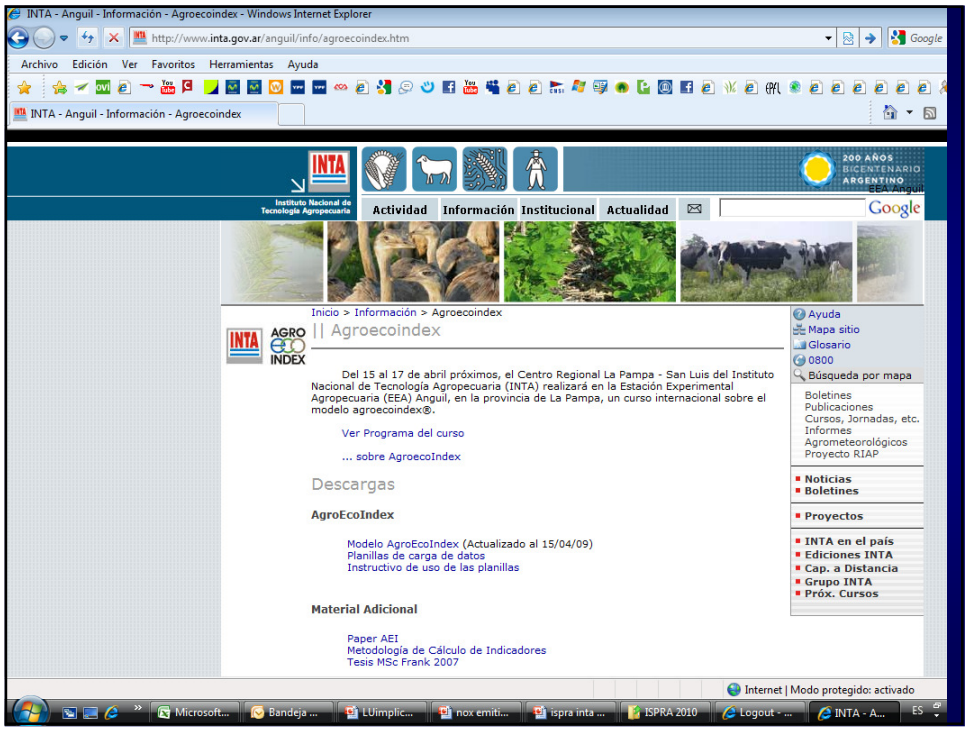
Agroecological Aptitude for soybean under biodiversity and legal considerations.

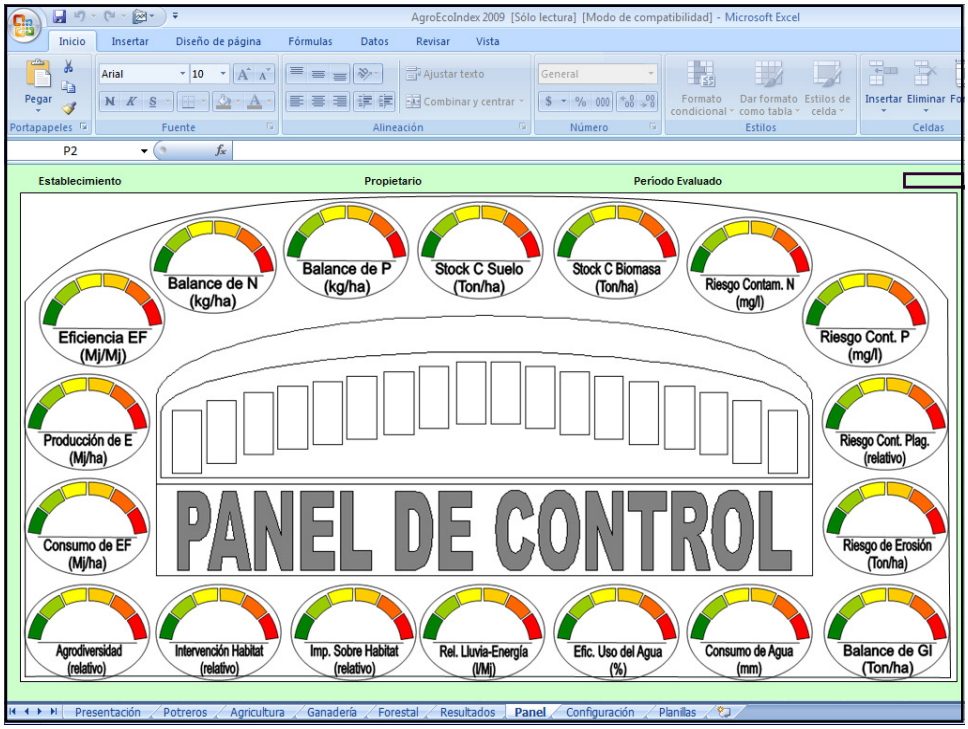
INTA
PROJECTS AND ACTIONS REGARDING SOIL WATER & BIODIVERSITY CONSERVATION

INTA


AgroEcoIndex 2009 [Sólo lectura] [Modo de compatibilidad] - Microsoft Excel
Inicio
Insertar
Diseño de página
Fórmulas
Datos
Revisar
Vista
D22
Nota: Esta versión del modelo funciona mejor bajo
AGRO-ECO-INDEX
Versión 2009
Programa Nacional de Gestión Ambiental
INTA
AGRO ECO INDEX
Desarrollo Metodológico
Desarrollo del Software
Elaboración de Base de Datos
Ernesto F. Viglizzo
Federico C. Frank
Sergio E. Cabo
Nota : Esta versión del modelo funciona mejor bajo Excel 2002. Ajuste el zoom para otras versiones.
Comenzar el Programa
Leer el Instructivo
Ir a la Ayuda


La Rosita
Juan Pérez
1990 - 2003
Santa Rosa
La Pampa
Pampa central semiárida
Establecimiento
Propietario
Período Evaluac
25,000
3.458,640
0,244
Localidad
Provincia
Ecorregión
Indicator 0 5,841 % Percentage of anual crops
Index 1 -20,700 Mj/ha/año Fossil fuel consumption
Index 2 0,250 Mj EF/Mj prod. Fossil fuel use efficiency
Index 3 0,000 kg/ha/año Nitrogen balance
Index 4 0,075 kg/ha/año Phosphorus balance
Index 5 0,492 Indice relativo N risk of contamination
Index 6 0,045 Indice relativo P resk of contamination
Index 7 -0,156 Indice relativo Pesticide resk of contamination
Index 8 12,805 Indice relativo Soil erosion risk
Index 9 Indice relativo Habitat intervention
Index 10 ton/ha/año Carbon stock
Index 11 ton/ha/año Greenhouse gases balance

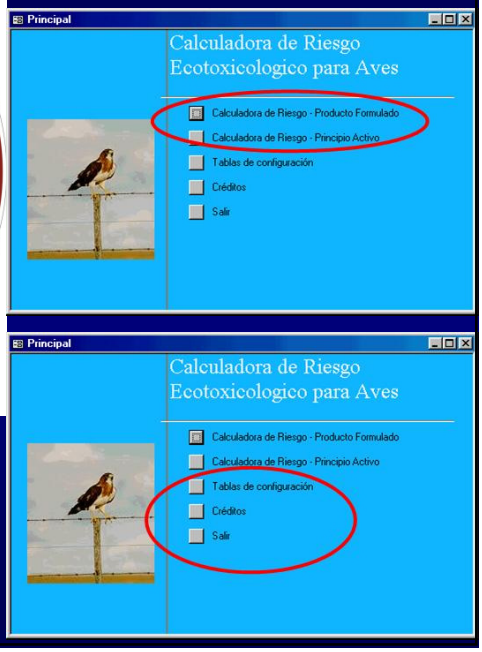

INTA - Anguil - Información - Agroecoindex - Windows Internet Explorer
http://www.inta.gov.ar/anguil/info/agroecoindex.htm
Archivo Edición Ver Favoritos Herramientas Ayuda
INTA - Anguil - Información - Agroecoindex
Instituto Nacional de Tecnología Agropecuaria
200 AÑOS BICENTENARIO ARGENTINO
EEA Anguil
Actividad Información Institucional Actualidad
Google
Inicio > Información > Agroecoindex
INTA AGRO ECO INDEX || Agroecoindex
Del 15 al 17 de abril próximos, el Centro Regional La Pampa - San Luis del Instituto Nacional de Tecnología Agropecuaria (INTA) realizará en la Estación Experimental Agropecuaria (EEA) Anguil, en la provincia de La Pampa, un curso internacional sobre el modelo agroecoindex®.
Ver Programa del curso
... sobre AgroecoIndex
Descargas
AgroEcoIndex
Modelo AgroEcoIndex (Actualizado al 15/04/09)
Planillas de carga de datos
Instructivo de uso de las planillas
Material Adicional
Paper AEI
Metodología de Cálculo de Indicadores
Tesis MSc Frank 2007
Ayuda
Mapa sitio
Glosario
0800
Búsqueda por mapa
Boletines
Publicaciones
Cursos, Jornadas, etc.
Informes
Agrometeorológicos
Proyecto RIAP
Noticias
Boletines
Proyectos
INTA en el país
Ediciones INTA
Cap. a Distancia
Grupo INTA
Próx. Cursos
Internet | Modo protegido: activado


AgroEcoIndex 2009 [Sólo lectura] [Modo de compatibilidad] - Microsoft Excel
Inicio Insertar Diseño de página Fórmulas Datos Revisar Vista
Establecimiento
Propietario
Período Evaluado
Balance de N (kg/ha)
Balance de P (kg/ha)
Stock C Suelo (Ton/ha)
Stock C Biomasa (Ton/ha)
Riesgo Contam. N (mg/l)
Eficiencia EF (Mj/Mj)
Riesgo Cont. P (mg/l)
Producción de E (Mj/ha)
Riesgo Cont. Plag. (relativo)
PANEL DE CONTROL
Consumo de EF (Mj/ha)
Riesgo de Erosión (Ton/ha)
Agrodiversidad (relativo)
Intervención Habitat (relativo)
Imp. Sobre Habitat (relativo)
Rel. Lluvia-Energía (l/Mj)
Efic. Uso del Agua (%)
Consumo de Agua (mm)
Balance de GI (Ton/ha)
Presentación Potreros Agricultura Ganadería Forestal Resultados Panel Configuración Planillas

