SASES meeting
ASA meetings - Houston, October 5, 2008

Agriculture and agronomy at Argentina and the Southern Cone of Latin America

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IPNI
INTERNATIONAL
PLANT NUTRITION
INSTITUTE

Mission Statement

The mission of IPNI is to develop and promote scientific information about the responsible management of plant nutrients for the benefit of the human family.

IPNI Purpose

To help provide a coordinated scientific foundation for fertilizer nutrient use and to scientifically address the associated environmental issues.

Better Crops, Better Environment … through Science

Outline

❖Agriculture in the Southern Cone

➢Statistics, opportunities and challenges

❖Agriculture in Argentina

➢Information on field crops

➢Management of field crop systems

❖Agronomy in Argentina
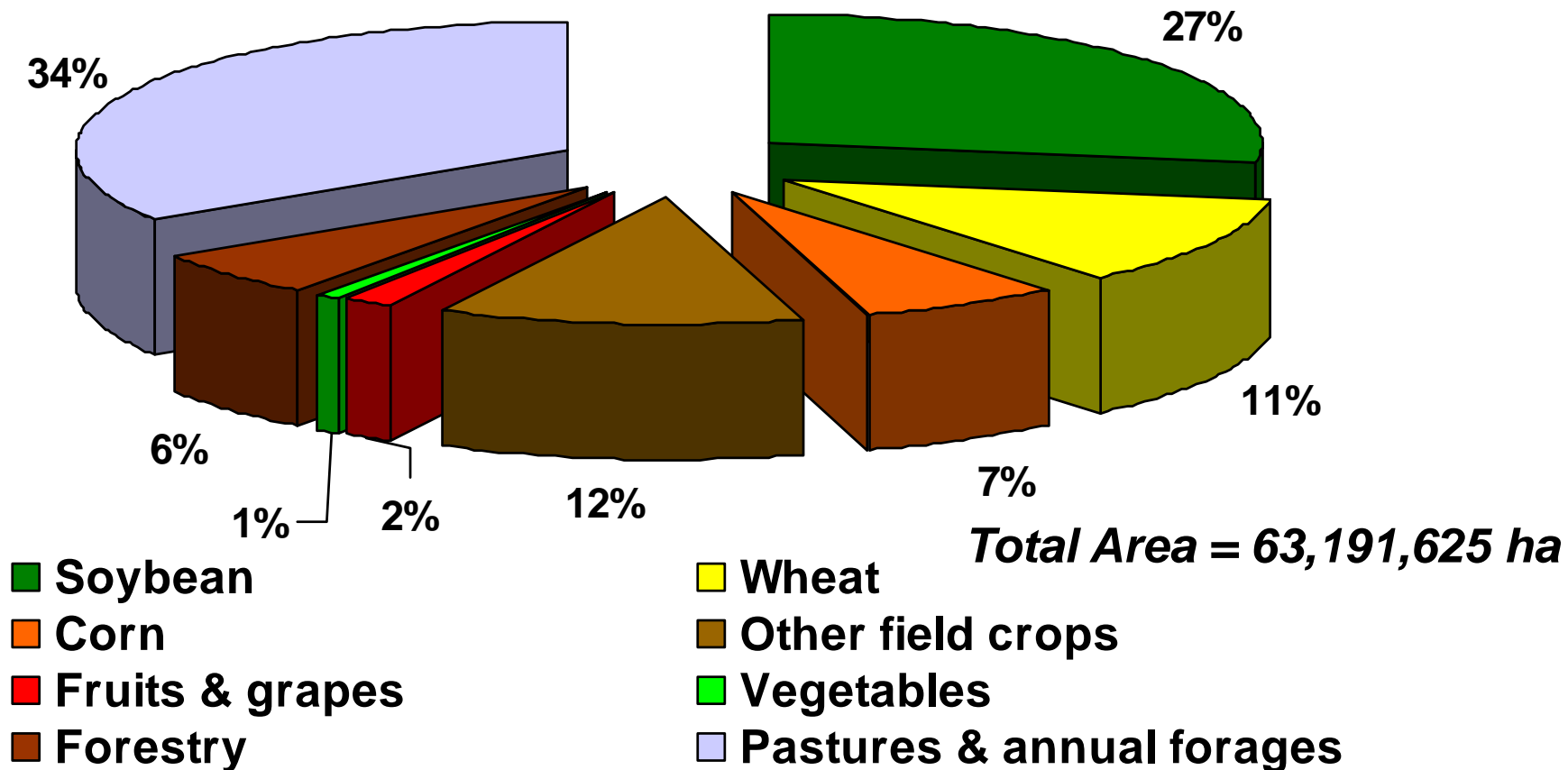
❖Cropping areas at the other Southern Cone countries

Bolivia

Paraguay

Latin America
Southern Cone program

Pacific
Ocean

Argentina

Atlantic
Ocean

Chile

Uruguay

Image © 2005 EarthSat

Country	Area	Population
	thousand km^2	millions
Argentina	2780	37.0
Bolivia	1099	8.3
Chile	757	15.1
Paraguay	407	5.7
Uruguay	177	3.4
Total	5220	69.5

Crops in the Southern Cone countries

34%

27%

6%

1%

2%

12%

7%

11%

Total Area = 63,191,625 ha

- ■ Soybean
- ■ Corn
- ■ Fruits & grapes
- ■ Forestry
- □ Wheat
- ■ Other field crops
- ■ Vegetables
- □ Pastures & annual forages

Other crops includes sunflower, sorghum, barley, rice, sugarcane, cotton, tobacco, potatoes, etc.
Fruits and grapes includes citrus, grapes, apples, pears, peaches, etc.

