Land-Use and Livestock

Geraldo Martha, Jr.

Global Multi-Stakeholder Meeting on Responsible Livestock, Brasília, June 17 – 20 2011

Outline

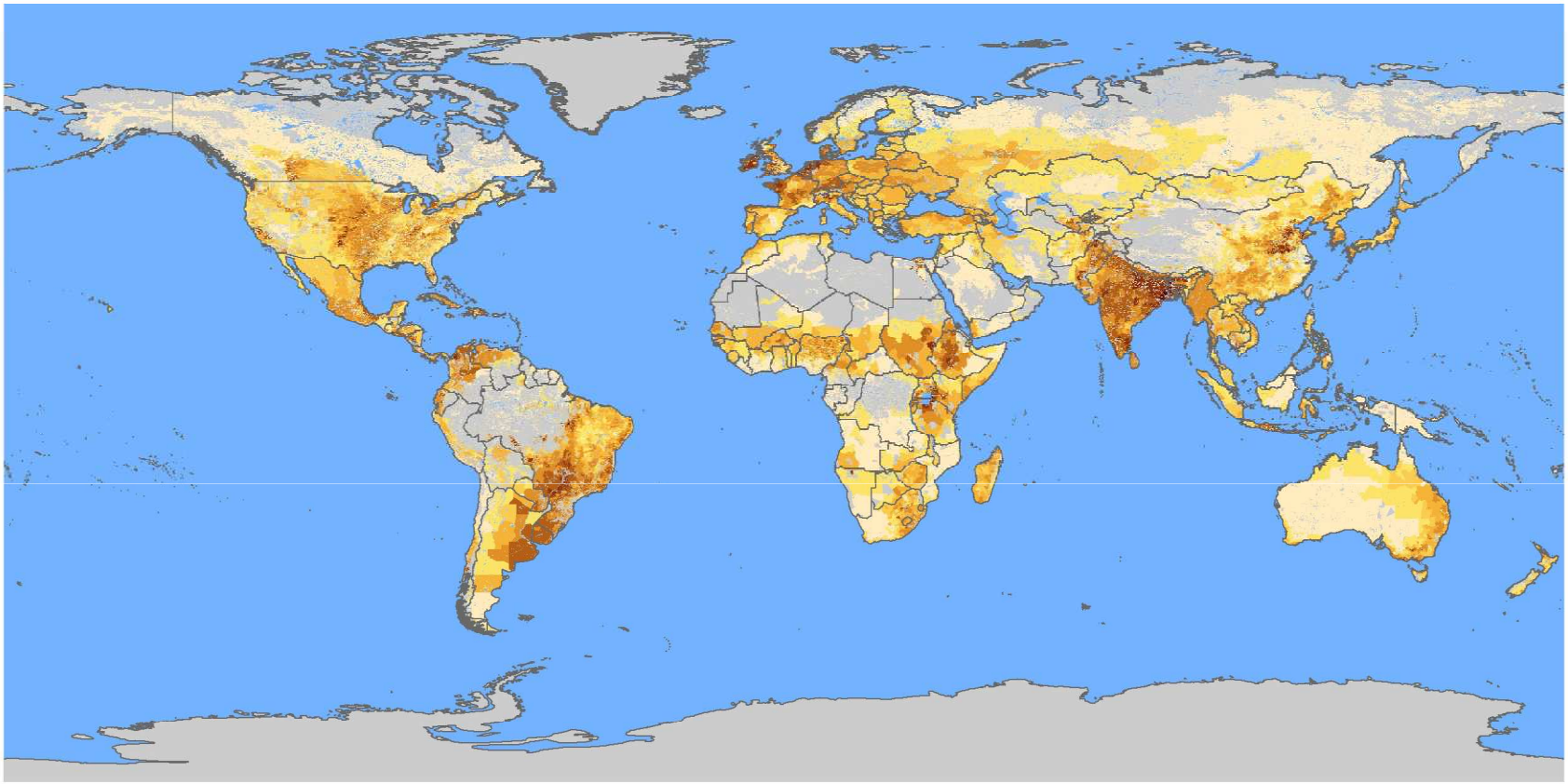
I – Livestock and land-use: a global perspective (focus on land-use);

II – Brazil as a template for other tropical countries: key concepts to be analysed;

III – The way ahead (focus on land-use and technologies).

- **Cattle: feedlots / pasture-based systems / rangelands;**
  - ***Industrialized countries: feedlots (corn and soybean);***
  - ***LA countries: pasture-based systems;***
- **Poultry and swine: feedlots (corn and soybean);**

Estimated Global Distribution of Cattle



Number per square km

<1	5–10	20–50	100–250	Water
1–5	10–20	50–100	>250	Unsuitable for ruminat

FAO Gridded Livestock of the World (2011).