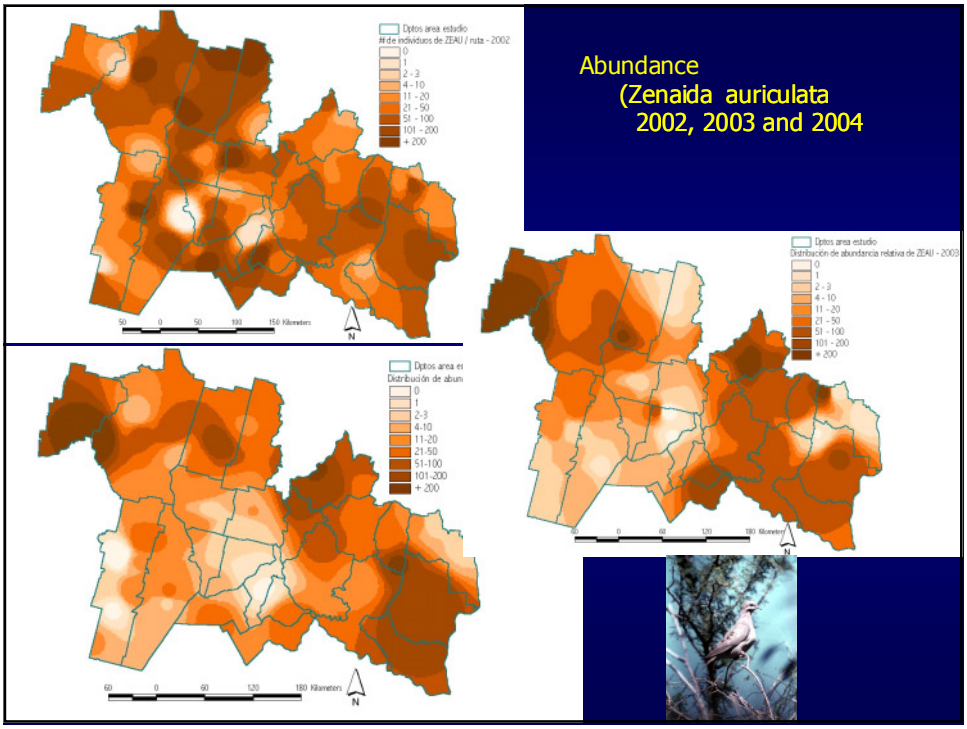
ECOTOXICAL AGRO INDEX SYSTEM

Maria Elena Zacagnini
Natural resource national research center

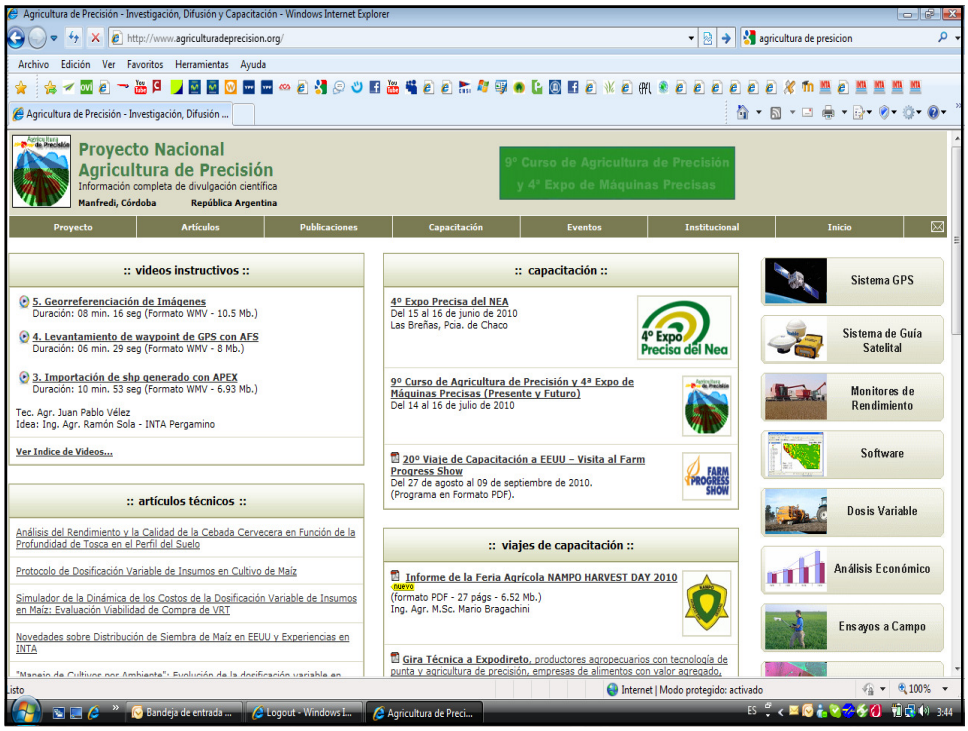
The program combines field and GOS folowup information regarding birds populations and the effect of agrochemical use, risks and agricultural expansion in different territories



Biodiversity search on different agroecosystems



Abundance
(Zenaida auriculata
2002, 2003 and 2004


Agricultura de Precisión - Investigación, Difusión y Capacitación - Windows Internet Explorer
http://www.agriculturadeprecision.org/
agricultura de presicion
Archivo Edición Ver Favoritos Herramientas Ayuda
Proyecto Nacional
Agricultura de Precisión
Información completa de divulgación científica
Manfredi, Córdoba República Argentina
9° Curso de Agricultura de Precisión y 4° Expo de Máquinas Precisas
Proyecto
Artículos
Publicaciones
Capacitación
Eventos
Institucional
Inicio
:: videos instructivos ::
5. Georreferenciación de Imágenes
Duración: 08 min. 16 seg (Formato WMV - 10.5 Mb.)
4. Levantamiento de waypoint de GPS con AFS
Duración: 06 min. 29 seg (Formato WMV - 8 Mb.)
3. Importación de shp generado con APEX
Duración: 10 min. 53 seg (Formato WMV - 6.93 Mb.)
Tec. Agr. Juan Pablo Vélez
Idea: Ing. Agr. Ramón Sola - INTA Pergamino
Ver Indice de Videos...
:: artículos técnicos ::
Análisis del Rendimiento y la Calidad de la Cebada Cervecera en Función de la Profundidad de Tosca en el Perfil del Suelo
Protocolo de Dosificación Variable de Insumos en Cultivo de Maíz
Simulador de la Dinámica de los Costos de la Dosificación Variable de Insumos en Maíz: Evaluación Viabilidad de Compra de VRT
Novedades sobre Distribución de Siembra de Maíz en EEUU y Experiencias en INTA
:: capacitación ::
4° Expo Precisa del NEA
Del 15 al 16 de junio de 2010
Las Breñas, Pcia. de Chaco
9° Curso de Agricultura de Precisión y 4ª Expo de Máquinas Precisas (Presente y Futuro)
Del 14 al 16 de julio de 2010
20° Viaje de Capacitación a EEUU – Visita al Farm Progress Show
Del 27 de agosto al 09 de septiembre de 2010.
(Programa en Formato PDF).
:: viajes de capacitación ::
Informe de la Feria Agrícola NAMPO HARVEST DAY 2010
nuevo
(formato PDF - 27 págs - 6.52 Mb.)
Ing. Agr. M.Sc. Mario Bragachini
Gira Técnica a Expodireto, productores agropecuarios con tecnología de punta y agricultura de precisión, empresas de alimentos con valor agregado.
Sistema GPS
Sistema de Guía Satelital
Monitores de Rendimiento
Software
Dosis Variable
Análisis Económico
Ensayos a Campo
Internet | Modo protegido: activado
100%


SKY ARROW 650 E.R.A.
Environmental Research Aircraft
INTA GHG monitoring on agricultural land
Main sensors in the platform
I.N.T.A. CASTELAR – INSTITUTO DE CLIMA Y AGUA

ENVIRONMENT ASPECTS OF AGRICULTURAL PRODUCTION IN ARGENTINA

Jorge Antonio Hilbert

Water Footprint

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

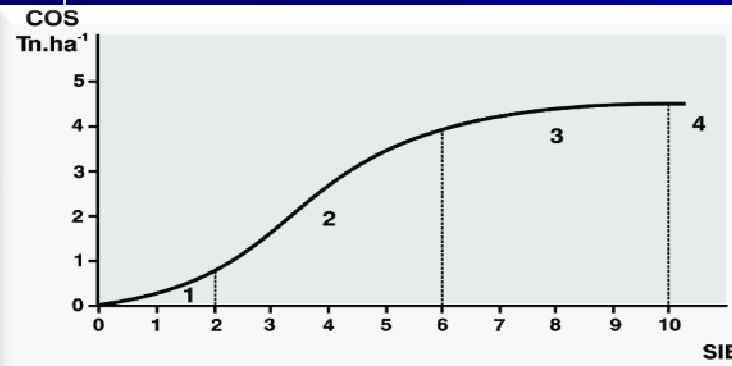
Each mm. of usefull water gained means:

18 a 24 kg/ha o corn

5 a 7 kg/ha of soy beans

8 a 12 kg/ha of wheat

INCREMENT IN SOIL CARBON THROUGH NO TILLAGE PRACTICES IN ARGENTINA WHEAT – SOY – CORN ROTATION



1 y 3 : Menor Tasa de Acumulación de COS
2 : Mayor Tasa de Acumulación de COS
4 : Estabilización de COS