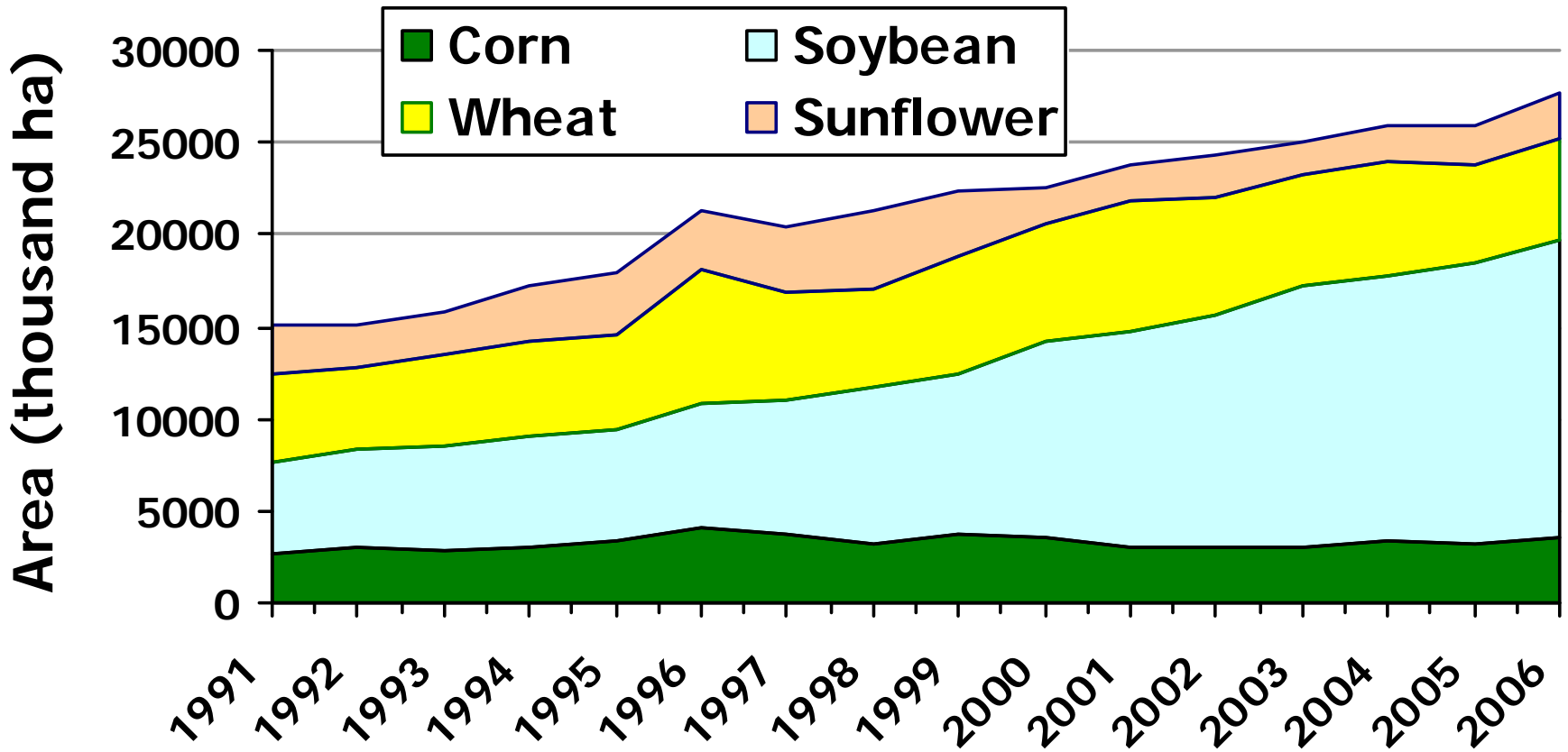Source : SAGPyA, INE, ODEPA, DGEEC, DIEA

Opportunities for Agriculture

- Increasing world demand of food, energy, feed, and fiber

- Good economical situations of farmers

- Increasing cropping areas in southern cone countries

- Possibility of development of sustainable cropping systems through no-tillage + rotations + cover crops + balance nutrition
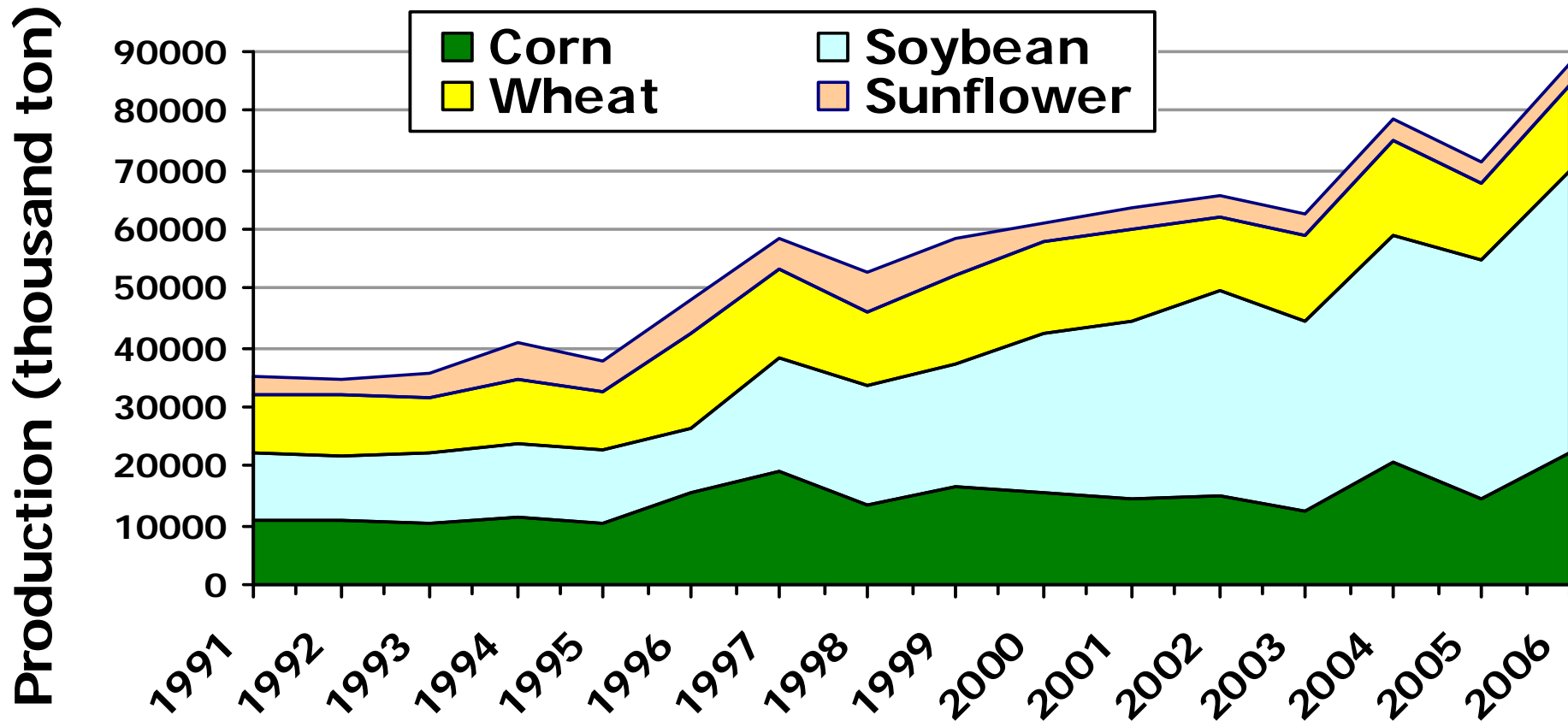
Constraints for Agriculture

- World economy?

- Political instability, lack of decisions

- Taxes on exportations

- Increasing ag chemicals and fertilizer costs

- Soybean monoculture

- Lack of support to research and extension institutions
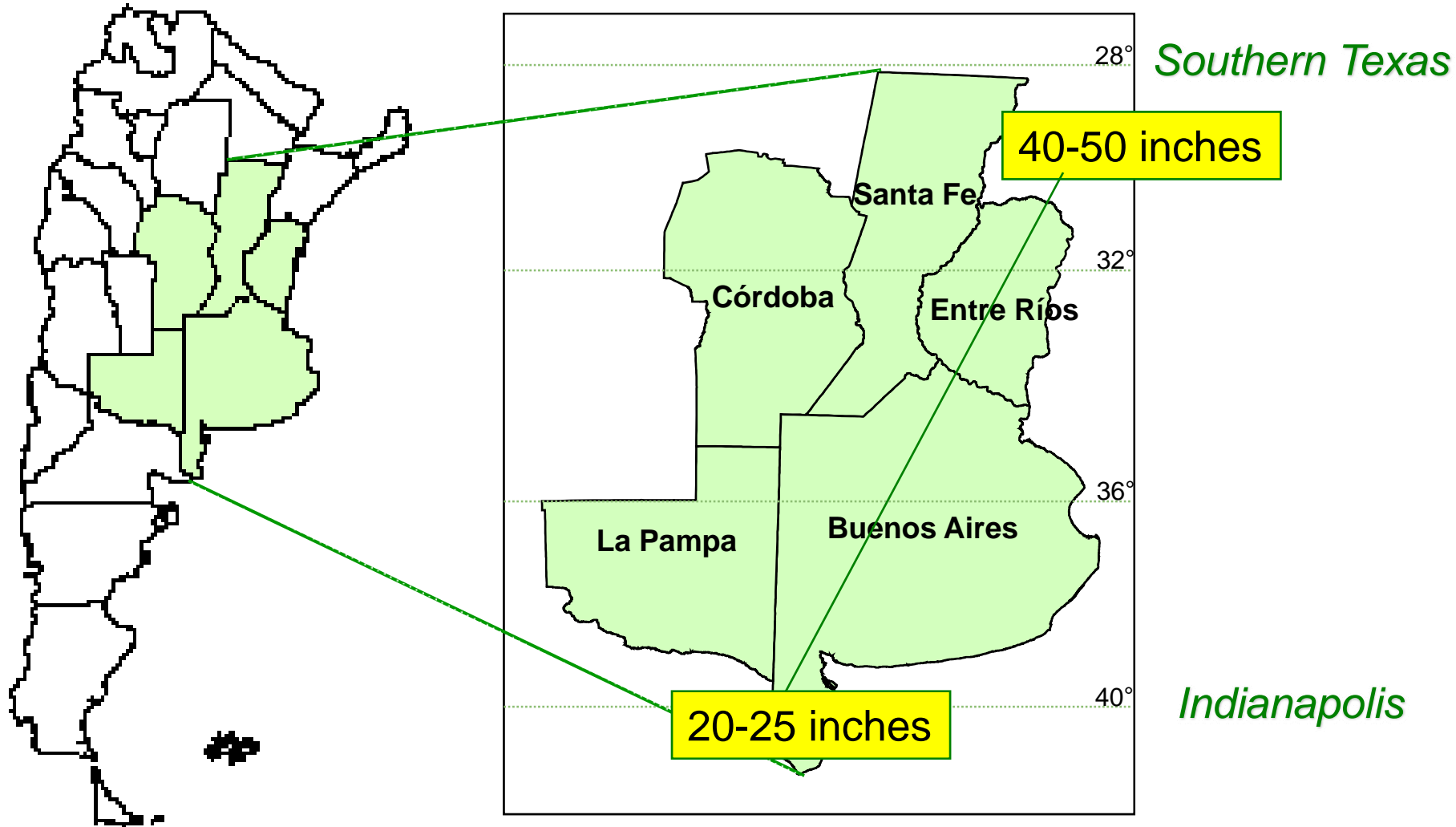
Field crops at Argentina Area from 1991 to 2007

Area (thousand ha)