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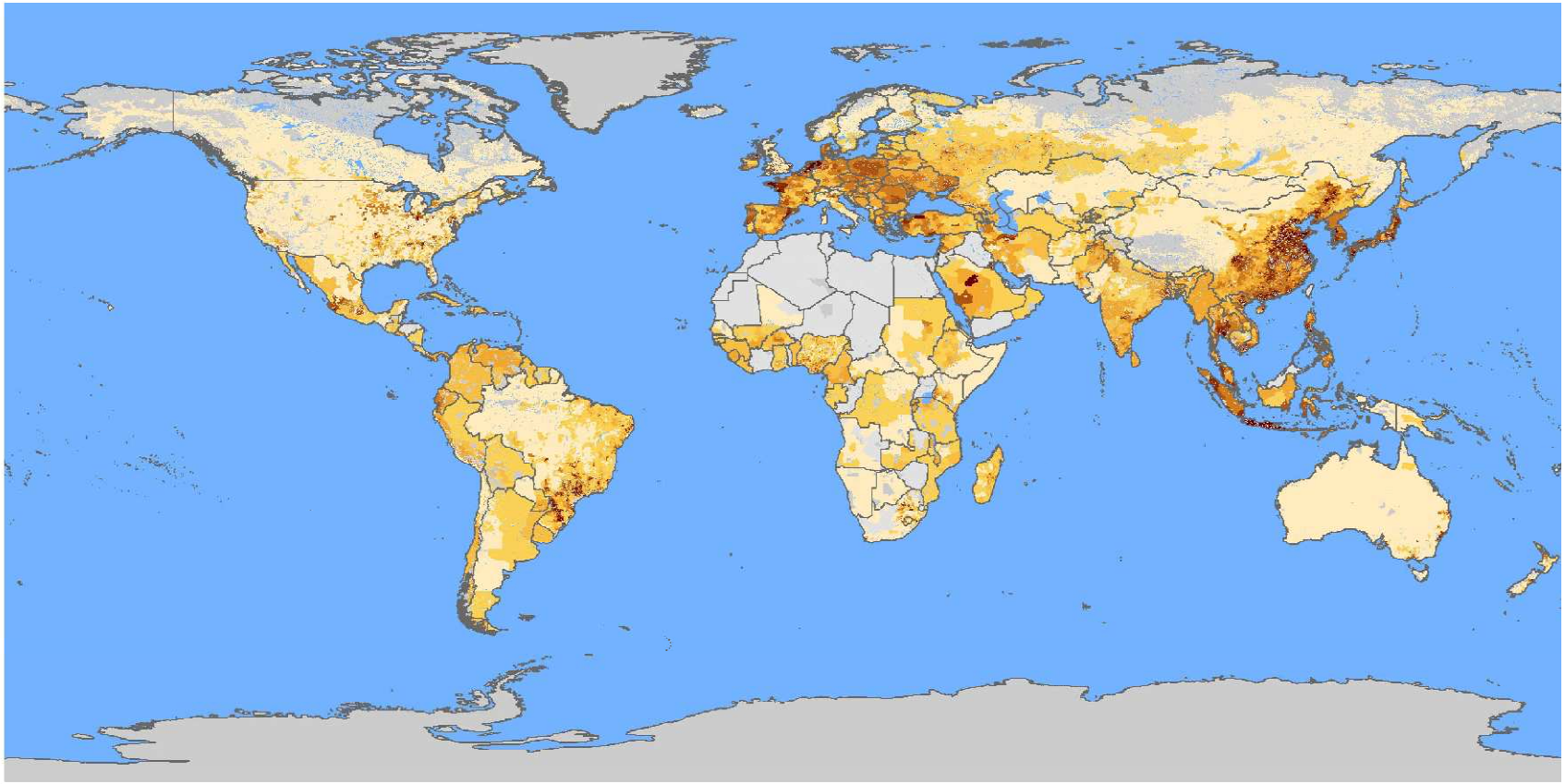
Estimated Global Distribution of Poultry