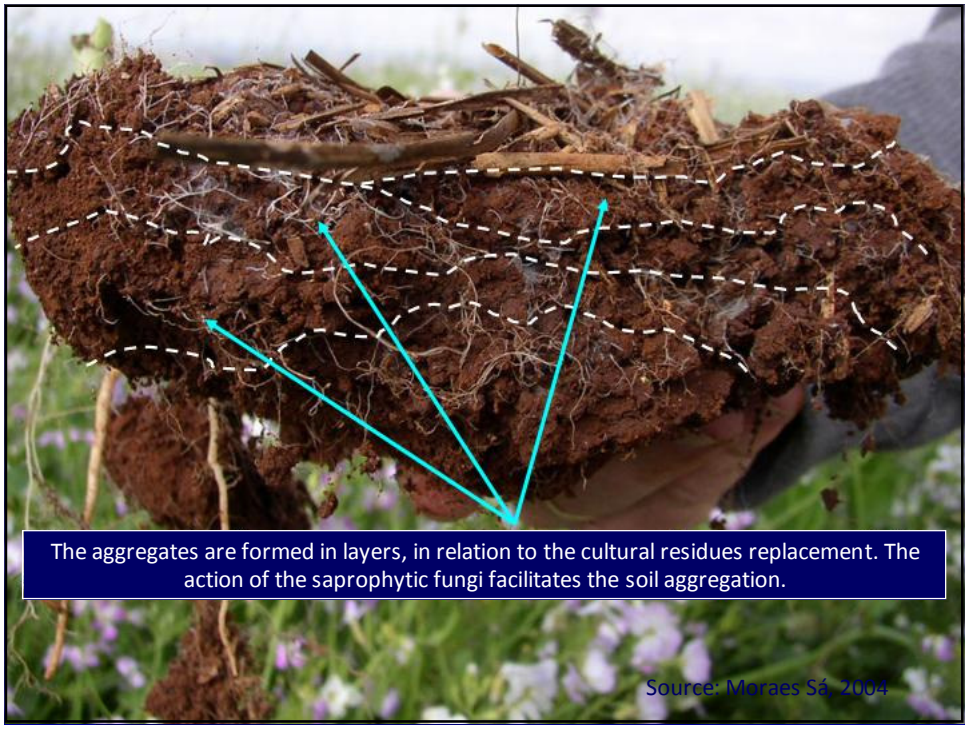
Casas, 2003

The no-till system Concept

New agricultural paradigm

Productive system based on the **lack of tillage** and the presence of **permanent cover** of the soil via crops and residues


In NT the function of the roots and the fauna plays an important role in the soil porosity regeneration
The highest biodiversity in agricultural ecosystems relies in the soil
This biodiversity is highly preserved and increased


The aggregates are formed in layers, in relation to the cultural residues replacement. The action of the saprophytic fungi facilitates the soil aggregation.
Source: Moraes Sá, 2004

Evolution af presition agriculture components

Argentina is the 2nd country by number of yield monitors after US

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2009
Yield monitors	50	200	300	450	560	600	850	1300	1600	2500	6200
Yield monitors with GPS	25	75	155	270	400	420	600	900	1300	2200	2750
Yield monitors with no GPS	25	125	145	180	160	180	250	400	300	300	380
Variable rate planters VRT fertilizers	3	4	5	6	10	12	25	40	130	500	1400
Planting monitors	400	500	700	1000	1300	1500	1800	2200	3000	4200	9500
Aeroplane GPS parallel swathing	35	60	100	160	200	230	300	450	480	550	700
Spayers GPS parallel swathing	0	10	70	200	400	500	2000	3000	4000	5000	10500
Automatic guidance	0	0	0	0	0	0	0	3	25	50	650
Nitrogen sensors	0	0	2	2	4	5	6	7	7	12	22

Date Presition agriculture project INTA

PRESITION NUTRIENT MANAGEMENT

Recent local electronic developments

Central automathic control.

Yield monitor with GPRS transfer of data

Productive and environmental quality management system in CA (QMS/CA)

GAP's

AAPRESID THE NATIONAL PRIVATE ASOCIATION OF NO TILLAGE FARMERS IS PROMOTING A NEW CERTIFICATION PROCESS

Why?

Because there are scientific fundamentals that correlate soil health indicator values with agronomical practices

Because there are distinctive advantages of Argentina´s type of farming that must be proved and exported.

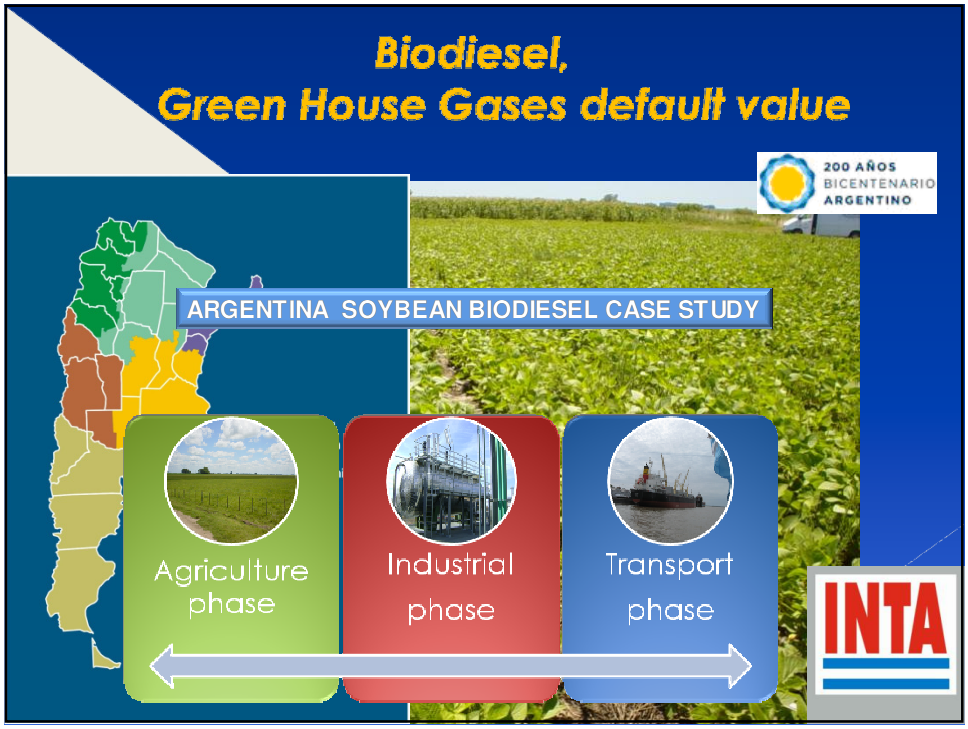

GAP 1: no tillage (residue cover)

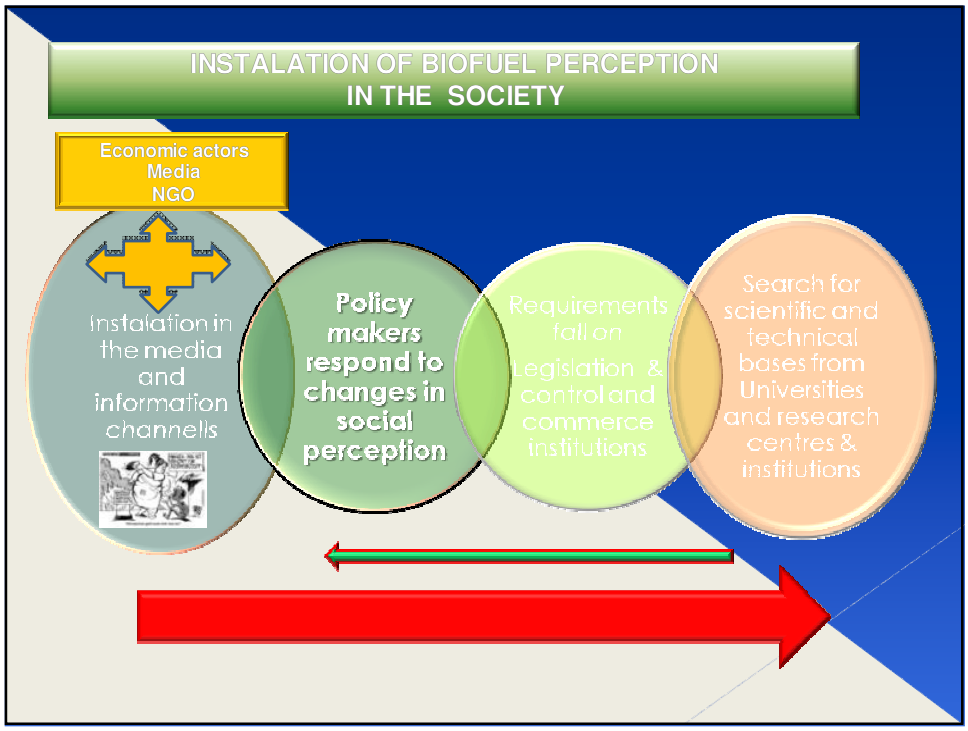

GAP 2: Crop rotations: Diversity and intensity
Argentina; Coronel Suarez (Bs As)
Federico Roveda (2007)


GAP 3: Balanced nutrition, with nutrient replacement


GAP 4: Integrated pest, weed and disease management.
Including the correct agrochemical management and its containers


GAP 5: Monitoring and systematic register of agronomic georefereced information


Biodiesel,
Green House Gases default value
200 AÑOS
BICENTENARIO
ARGENTINO
ARGENTINA SOYBEAN BIODIESEL CASE STUDY
Agriculture phase
Industrial phase
Transport phase
INTA



COMPARATIVE ANALYSIS OF ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS FROM THE PRODUCTION OF BIODIESEL FROM SOYBEAN UNDER CONVENTIONAL AND NO TILL FARMING SYSTEMS

Hilbert J.A; Donato L.B..; Muzio J.; Huerga I;

The general objective of the study was to establish, analyze, compare and evaluate the energetic consumption and greenhouse gas (GHG) emissions of soy-based biodiesel production in Argentina, throughout different regions.

Parameters used for the Argentine case

The study consists in a regional approach study on GHG emissions for soybean production in different regions of the country. Soybean represents more than 40 % of total grain production in Argentina (campaign 2008-2009) accounting 30 millions tons. The production is spread around central and north region of Argentina

The areas under research by this study represent around 85% of total soybean production in Argentina, giving a significant value to the conclusions of this paper

SPECIFIC OBJETIVES

Obtain "real values and data" to the national soybean biodiesel production, with respect to the energetic consumption and GHG emissions, so as to be able to compare domestic scenarios with those proposed and introduced in the European legislation by different institutions from the European Union.

Compare different scenarios of energetic consumption and GHG emissions in the production of soy-based biodiesel in Argentina, establishing whether there are significant differences among them, and on what stage(s) of the production chain these significant differences are more obvious.

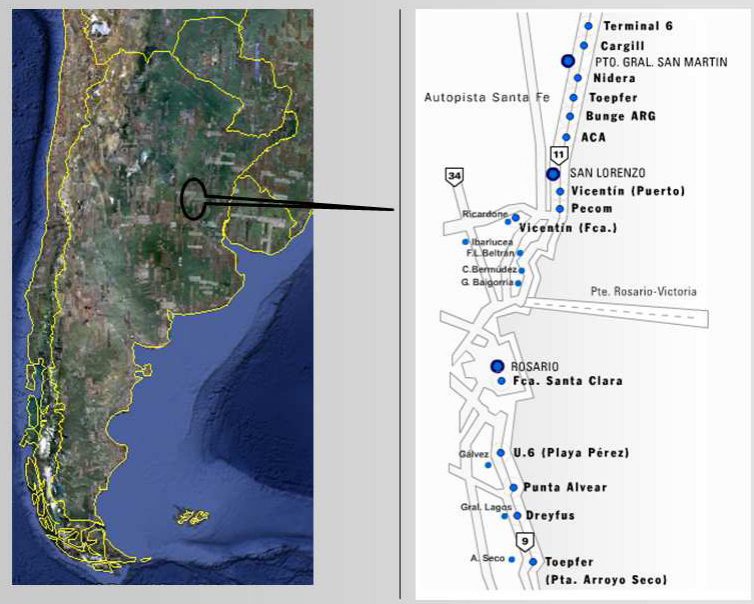
Compare basic and real data used in the different studies in Argentina with those used by the European Commission Joint Research Centre (JRC).