Legend: Corn, Soybean, Wheat, Sunflower

Field crops at Argentina Production from 1991 to 2007

Elaborated from information of SAGPyA

The Pampas region of Argentina

Santa Fe

Córdoba

Entre Ríos

La Pampa

Buenos Aires

40-50 inches

20-25 inches

Southern Texas

Indianapolis

28°

32°

36°

40°

Map developed with ArcView - ESRI

Global Soil Regions

Midwest and Central Great Plains

Pampas and Chaco regions

Robinson Projection
Scale 1:130,000,000

Soil Orders

Alfisols		Entisols		Inceptisols		Spodosols		Rocky Land
Andisols		Gelisols		Mollisols		Ultisols		Shifting Sand
Aridisols		Histosols		Oxisols		Vertisols		Ice/Glacier

Field crops at USA and Argentina 2007 season

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Area

thousand ha		
100000	88991	
80000		
60000		
40000		29000
20000		
0	USA	Argentina
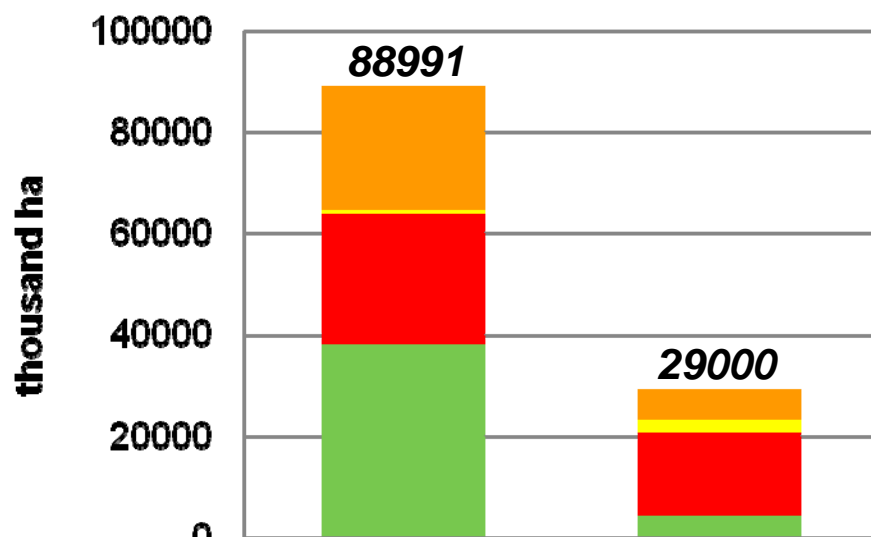
	USA	Argentina
■ Wheat	24475	5850
■ Sunflower	838	2650
■ Soybean	25771	16500
■ Corn	37908	4000

Production

thousand t		
500000		
400000	460368	
300000		
200000		
100000		87530
0	USA	Argentina
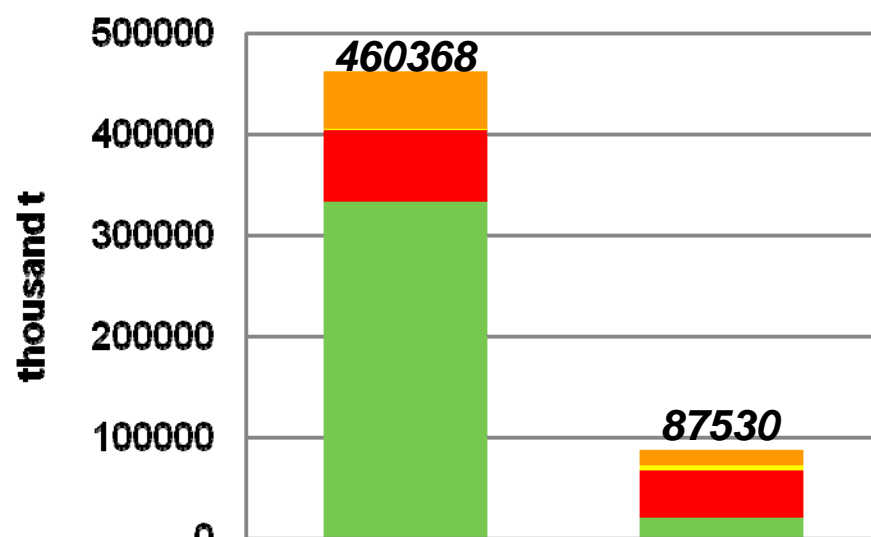
	USA	Argentina
■ Wheat	56298	16000
■ Sunflower	1311	4630
■ Soybean	70421	46500
■ Corn	332338	20400

Elaborated from information of USDA and SAGPyA

Grain yields at USA and Argentina 1991 to 2007

Corn
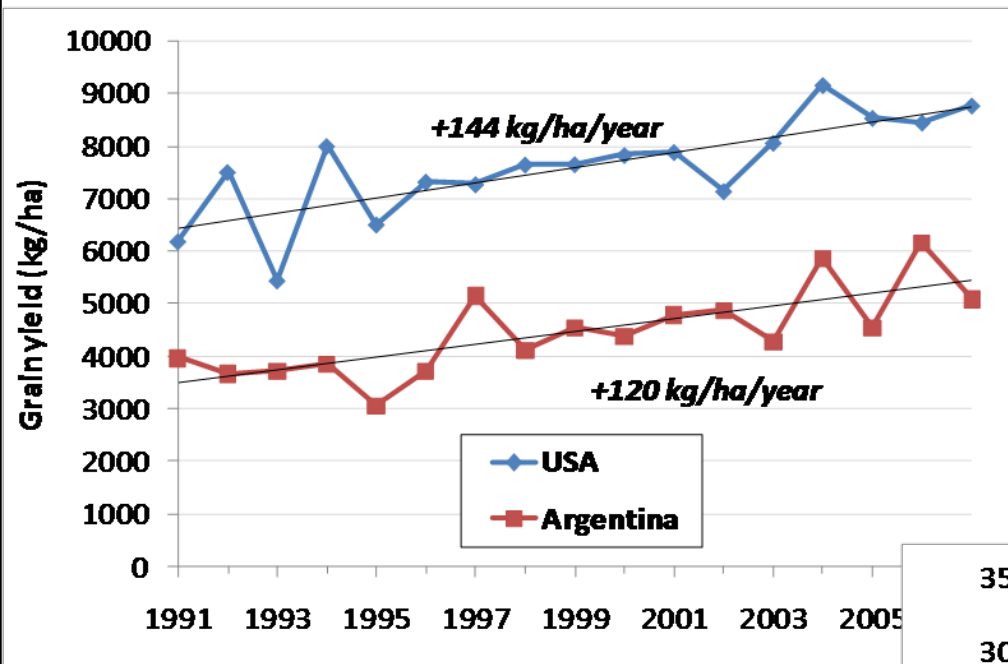
Soybean
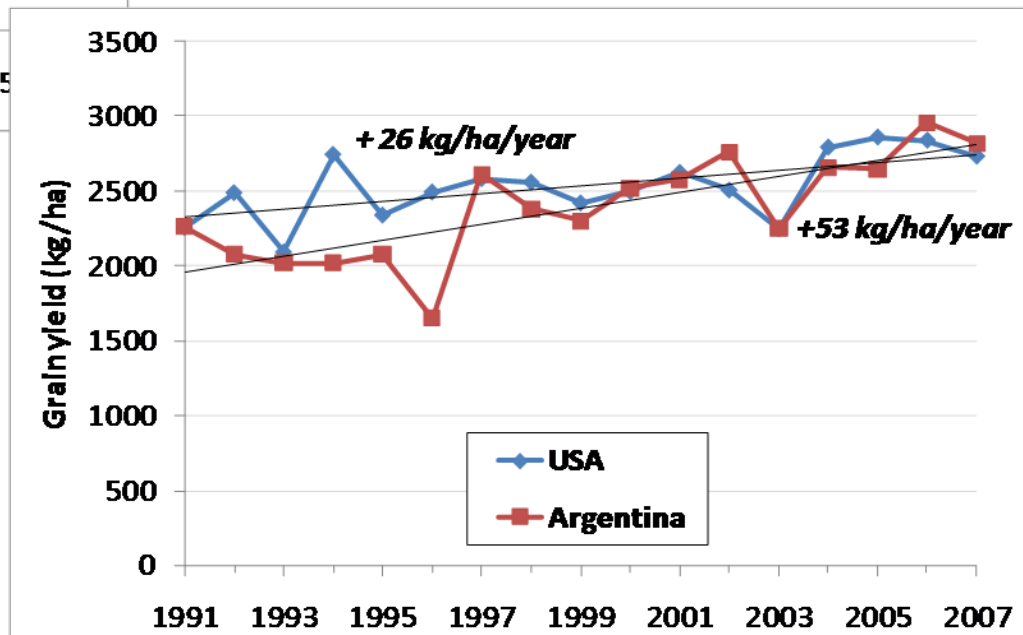
Elaborated from information of USDA and SAGPyA