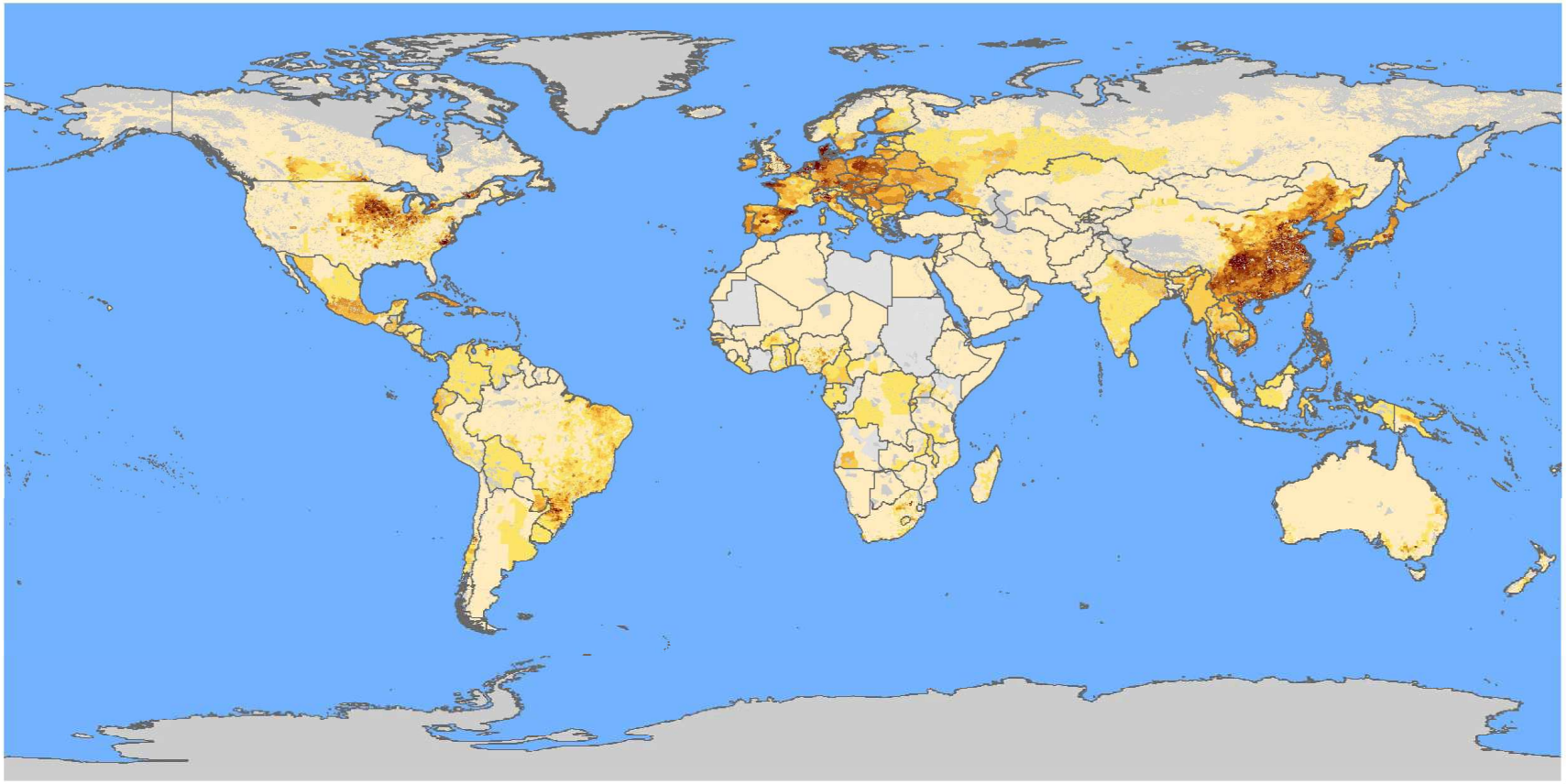


Number per square km

<10	50–100	200–500	1 000–2 500	Water	No data
10–50	100–200	500–1 000	>2 500	Unsuitable for monogastric	

FAO Gridded Livestock of the World (2011).

Estimated Global Distribution of Swine



Number per square km

<1	5–10	20–50	100–250	Water
1–5	10–20	50–100	>250	Unsuitable for ruminat

FAO Gridded Livestock of the World (2011).