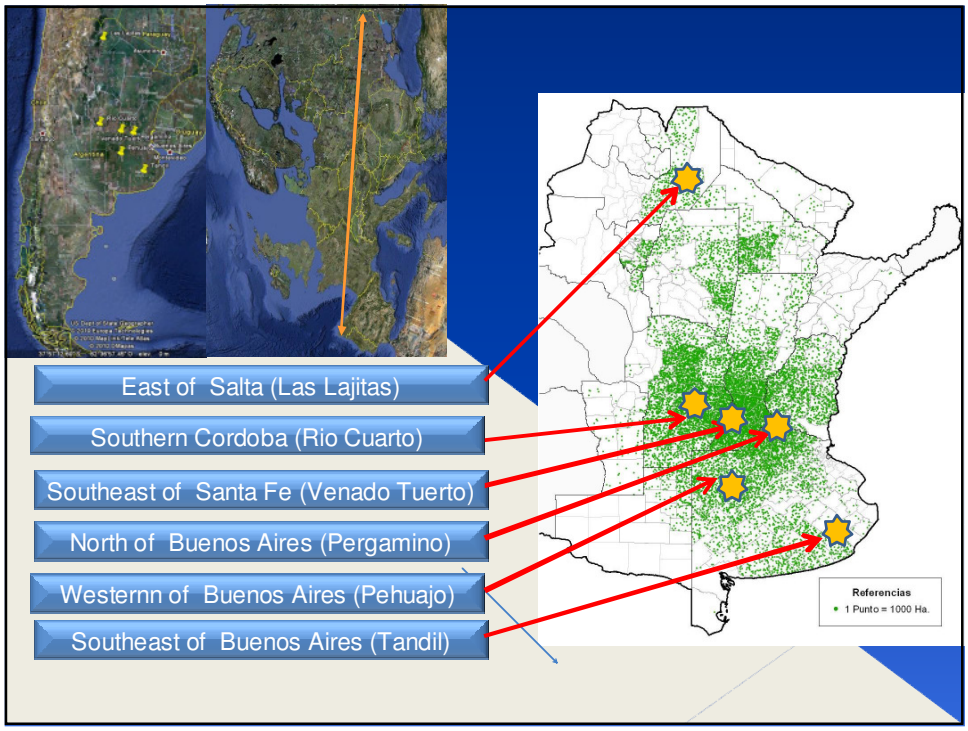
Introduce the use of the software "*the CO_2 Bioenergy Tool*". Version 2.1b., as a methodological tool for the calculation of the energetic consumption and GHG emissions of soy-based biodiesel.

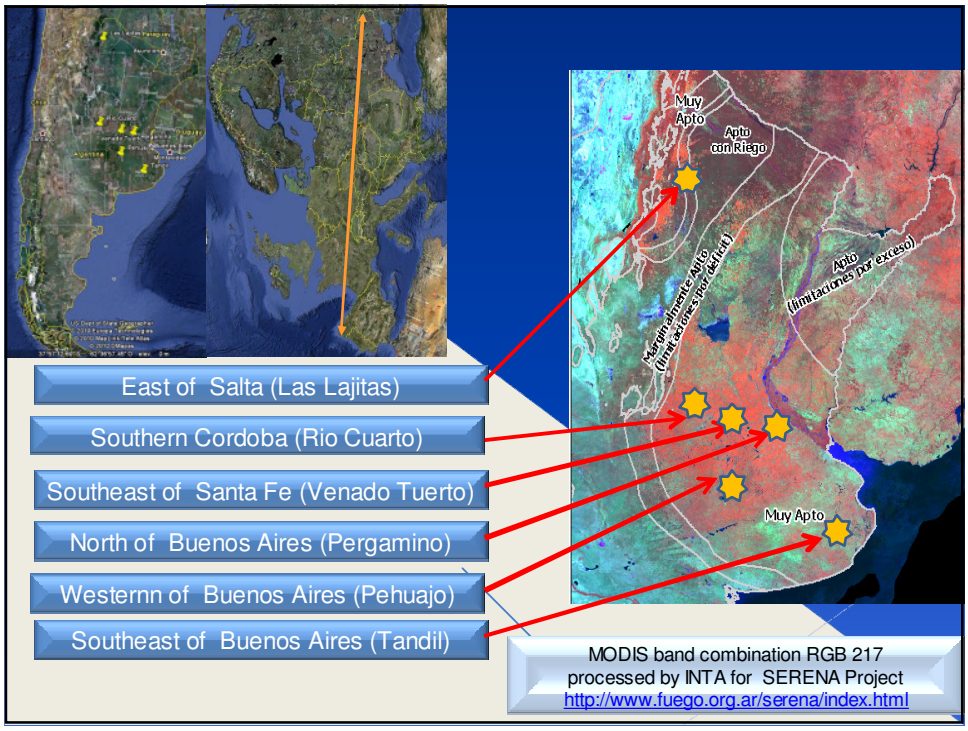
MATERIALS AND METHODS

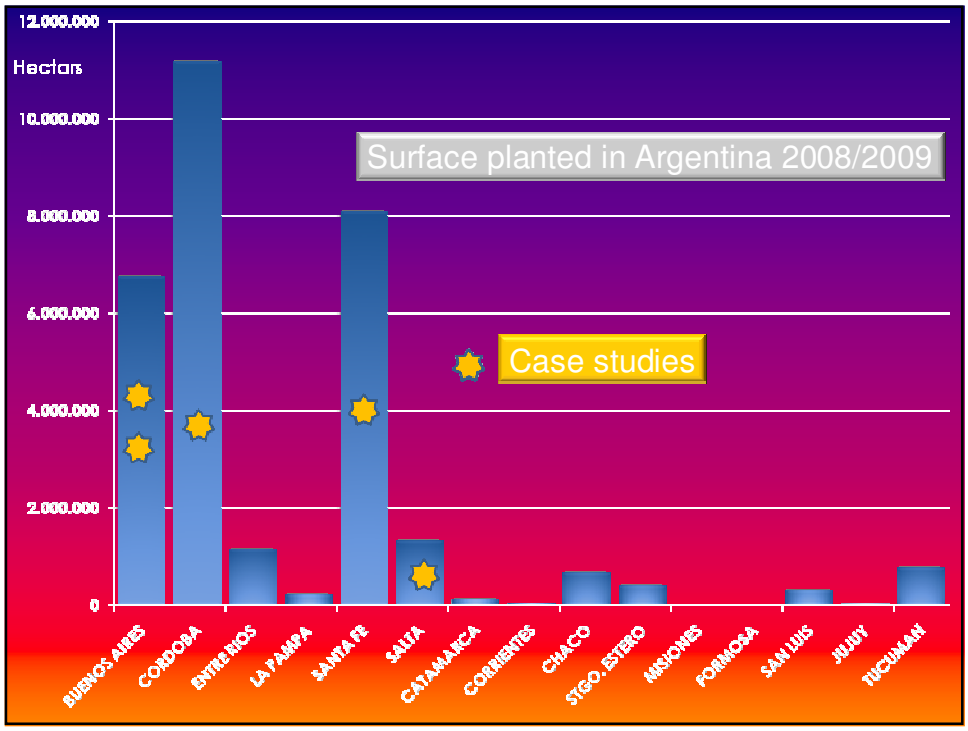
For the calculation of energetic consumption and GHG emissions in the production of soy-based biodiesel in Argentina, the software *"Greenhouse gas calculator for biofuels"* Version 2.1b (available for free at: http://www.senternovem.nl/gave_english/co2_tool/index.as and developed by the *SenterNovem* Agency of the Dutch Government) was used

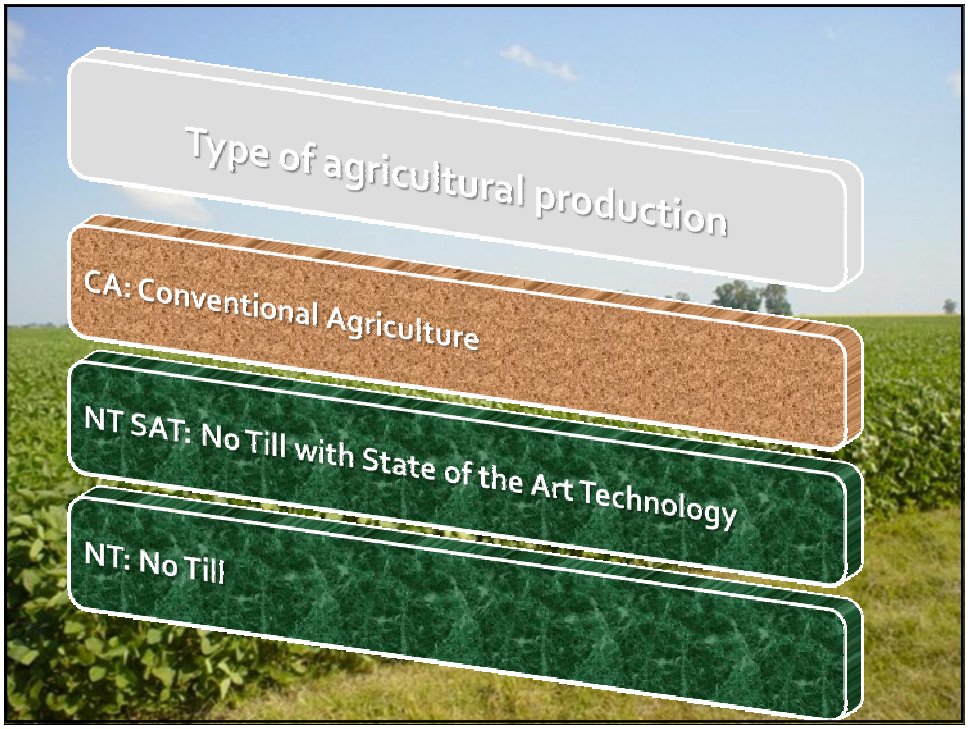
Input data was obtained from INTA research on farm productions and a survey of the principal transforming soybean plants in Argentina