Beef and Dairy production at USA and Argentina

	USA	**Argentina**
Beef cattle (heads)	104 million	50 million
Beef production (t)	12 million	3 million
Dairy cows (heads)	9 million	1.7 million
Milk production (L)	77 million	9 million

Source: USDA and SAGPyA

Organic C levels in soils of the northern Pampas since beginning of agriculture (Argiudolls)

43% of original

y = -6,4 Ln(x) + 70

R^2 = 0,71

Carbon (t/ha)

Years under cropping
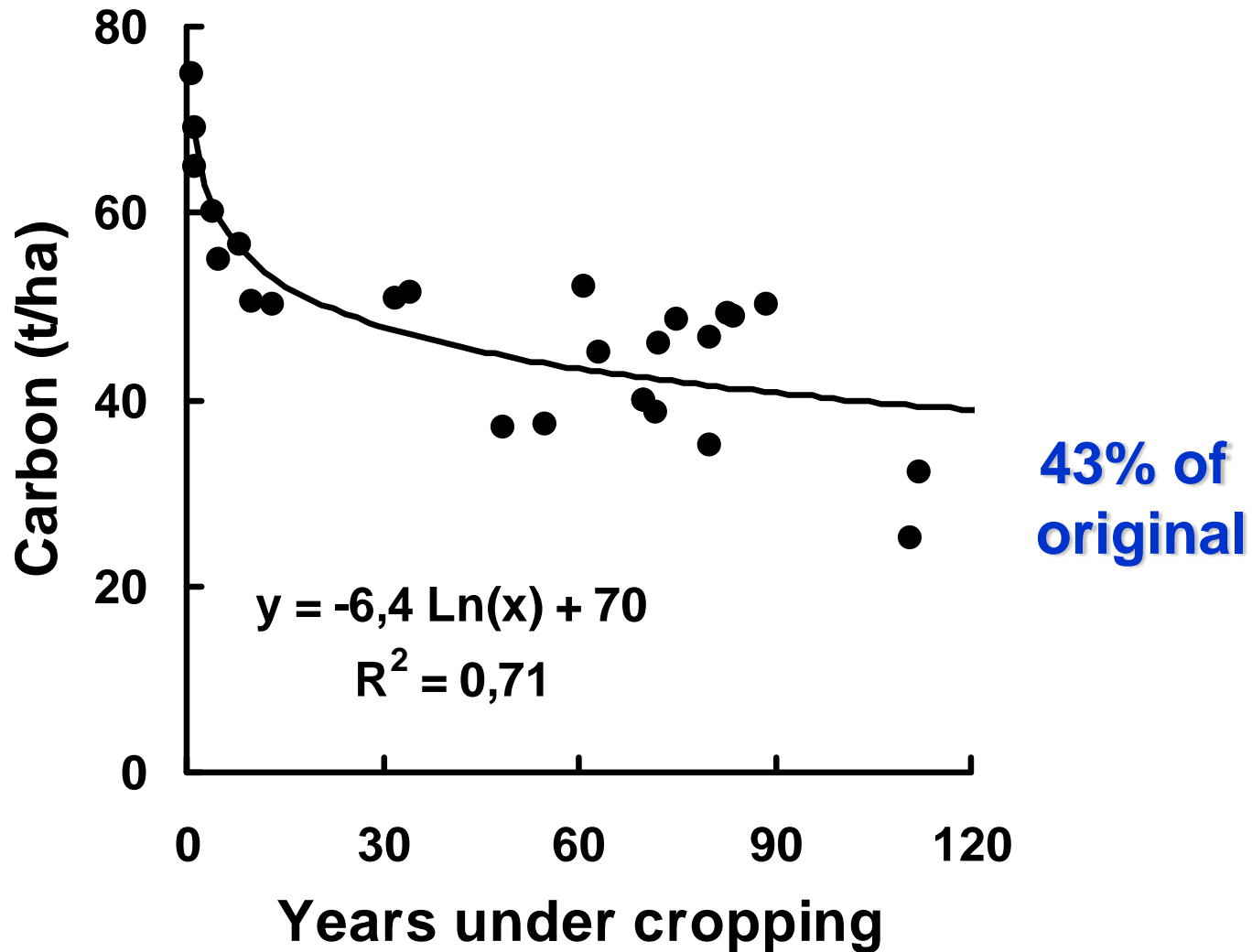
Nutrient Depletion in the Pampean Region

Typic Argiudoll - Arroyo Dulce Series
Original = Undisturbed for at least the last 18 years
Cropped = 30 years of annual cropping (20 years soybeans)

Property	Original	Cropped
Organic matter (%)	5.3	3.5
pH	6.2	6.0
Total Nitrogen (g/kg)	2.8	1.9
Bray P (mg/kg)	123.5	14.9
Exch. Ca (cmol/kg)	10.1	10.0
Exch. Mg (cmol/kg)	2.4	1.9
Exch. K (cmol/kg)	2.3	1.3
Zinc (mg/kg)	3.9	1.9
Copper (mg/kg)	3.5	2.4
Boron (mg/kg)	0.77	0.28

Urricarriet and Lavado, 1997

Looking for sustainability

- No-tillage
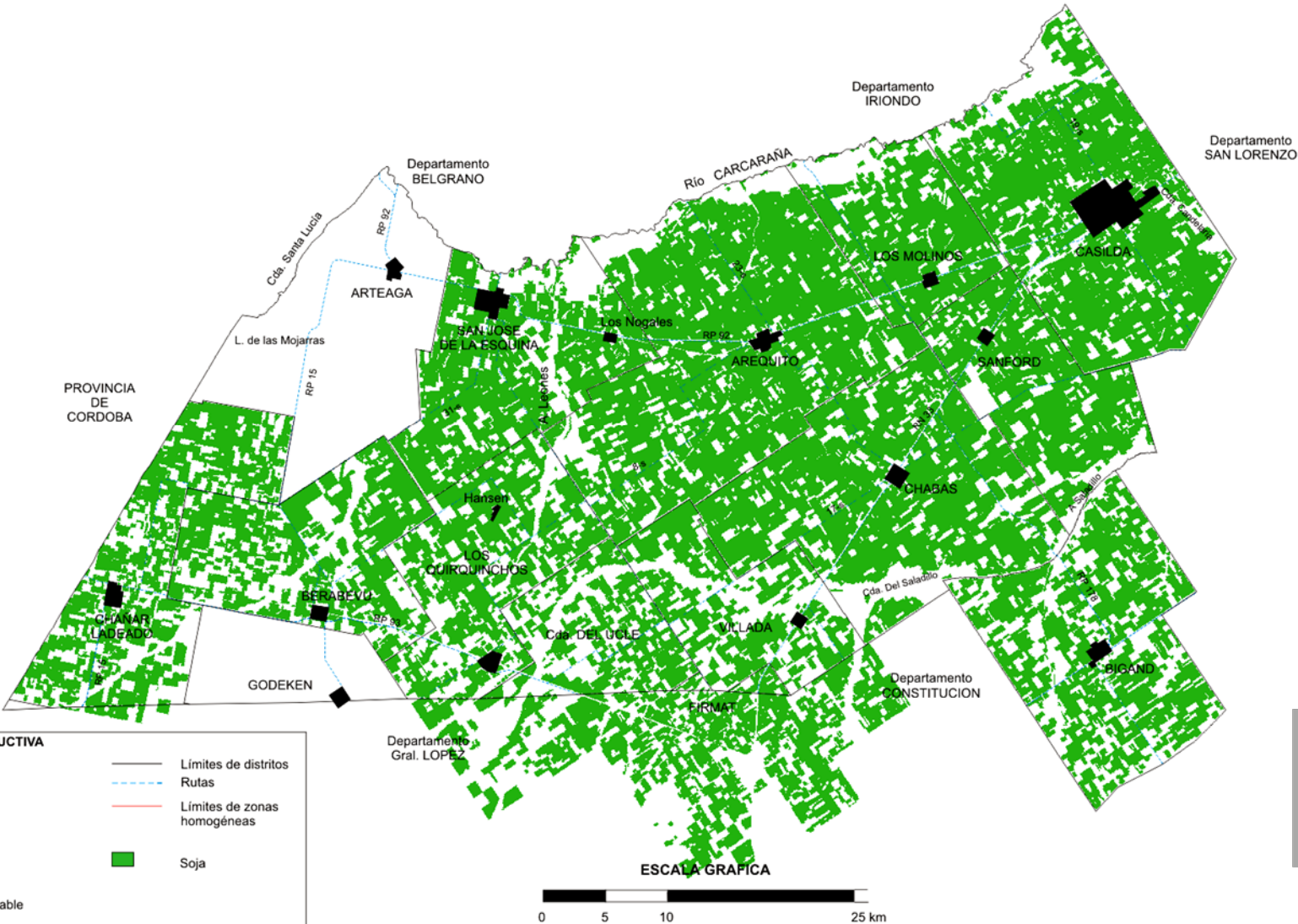 - Decrease erosion
  - Stable and higher yields
  - Improved water use efficiency
  - Improved soil C balance

- Rotations
  - Residues: greater amount, different quality
  - Diversity of root systems: Architecture and rizosphere
  - Soil cover for longer periods (cover crops)

- Balanced nutrition

Area planted to Soybeans in the County of Caseros
South-Central Santa Fe - Soybean Belt of Argentina - 2000/01
Source: G. Cordone (INTA Casilda)

REFERENCIAS

CAPACIDAD PRODUCTIVA

A	Alta
B1	Media - alta
B2	Media - baja
C	Baja
D	Muy baja
E	Muy baja - anegable
L	Lagunas

— Límites de distritos
- - - Rutas
— Límites de zonas homogéneas
▢ Soja

ESCALA GRAFICA

0   5   10   25 km

Reducción de la síntesis
en escala 1:250.000

AUTORES: Tosolini Rubén, Raúl Giorgi, Verónica Sapino, Cristian León y Alejandro Chiavassa

Effects of soybean expansion in the soil system

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Soybeans dominate the rotation (soybean monoculture)

Low C input to the system

SOM decreases

Biological, chemical and physical soil properties are affected

Corn, wheat or other crops are not profitable

Field at Southeastern Cordoba under continuous soybean

Soil profile showing compacted zones (red marks) at 10-15 cm
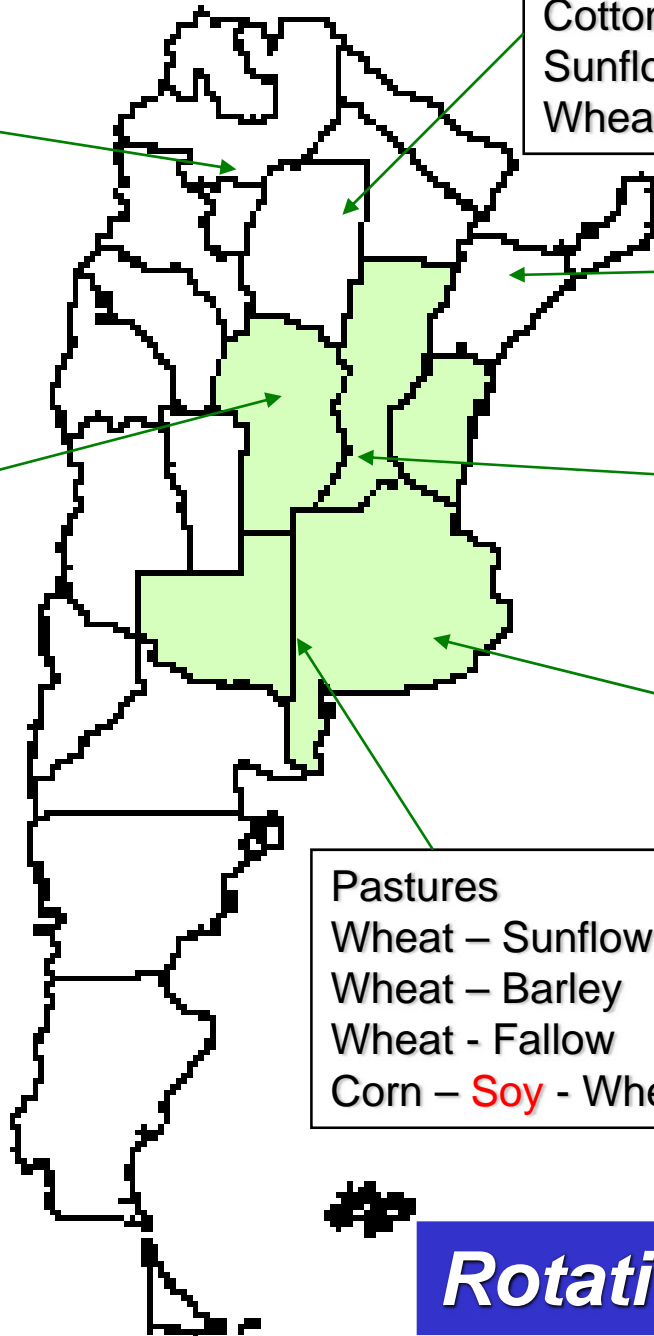
Sugarcane
Continuous Soy
Soy – Corn
Wheat/Soy