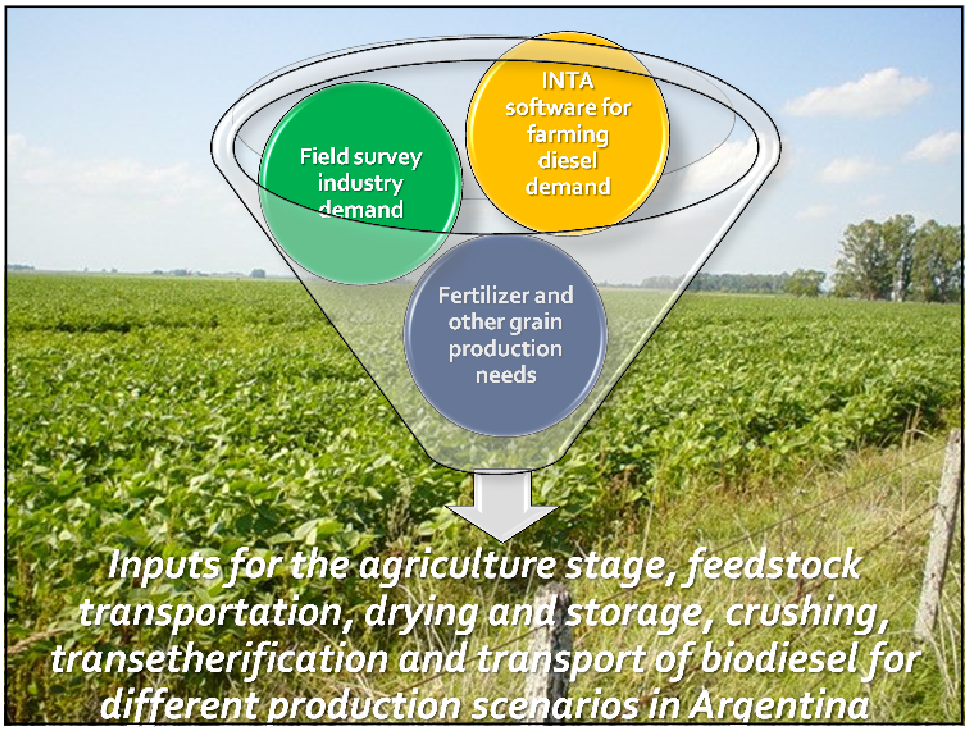



East of Salta (Las Lajitas)
Southern Cordoba (Rio Cuarto)
Southeast of Santa Fe (Venado Tuerto)
North of Buenos Aires (Pergamino)
Westernn of Buenos Aires (Pehuajo)
Southeast of Buenos Aires (Tandil)
Referencias
1 Punto = 1000 Ha.


East of Salta (Las Lajitas)
Southern Cordoba (Rio Cuarto)
Southeast of Santa Fe (Venado Tuerto)
North of Buenos Aires (Pergamino)
Westernn of Buenos Aires (Pehuajo)
Southeast of Buenos Aires (Tandil)
Muy Apto
Apto con Riego
Marginalmente Apto (limitaciones por deficit)
Apto (limitaciones por exceso)
Muy Apto
MODIS band combination RGB 217
processed by INTA for SERENA Project
http://www.fuego.org.ar/serena/index.html

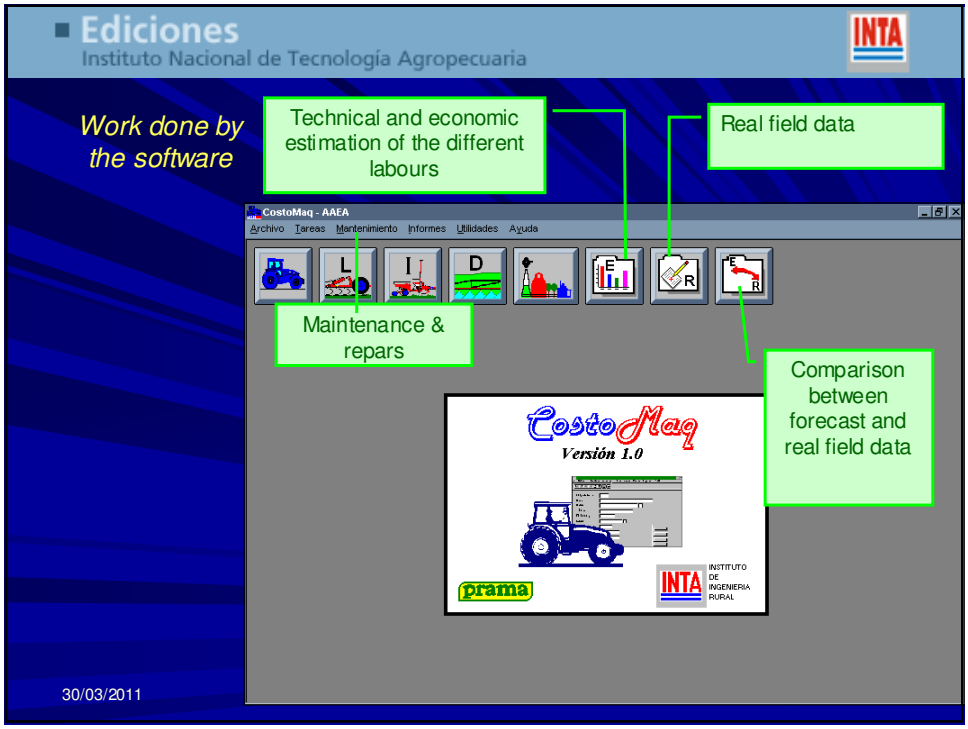

12.000.000
Hectars
10.000.000
8.000.000
6.000.000
4.000.000
2.000.000
0
Surface planted in Argentina 2008/2009
Case studies
BUENOS AIRES
CORDOBA
ENTRE RIOS
LA PAMPA
SANTA FE
SALTA
CATAMARCA
CORRIENTES
CHACO
STGO. ESTERO
MISIONES
FORMOSA
SAN LUIS
JUJUY
TUCUMAN


Type of agricultural production
CA: Conventional Agriculture
NT SAT: No Till with State of the Art Technology
NT: No Till



Type of Agriculture*1		CA	NT SAT	NT	NT	NT	NT
Stage		**Zone of reference**					
Agriculture		**Southeast of Buenos Aires (Tandil)**	**South of (Venado Tuerto)**	**North of Bs. As./South of (Pergamino)**	**West of (Pehuajo)**	**South of Córdoba (Rio Cuarto)**	**Salta**
Feedstock (Kg/ha/year)*2	**Soybean**	2.800	4.500	3.600	3.600	2.750	2.750
Energy consumption (MJ/ha/year) *3	**Diesel**	1.575	998	998	998	998	998
Fertilizers*4 (Kg/ha/year)	**Nitrogen**	10	14	4,4	4,4	0	0
	P_2O_5	23	78	21	21	0	0
	K_2O	0	0	0	0	0	0
***Feedstock transportation*5**							
Transport (km)	**Conv. Diesel truck**	614	191	139,9	436	395	1130


*2 Average yields for each area according to Márgenes Agropecuarios Magazine (2008).
*3 The energy consumption for the first stage, "Agriculture", was estimated according to Donato & Huerga (2007)
*4 Fertilizers used frequently in each zone, according to Márgenes Agropecuarios magazine (2008).
*5 Distance calculated using Guía YPF (www.guiaypf.com.ar), from feedstock production area to Port complex at Pto. San Lorenzo/Pto. Gral. San Martín (Prov. of Santa Fe).


Ediciones
Instituto Nacional de Tecnología Agropecuaria
INTA
Work done by the software
Technical and economic estimation of the different labours
Real field data
CostoMaq - AAEA
Archivo Tareas Mantenimiento Informes Utilidades Ayuda
Maintenance & repars
Comparison between forecast and real field data
CostoMaq
Versión 1.0
prama
INTA
INSTITUTO DE INGENIERIA RURAL
30/03/2011

Costomaq software
Integral Management of Farma Machinery

Scientific latin america winning price
Mejores de la Tierra
2006
R&D category
BRASIL

Uso de energía en mecanización agrícola

Soja Primera:

Convencional — 33.1 L/ha

1. Sudeste de Bs. As.:
   2 Disco doble; 1 Vibrocultivador c/rastra de dientes; 1 Siembra; 1 Fertilización y Pulverizaciones.

Siembra Directa — **80% de la superficie** — 17.1 L/ha

Norte y Oeste de Bs. As., Santa Fe, Sur Entre Ríos, Sur Córdoba, Sur Sgo.del Estero, Salta

SO de Bs. As.: **SE Bs As : 50% de la superficie**

1 Siembra directa; 1 Fertilización y 6 Pulverizaciones.

Siembra Directa con tecnología de punta — 17.1 L/ha

Sur de Santa Fe:

1 Siembra directa; 1 Fertilización y 6 Pulverizaciones.

Soja Segunda:

Siembra Directa — 13.5 L/ha

Sudeste de Córdoba, Norte de Bs. As., Sur de sta. Fé y O Bs. As.:

1 Siembra directa y 4 Pulverizaciones.

Type of Agriculture*1		CA	NT SAT	NT	NT	NT	NT
Stage		Zone of reference					
Agriculture		Southeast of Buenos Aires (Tandil)	South of (Venado Tuerto)	North of Bs. As./South of (Pergamino)	West of (Pehuajo)	South of Córdoba (Rio Cuarto)	Salta
Drying and storage							
Feedstock (Kg/Kg)	Soybean	1	1	1	1	1	1
Energy Consumption	Electricity*6a (KWh/ton)	1,2	1,2	1,2	1,2	1,2	1,2
	Natural gas*6b (MJ/ton)	141	141	141	141	141	141
	Conv. Diesel*7 (MJ/ton)	3	3	3	3	3	3

*6a Electricity consumption 1 Kwh/T estimated by de Dios, Carlos, *Grains drying and dryers*; Hemisferio Sur, 2000, pp. 244. Diego de la Torre quotes values for 0,6 in seven districts of Argentina.