Continuous Soy
Cotton
Sunflower/Soy
Wheat/Soy –Corn/Soy

Pastures
Rice - Pastures
Soy - Rice

Continuous Soy
Corn – Soy
Pastures

Continuous Soy
Wheat/Soy
Corn – Wheat/Soy
Corn – Soy - Wheat/Soy

Pastures
Wheat – Sunflower
Corn – Wheat/Soy
Corn – Soy - Wheat

Pastures
Wheat – Sunflower
Wheat – Barley
Wheat - Fallow
Corn – Soy - Wheat

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Rotations and Sequences

New Situation

Area under No-Tillage in Argentina

19,719,000 ha in 2005/06
69% of the total cropped area

Area under NT (thousand ha)
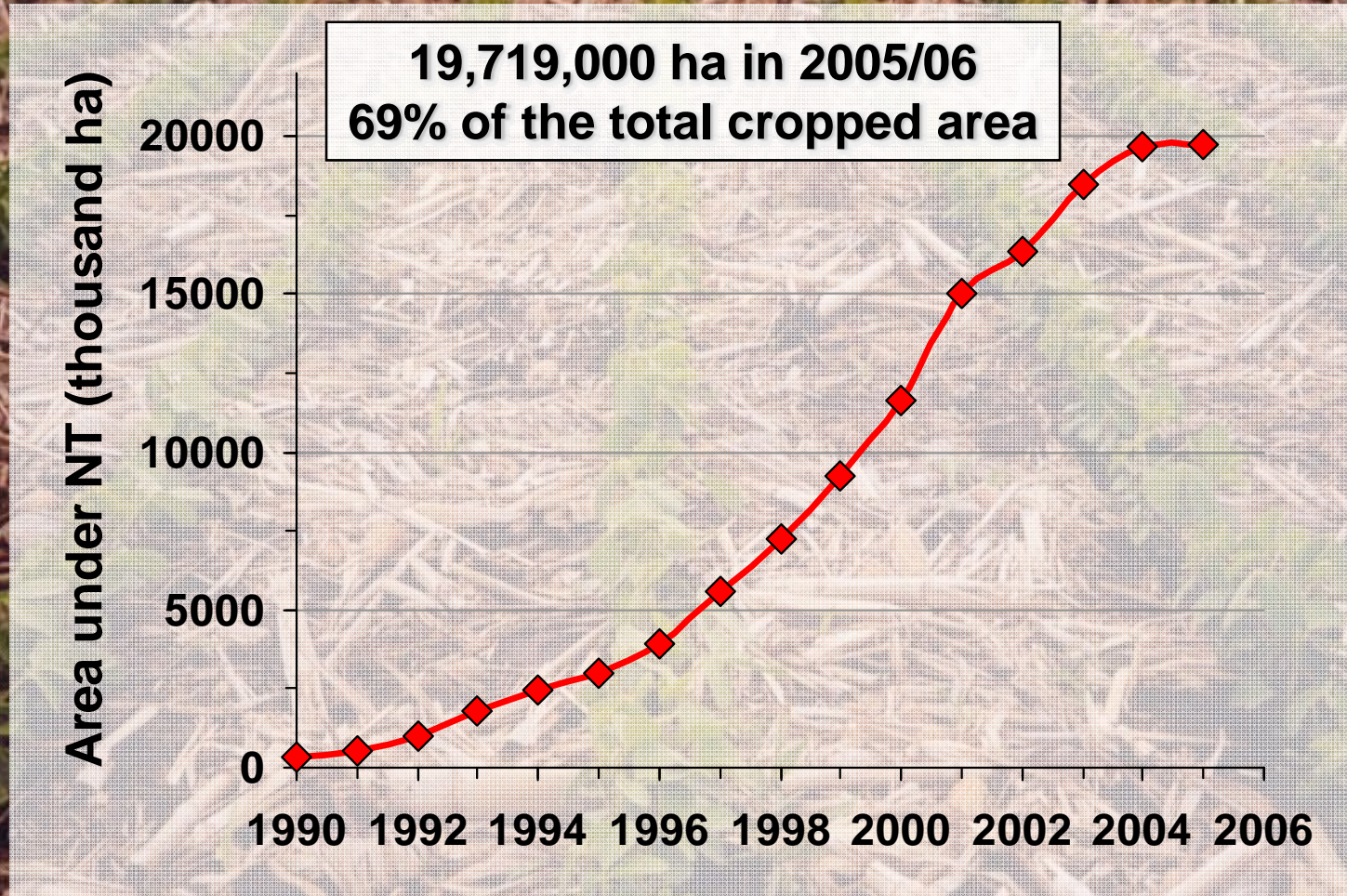
Source: AAPRESID (2007)
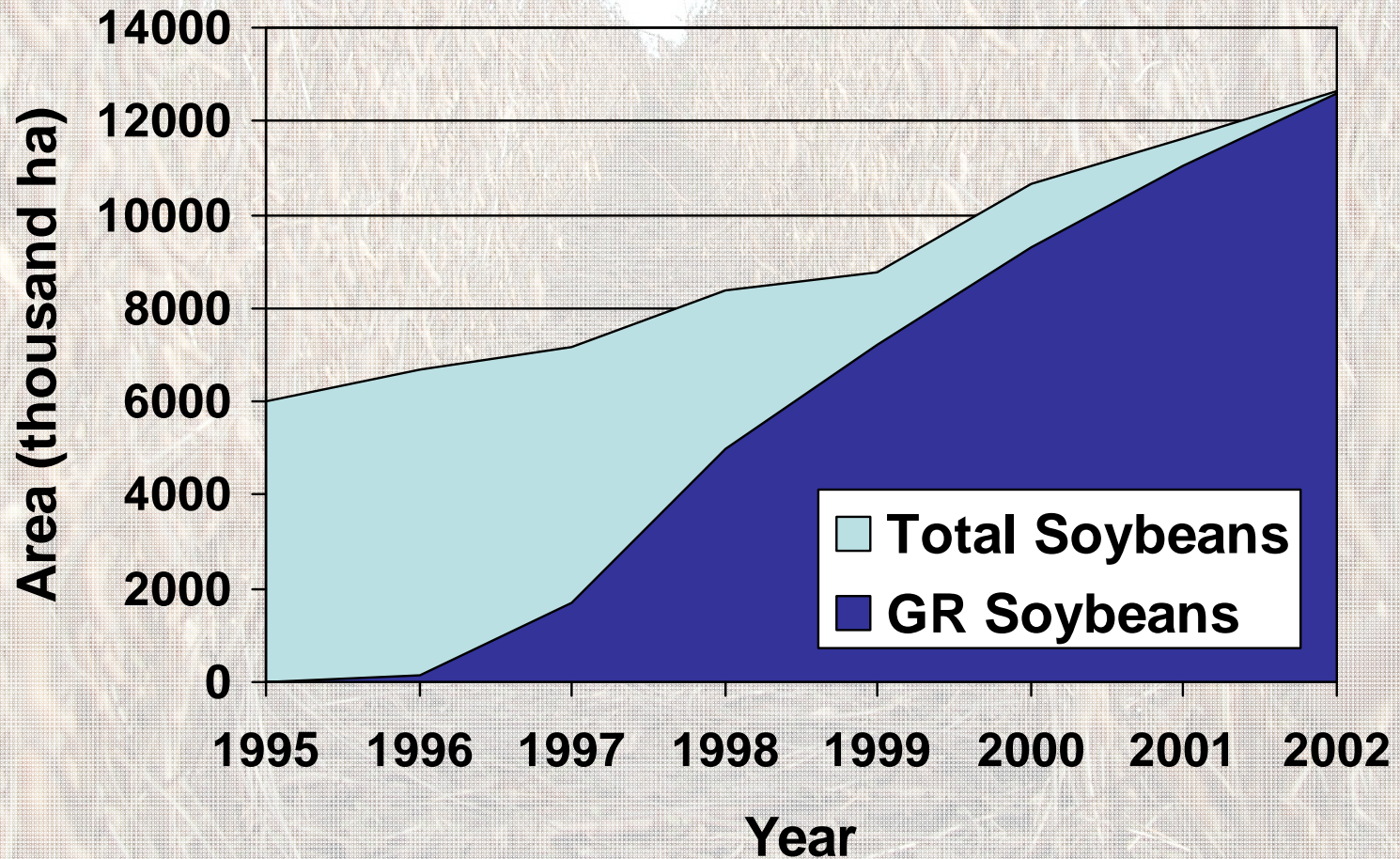
Vetch as cover crop during winter for corn (J. Romagnoli. M. Buey, 2007/08)
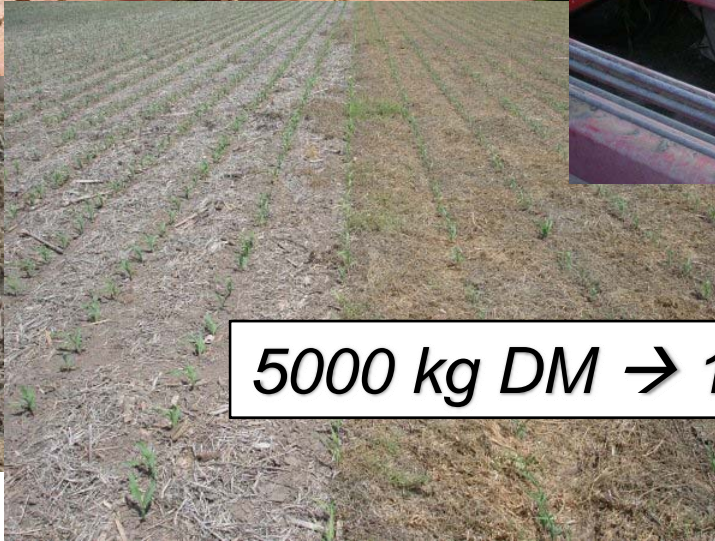
5000 kg DM → 130 kg/ha de N

Argentina
Fertilizer consumption from 1991 to 2007

Consumption = 179 Year - 356083
R^2 = 0.918
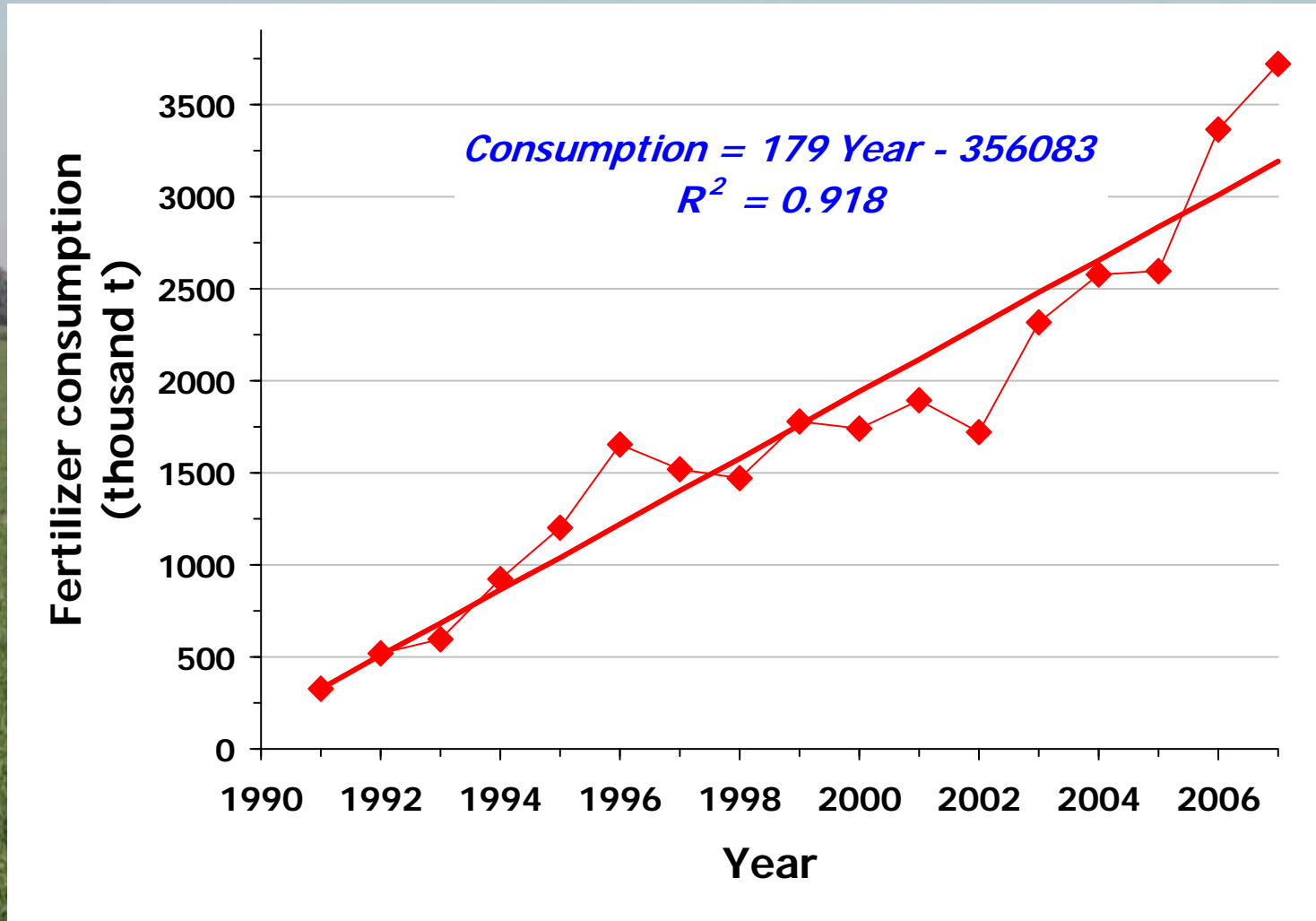
Source: SAGPyA and Fundacion Producir Conservando