*6b Estimated energy consumption for grain drying at the agricultural stage according to de la Torre & Bartosik (2008). (25 % is dried at storage and 75 % at the industry with 3 and 2 points of drying respectively over a total of 40,4 million tones. http://www.inta.gov.ar/balcarce/info/indices/tematica/agric/posco/gral.htm . Diego de la Torre personal communication quotes efficiencies in Argentine dryers between 982 to 2046 Kcal/kg of water and taking a reference value of 1900 Kcal/kg of water in the calculation which is conservative for Argentina reality.

*7 Energy fuel used for grain drying at the agricultural stage estimated according to de la Torre & Bartosik(2008). (8 % diesel and 92 % gas NG & LPG

*8 IIR-BC-INF-03-09 *Energy Balances of Argentine Biodiesel Production*, with local industrial data I Huerga; J.A.Hilbert; L.Donato 2009.

*9 1,45 kg steam/tons of oil – Maximum value for the two surveyed companies: 785,7 kcal/kg of steam – average consumption value in Argentina Raúl Bernardi UnitecBio personal communication.

Agriculture		All regions
Crushing		
By-product (Kg/Kg of seed)	Vegetable oil	0.194
	Meal	0,714
Energy Consumption[8]	Electricity (KWh/ton s)	34,3
	Natural Gas MJ/ton[9]	4770
	Hexane[10] (MJ/ton)	4,66
Estherification		
By-product (Kg/Kg oil)	Biodiesel	0,95
(Kg/Kg oil)	Glycerine[11]	0,12
Energy use	Electricity (KWh/ton bio[12]	34,8
	Natural gas MJ/Ton biod[13]	1499
	Methanol (Kg/ton seeds)	99
Biodiesel transportation		
Transport (km)*[14]	Diesel ship	12.091

*[10] Corresponding to 981 Kcal/kg of hexane and to 24 MJ/T of oil. IIR-BC-INF-03-09.

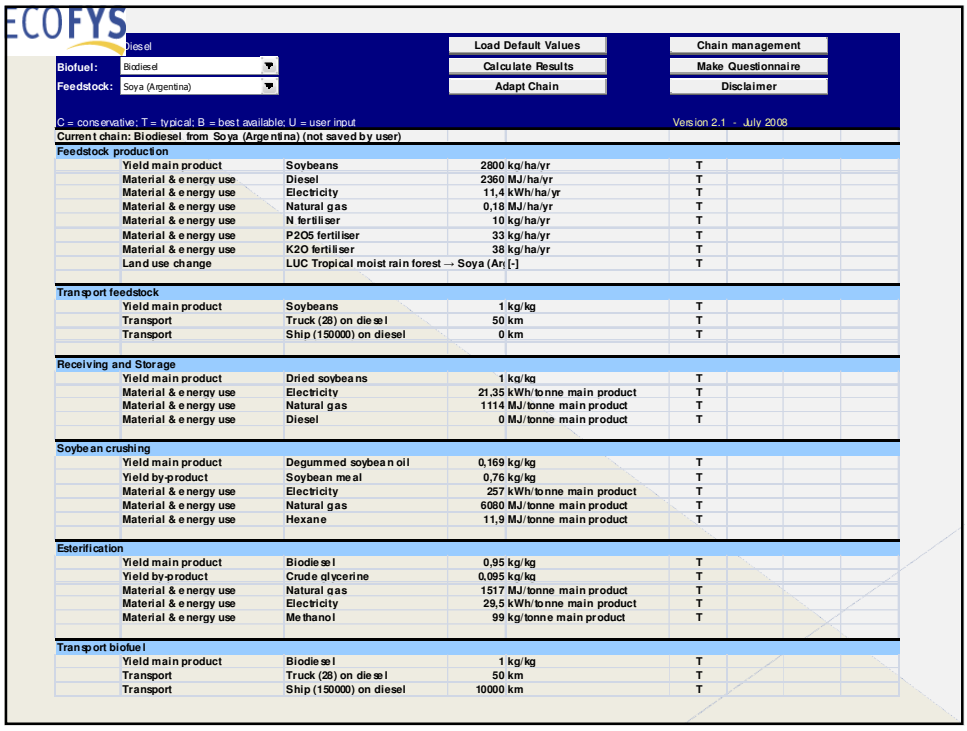
*[11] Corresponding to the average value registered on the survey of biodiesel production companies in Argentina 0,121 T crude glycerine moist base/T biodiesel IIR-BC-INF-03-09.

*[12] Corresponding to the average value registered on the survey of biodiesel production companies in Argentina 34,79 Kwh/T biodiesel given the high dispersion of results IIR-BC-INF-03-09.

*[13] Corresponding to the average value registered on the survey of four biodiesel production companies in Argentina 0,456 T.vapor/Tbiodiesel IIR-BC-INF-03-09. This results in a value of 1499 MJ/T of oil.

*[14] Distance calculated from the Port complex Pto. San Lorenzo/Pto. Gral. San Martín (Prov. of Santa Fe) to the Port of Rotterdam, Holland (Ciani *et al.*, 2007, Panichelli, 2005)L.

*[15] Argentine production companies for export are located near the ports and biodiesel transport is performed through pipes from the plants to the terminal ports. Smaller production plants are located not far than 30 km away.



ECOFYS

Diesel

Biofuel: Biodiesel

Feedstock: Soya (Argentina)

Load Default Values | Calculate Results | Adapt Chain

Chain management | Make Questionnaire | Disclaimer

C = conservative; T = typical; B = best available; U = user input — Version 2.1 - July 2008

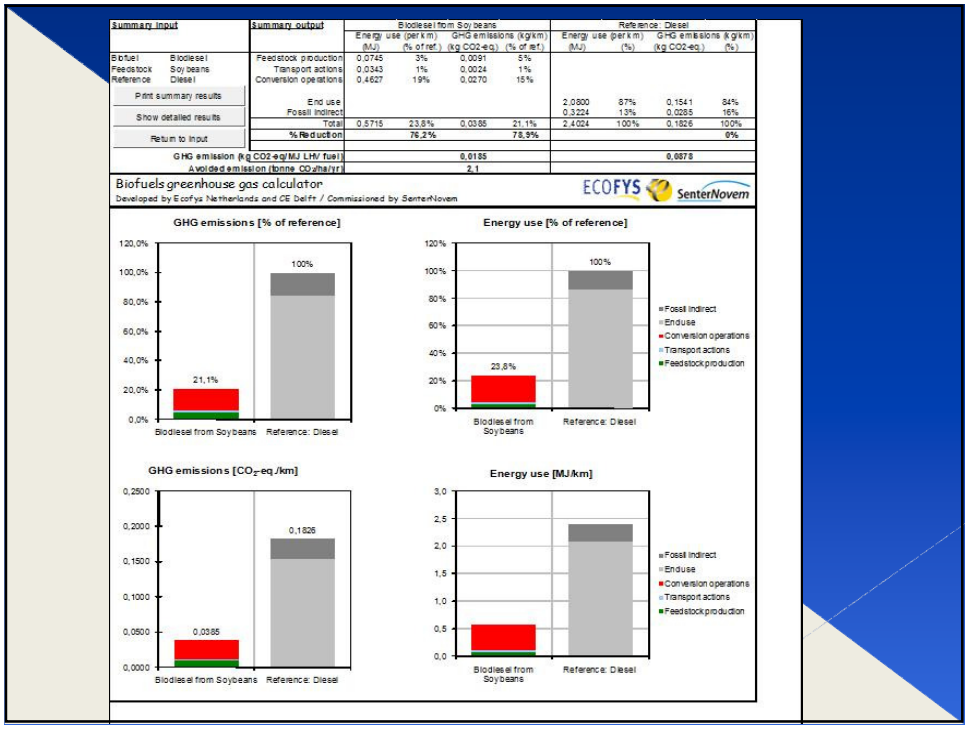
Current chain: Biodiesel from Soya (Argentina) (not saved by user)

Feedstock production				
	Yield main product	Soybeans	2800 kg/ha/yr	T
	Material & energy use	Diesel	2360 MJ/ha/yr	T
	Material & energy use	Electricity	11,4 kWh/ha/yr	T
	Material & energy use	Natural gas	0,18 MJ/ha/yr	T
	Material & energy use	N fertiliser	10 kg/ha/yr	T
	Material & energy use	P2O5 fertiliser	33 kg/ha/yr	T
	Material & energy use	K2O fertiliser	38 kg/ha/yr	T
	Land use change	LUC Tropical moist rain forest → Soya (Ar	[-]	T
Transport feedstock				
	Yield main product	Soybeans	1 kg/kg	T
	Transport	Truck (28) on diesel	50 km	T
	Transport	Ship (150000) on diesel	0 km	T
Receiving and Storage				
	Yield main product	Dried soybeans	1 kg/kg	T
	Material & energy use	Electricity	21,35 kWh/tonne main product	T
	Material & energy use	Natural gas	1114 MJ/tonne main product	T
	Material & energy use	Diesel	0 MJ/tonne main product	T
Soybean crushing				
	Yield main product	Degummed soybean oil	0,169 kg/kg	T
	Yield by-product	Soybean meal	0,76 kg/kg	T
	Material & energy use	Electricity	257 kWh/tonne main product	T
	Material & energy use	Natural gas	6080 MJ/tonne main product	T
	Material & energy use	Hexane	11,9 MJ/tonne main product	T
Esterification				
	Yield main product	Biodiesel	0,95 kg/kg	T
	Yield by-product	Crude glycerine	0,095 kg/kg	T
	Material & energy use	Natural gas	1517 MJ/tonne main product	T
	Material & energy use	Electricity	29,5 kWh/tonne main product	T
	Material & energy use	Methanol	99 kg/tonne main product	T
Transport biofuel				
	Yield main product	Biodiesel	1 kg/kg	T
	Transport	Truck (28) on diesel	50 km	T
	Transport	Ship (150000) on diesel	10000 km	T