Argentina: Relationship Application/Removal in field crops for N, P, K, and S
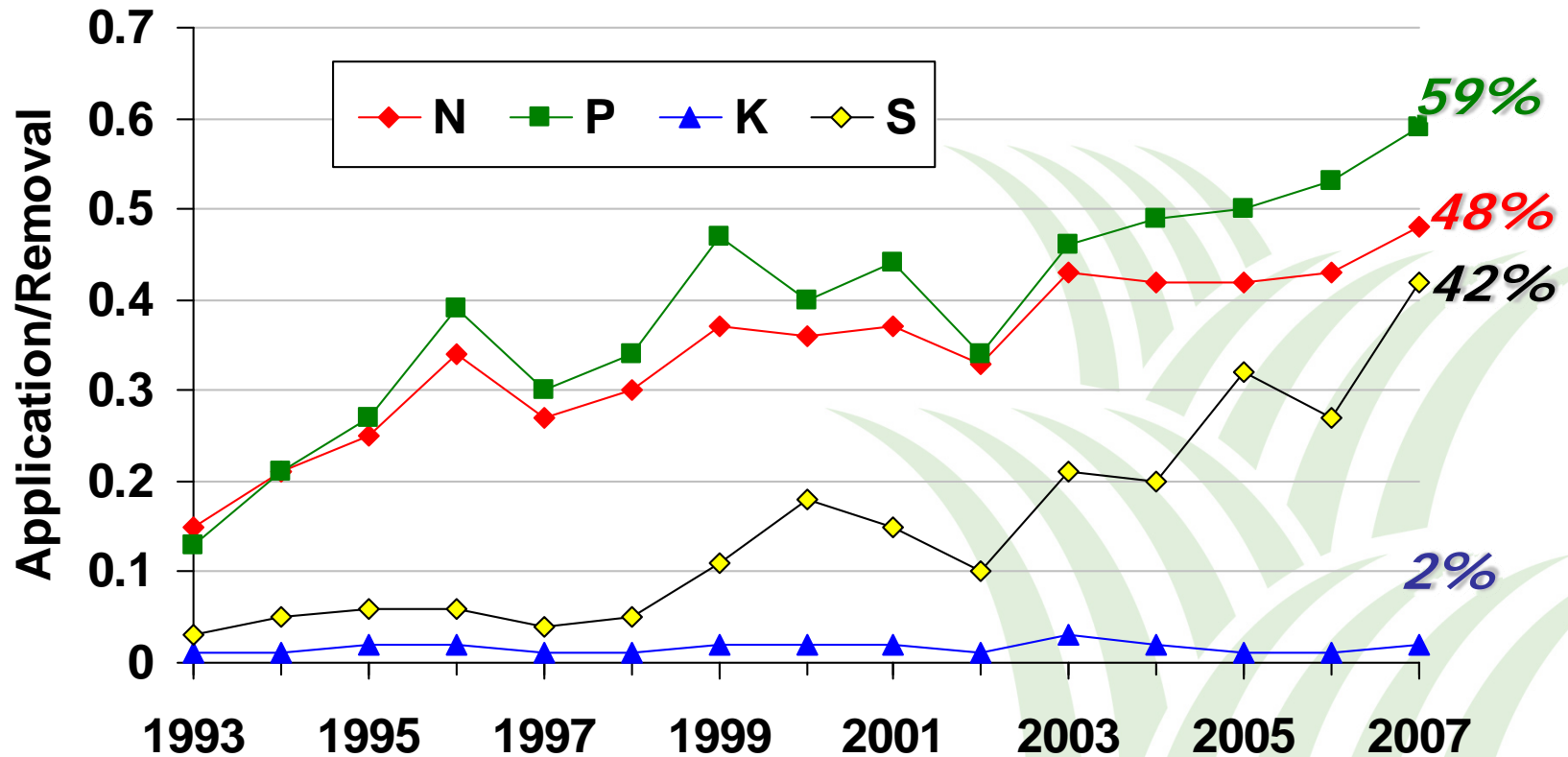
Nutrition Network CREA Southern Santa Fe

NPS

Check

NPS Micros

Wheat

Check
2588 kg/ha

NPS
3878 kg/ha

Double crop soybeans

Check
2763 kg/ha
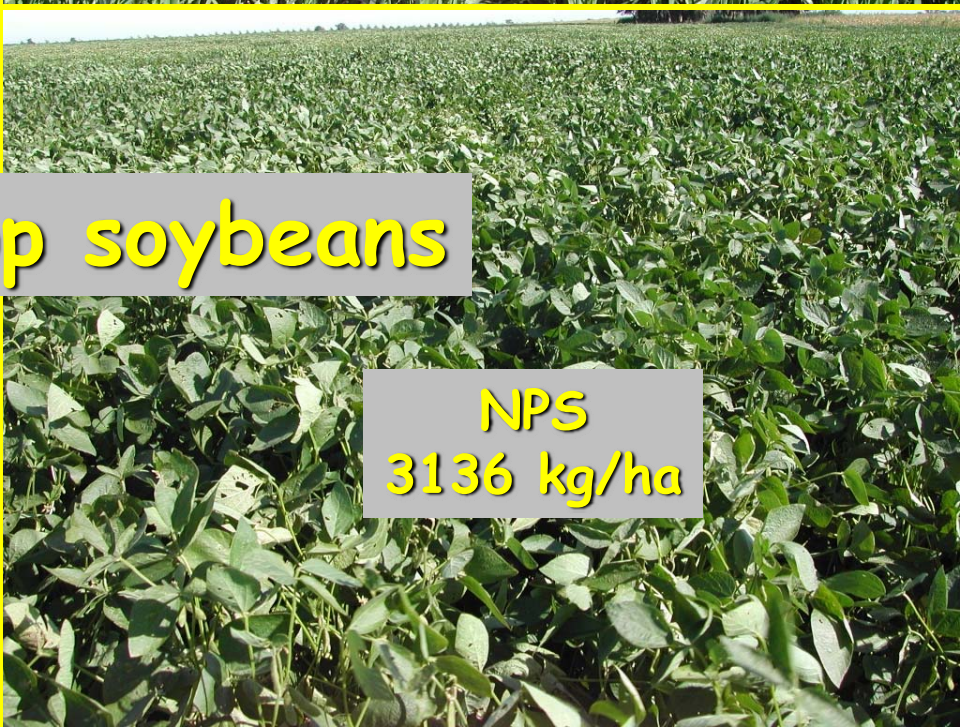
NPS
3136 kg/ha

Phosphorus Agronomic Efficiency and Partial Nutrient Balance in Soybean at the Northern Pampas of Argentina
15 field trials carried out at in the 2003/04 season

Treatment	Grain yield (kg/ha)	Agronomic Efficiency (kg soybean/kg P)
Check	3135	-
P10	3372	24
P20	3557	21
P30	3695	19

Source: Melchiori et al. (2004), Project INTA-IPNI-Mosaic

Check
7372 kg/ha

NPS
11540 kg/ha

31 site-years Nutrition Network CREA Southern Santa Fe

Precision Agriculture in Argentina

- **Adoption of PA in Argentina started when INTA launched in 1996 a National Project of Precision Agriculture at EEA INTA Manfredi (Cordoba) leaded by Mario Bragachini (www.agriculturadeprecision.org)**

- **Yield monitors, Global Positioning Systems (GPS) guidance and satellite images are increasingly used in large operations, while variable rate application (VRA) is rare.**

- **Constraints for the adoption of PA are: high investment cost, high risk, low management-induced soil variability, and the widespread use of custom operators.**

- **Adoption of PA is supported from: large farm operations with relatively high capital per worker, highly educated farm management, technology available from abroad, need for yield information, and ease of pooling data.**