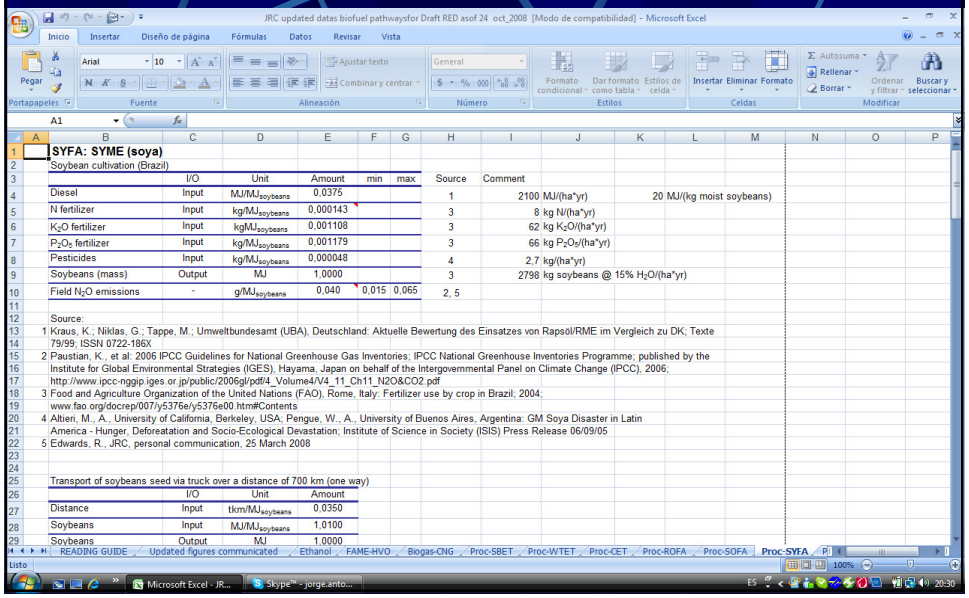
Energy consumption and GHG emissions for the different scenarios. TABLE III

	Energy consumption (per km)			GHG emissions (Kg/km)		
Reference zone	MJ per km	% of the reference *16	% of reductions*16	Kg CO_2-eq	% of the reference *16	% of reductions*16
South . (Tandil)	0,6450	26,8	73,2	0,047	24,5	75,5
Southern Santa Fe (Venado Tuerto)	0,5715	23,8	76,2	0,0385	21,1	78,9
. Aires./Southern (Pergamino)	0,5435	22,6	77,4	0,0342	18,7	81,3
. Aires (Pehuajo)	0,5745	23,9	76,9	0,0344	19,9	80,1
Southern Córdoba ()	0,5648	23,5	76,5	0,0341	18,7	81,3
Salta (Las Lajitas)	0,6419	26,7	73,3	0,0394	21,6	78,4

Reference zone	Stage	Energy consumption (MJ/km)	GHG emissions (g CO_2-eq/km)	Total emissions per stage (g CO_2-eq/MJ fuel LHV)*[17]	Annual saving in CO_2 Emissions (ton CO_2/ha/year)
South Eastern Bs. As. (Tandil)	Agriculture	0,1037	12,2	21.5	1,3
	Industrial	0,4627	27		
	Transport*[18]	0,0787	5,4		
	Total	**0,6450**	**44,7**		
Southern Sta. Fe (Venado Tuerto)	Agriculture	0,0745	9,1	18,5	2,1
	Industrial	0,4624	27		
	Transport	0,0343	2,4		
	Total	**0,5715**	**38,5**		
Northern Bs. As./Southern Sta. Fe (Pergamino)	Agriculture	0,0518	5,2	16,4	1,8
	Industrial	0,4627	27		
	Transport	0,0290	2		
	Total	**0,5435**	**34,2**		
Western Bs. A.s (Pehuajo)	Agriculture	0,0518	5,2	17,5	1,7
	Industrial	0,4627	27		
	Transport	0,0600	4,1		
	Total	**0,5745**	**36,4**		
Southern Córdoba (Río Cuarto)	Agriculture	0,0464	3,2	16,4	1,4
	Industrial	0,4627	27		
	Transport	0,0557	3,9		
	Total	**0,5648**	**34,9**		
Salta (Las Lajitas)	Agriculture	0,0464	3,2	18,9	1,3
	Industrial	0,4627	27		
	Transport	0,1328	9,2		
	Total	**0,6419**	**39,4**		



COMPARISON STUDY WITH JRC



SYFA: SYME (soya)

Soybean cultivation (Brazil)

	I/O	Unit	Amount	min	max	Source	Comment
Diesel	Input	$MJ/MJ_{soybeans}$	0,0375			1	2100 MJ/(ha*yr) 20 MJ/(kg moist soybeans)
N fertilizer	Input	$kg/MJ_{soybeans}$	0,000143			3	8 kg N/(ha*yr)
K_2O fertilizer	Input	$kgMJ_{soybeans}$	0,001108			3	62 kg K_2O/(ha*yr)
P_2O_5 fertilizer	Input	$kg/MJ_{soybeans}$	0,001179			3	66 kg P_2O_5/(ha*yr)
Pesticides	Input	$kg/MJ_{soybeans}$	0,000048			4	2,7 kg/(ha*yr)
Soybeans (mass)	Output	MJ	1,0000			3	2798 kg soybeans @ 15% H_2O/(ha*yr)
Field N_2O emissions	-	$g/MJ_{soybeans}$	0,040	0,015	0,065	2, 5	

Source:

1 Kraus, K.; Niklas, G.; Tappe, M.; Umweltbundesamt (UBA), Deutschland: Aktuelle Bewertung des Einsatzes von Rapsöl/RME im Vergleich zu DK; Texte 79/99; ISSN 0722-186X

2 Paustian, K., et al: 2006 IPCC Guidelines for National Greenhouse Gas Inventories; IPCC National Greenhouse Inventories Programme; published by the Institute for Global Environmental Strategies (IGES), Hayama, Japan on behalf of the Intergovernmental Panel on Climate Change (IPCC), 2006; http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_11_Ch11_N2O&CO2.pdf

3 Food and Agriculture Organization of the United Nations (FAO), Rome, Italy: Fertilizer use by crop in Brazil; 2004; www.fao.org/docrep/007/y5376e/y5376e00.htm#Contents

4 Altieri, M., A., University of California, Berkeley, USA; Pengue, W., A., University of Buenos Aires, Argentina: GM Soya Disaster in Latin America - Hunger, Deforeatation and Socio-Ecological Devastation; Institute of Science in Society (ISIS) Press Release 06/09/05

5 Edwards, R., JRC, personal communication, 25 March 2008

Transport of soybeans seed via truck over a distance of 700 km (one way)

	I/O	Unit	Amount
Distance	Input	$tkm/MJ_{soybeans}$	0,0350
Soybeans	Input	$MJ/MJ_{soybeans}$	1,0100
Soybeans	Output	MJ	1,0000

On the basis of the comparison of the result of the present study with the values proposed by the European Commission Joint Research Centre (JRC) on its calculation template Biofuels pathway RED method as of 14/11/2008, for soybean with values included for Brazil, the following comments can be made

The average yield value considered by JRC is 2798 kg/ha at 15% of water content, while in Argentina, depending on the studied production regions, yields range between 2750 and 4500 kg/ha

The Nitrogen N(ha/year) fertilizer value taken into account by JRC is 8 kg/ha, while in Argentina's production regions studied, values range between 0 and 14 kg/ha

The Potasium K_2O(ha/year) fertilizer value taken into account by JRC is 62 kg/ha, while according to the present study, this type of fertilizer is not used in the production regions in Argentina.

The Phosphate P_2O_5(ha/year) fertilizer value taken into account by JRC is 66 kg/ha, while in Argentina, values range between 0 and 78 kg/ha, according to the region studied.

The methodology used in the present study does not allow for the incorporation of other agrochemicals to the calculation, but their energetic impact is peripheral compared to other inputs.

Hexane values considered by the JRC are of 0,7 kg/Ton of grain, while in the present study on the Argentine case, the average value considered is 0,76.

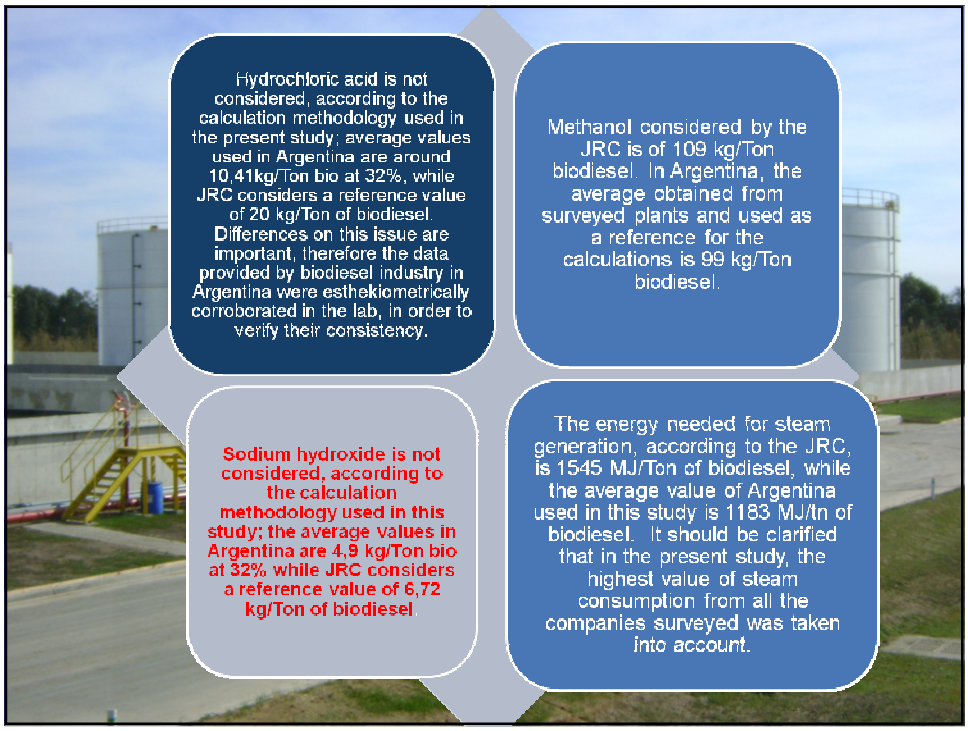
Oil yield value considered by the JRC is of 188 kg/Ton of grain, while the average value considered in the case of Argentina's big production plants is 193 kg/Ton grain.