- **Remote sensing for agriculture in Argentina is becoming increasingly used.**

- **The potential of precision farming in Argentina's agriculture is to reduce costs in grain production, to increase productivity and make input use more efficient.**

- **The challenge is to manage our agronomic knowledge to put these tools to work.**

Source: Bragachini et al., 2002; Bongiovanni, 2003 (www.agriculturadeprecision.org)

Remote sensing studies at EEA INTA Parana

Ricardo Melchiori and coworkers

N-Sensor

Green Seeker manual

Green Seeker RT 200

Green Seeker RT 200

Agronomy studies at Argentina

- Twenty four public colleges of agronomy with approximately 900 graduates per year

- Rate of graduation is of approximately 40%

- The Agronomy Career is of 4-5 years, it includes agronomy + animal science + ag economics + ag engineering

- Title is "Agronomy Engineer"

- Graduate schools at colleges of agronomy with "Specialization", M.S, and Ph.D. titles in different areas

- An estimated total of 15,000 agronomists in the country

Bolivia

Tropical area: Banana, palm, and others

Pastures: Beef cattle production

Eastern plains: Soybean, other grain crops, sugarcane

Valleys: Vegetables and fruits, potato , wheat

Chile

Field crops: Wheat, pastures, corn, potatoes, forestry, dairy, beef cattle
(Central and Southern Chile)

Specialties: Strongly oriented towards exportation markets (fruits, vegetables, wine grapes) (mainly Central Chile)
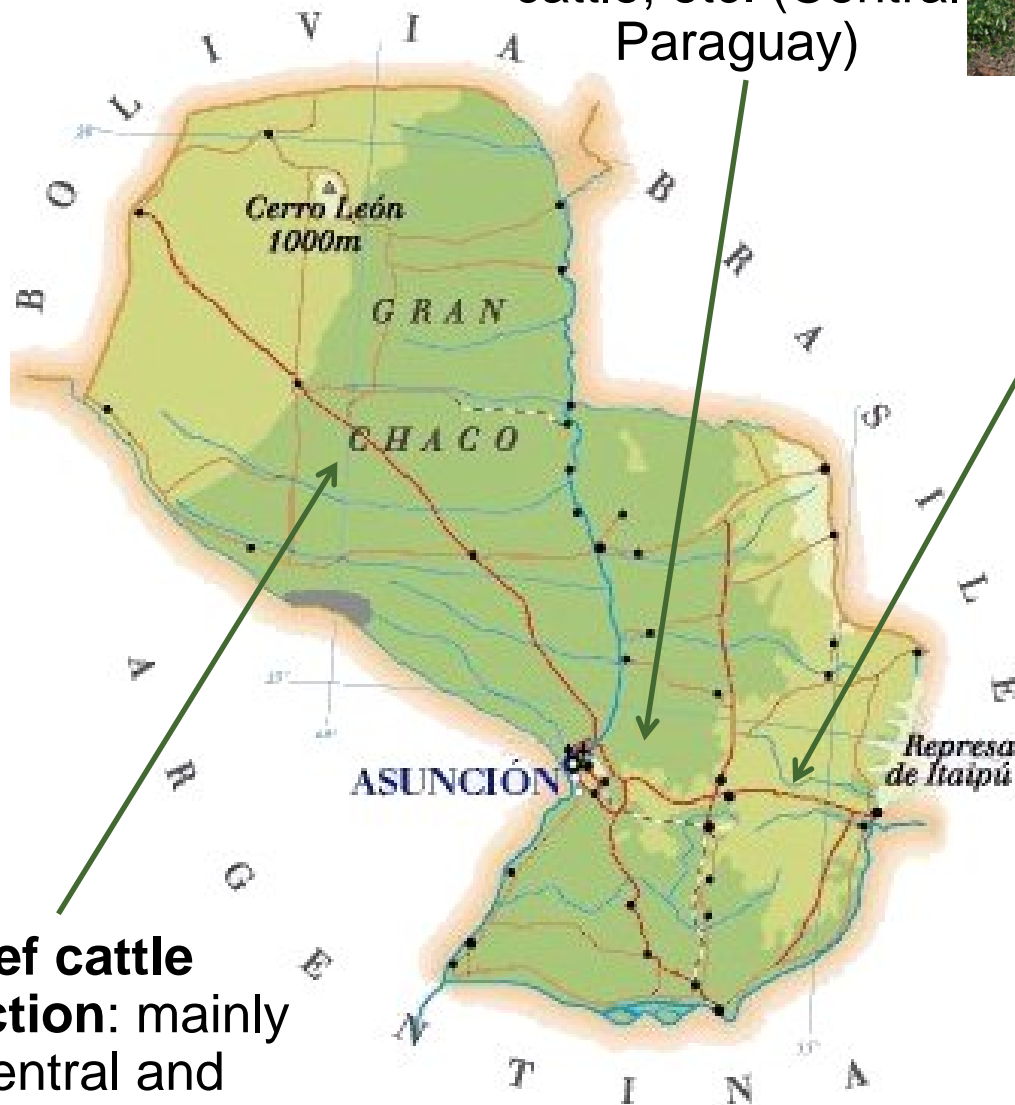
Paraguay

Small holders: Corn, vegetables, cattle, etc. (Central Paraguay)

Mechanized: Field crops, soybeans and others (Eastern Paraguay)

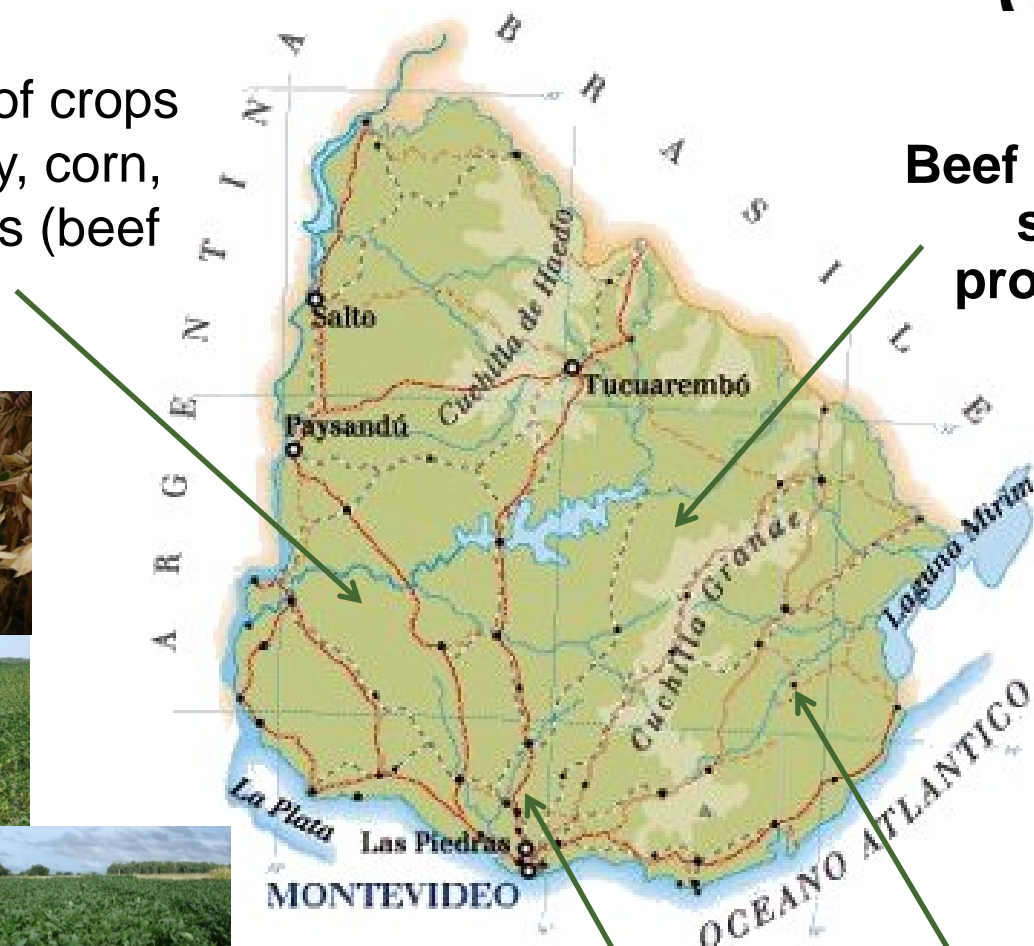**Beef cattle production**: mainly in Central and Western Paraguay

Uruguay

Field crops: Rotations of crops (soybean, wheat, barley, corn, sunflower) and pastures (beef production)

Beef cattle and sheep production

Rice production

Vegetables and fruits, dairy

Thank you!!

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Wheat field, Balcarce, Buenos Aires, Argentina