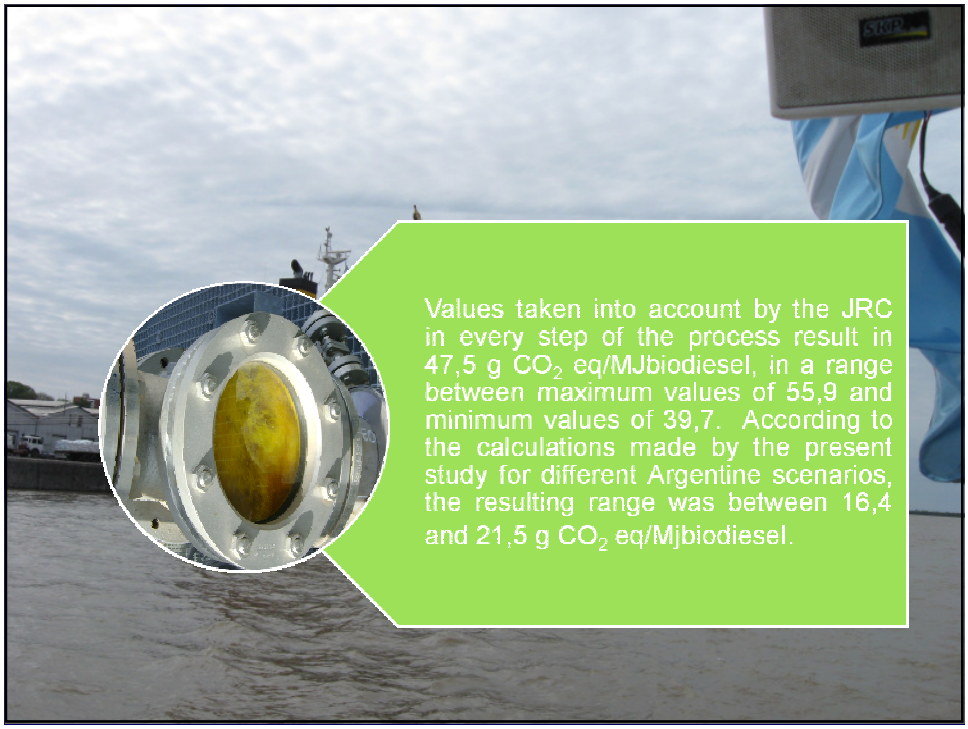
The amount of steam considered by the JRC is 1000 MJ/Ton of grain for the extraction stage and 296 MJ/Ton of grain for the refining stage, while in two Argentine plants, the average value for both processes combined is 1952 MJ/Ton.

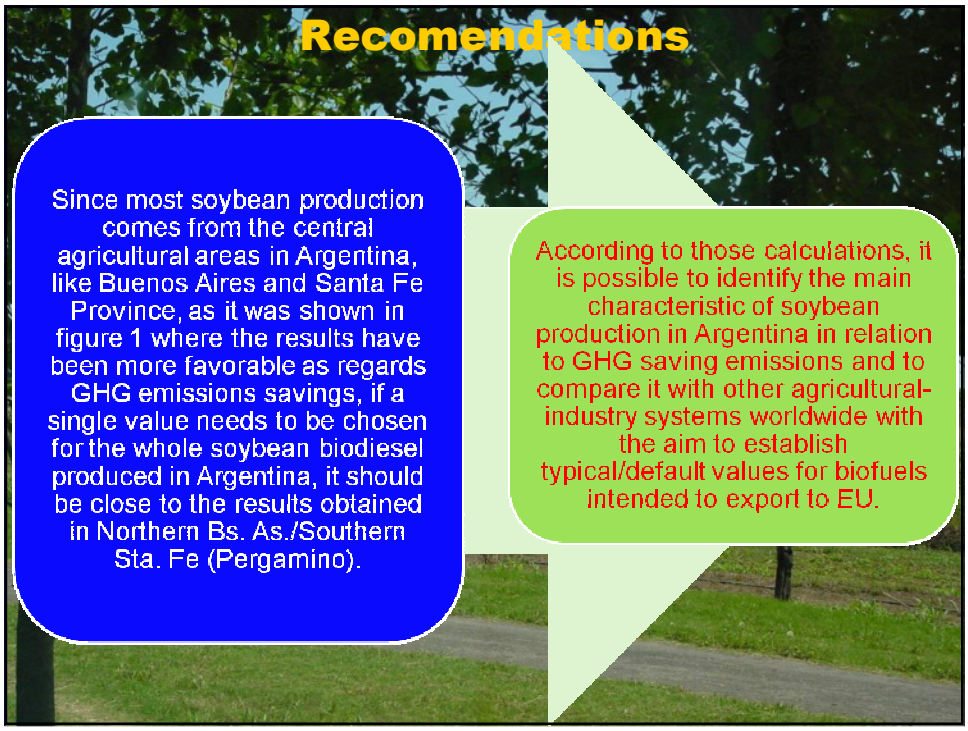
Electricity consumption considered by the JRC is 60 kWh/Ton of grain for the refining stage, while in two Argentine plants, the average value for both processes combined is 34,3kWh/Ton of grain.

Electricity consumption per ton of biodiesel calculated both by JRC and by the Argentine study is the same, 30 kWh/t biodiesel.

Phosphoric acid is not considered on the calculation methodology used by the present study; average values used by JRC as tally values for Argentina are 1,74 kg/Ton of biodiesel.


Hydrochloric acid is not considered, according to the calculation methodology used in the present study; average values used in Argentina are around 10,41kg/Ton bio at 32%, while JRC considers a reference value of 20 kg/Ton of biodiesel. Differences on this issue are important, therefore the data provided by biodiesel industry in Argentina were esthekiometrically corroborated in the lab, in order to verify their consistency.
Methanol considered by the JRC is of 109 kg/Ton biodiesel. In Argentina, the average obtained from surveyed plants and used as a reference for the calculations is 99 kg/Ton biodiesel.
Sodium hydroxide is not considered, according to the calculation methodology used in this study; the average values in Argentina are 4,9 kg/Ton bio at 32% while JRC considers a reference value of 6,72 kg/Ton of biodiesel.
The energy needed for steam generation, according to the JRC, is 1545 MJ/Ton of biodiesel, while the average value of Argentina used in this study is 1183 MJ/tn of biodiesel. It should be clarified that in the present study, the highest value of steam consumption from all the companies surveyed was taken into account.


Values taken into account by the JRC in every step of the process result in 47,5 g CO_2 eq/MJbiodiesel, in a range between maximum values of 55,9 and minimum values of 39,7. According to the calculations made by the present study for different Argentine scenarios, the resulting range was between 16,4 and 21,5 g CO_2 eq/Mjbiodiesel.



Productive chain – Soy products
IPCC application

Siembra Directa
Zona Norte PBA-Sur SF
3.800 Kgs./hectárea

Farming (Soy)

200 km

Electric energy
Fossile fuels
No losses considered

Drying and storage

200 km

Grain

200 km

Electric energy
Fossile fuels

Crushing

Meal 71%

Oil 19%

Electric energy
Fossile fuels
Methanol production

Estherification

Biodiesel 95%

INTA

N° Doc IIR-BC-INF-06-09

COMPARATIVE ANALYSIS OF ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS FROM THE PRODUCTION OF BIODIESEL FROM SOYBEAN UNDER CONVENTIONAL AND NO TILL FARMING SYSTEMS
(Hilbert J.A; Donato L.B..; Muzio J.; Huerga I)

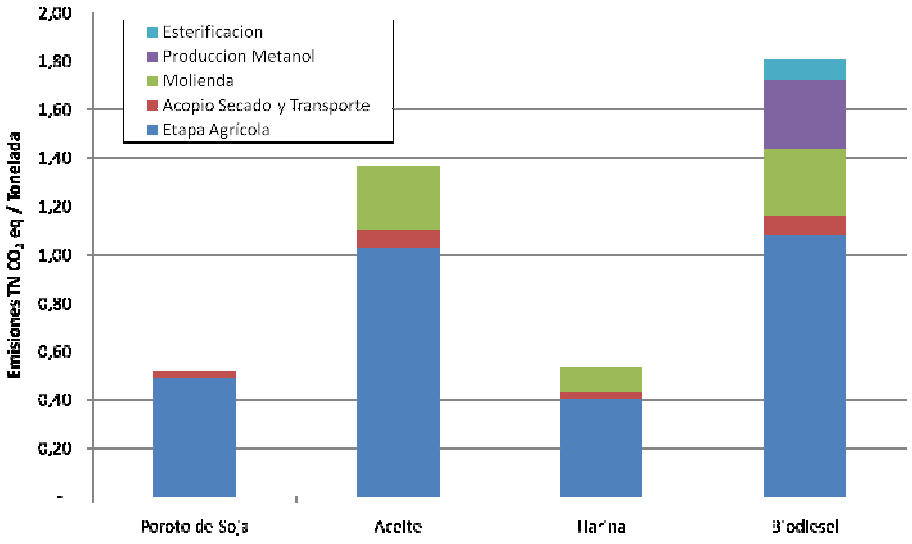
UNFCCC

EB 50 - Report - Annex 12

GUIDELINES ON APPORTIONING EMISSIONS FROM PRODUCTION PROCESSES BETWEEN MAIN PRODUCT AND CO- AND BY-PRODUCTS
(Versión 01)

Ing. Sebastián Galbusera

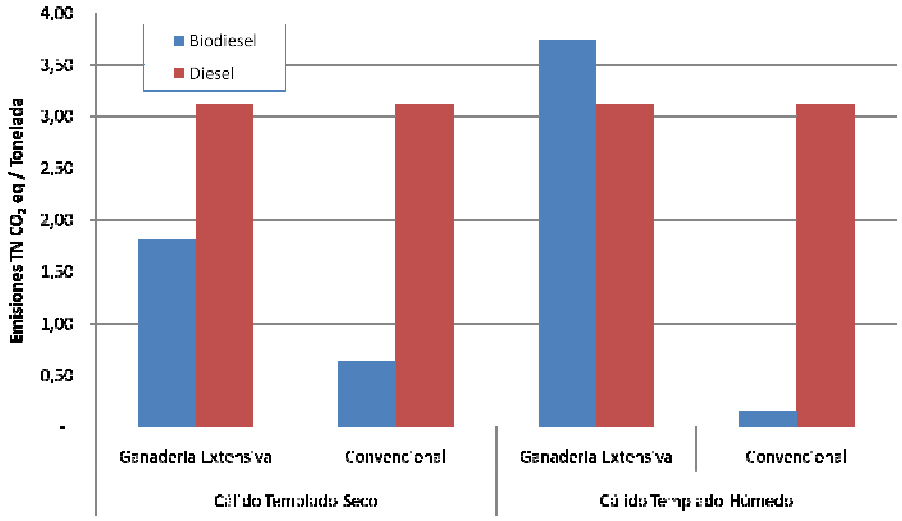
Carbon footprint – North PBA/South SF
No tillage – LB Gassland



Región Climática IPCC: Templado Cálido Seco

Ing. Sebastián Galbusera

Comparative Biodiesel vs Diesel



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