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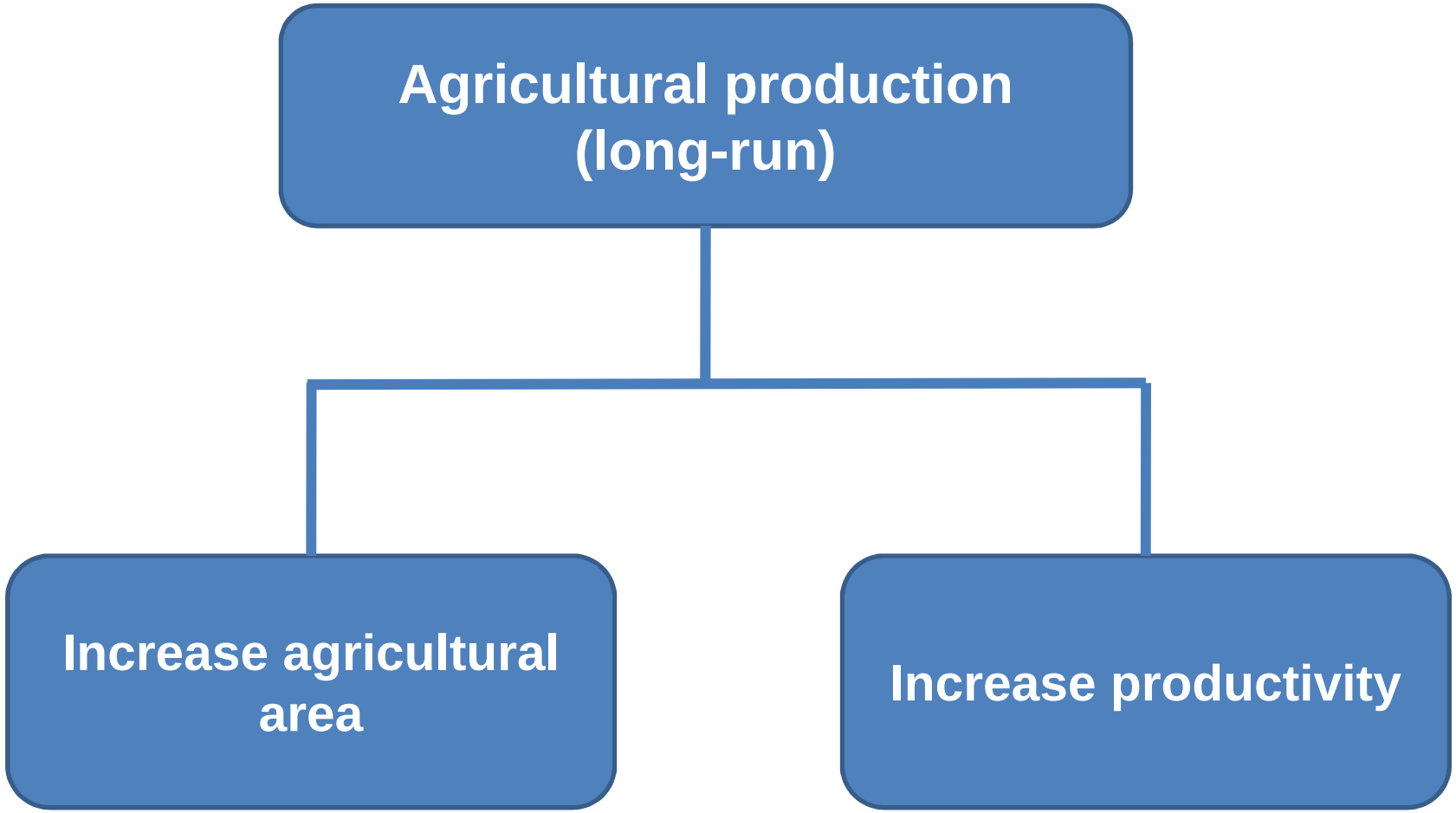
Agricultural Production



Soybean Production Growth

Countries	Unit	1970	2008	Growth	Share-growth (%)	Growth rate
World	ton	43.696.887	230.581.106	186.884.219	100,00%	4,47%
Africa	ton	97.211	1.336.488	1.239.277	0,66%	7,14%
Americas	ton	32.885.574	198.384.948	165.499.374	88,56%	4,84%
Asia	ton	10.007.602	28.082.234	18.074.632	9,67%	2,75%
Europe	ton	701.472	2.742.436	2.040.964	1,09%	3,65%
Oceania	ton	5.028	35.000	29.972	0,02%	5,24%

FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Soybean Yield Growth

Countries	Unit	1970	2008	Growth	Growth rate
World	t/ha	1,48	2,40	0,92	1,28%
Africa	t/ha	0,44	1,09	0,66	2,45%
Americas	t/ha	1,75	2,73	0,98	1,17%
Asia	t/ha	1,05	1,37	0,32	0,71%
Europe	t/ha	0,73	1,61	0,88	2,09%
Oceania	t/ha	1,01	2,33	1,32	2,22%

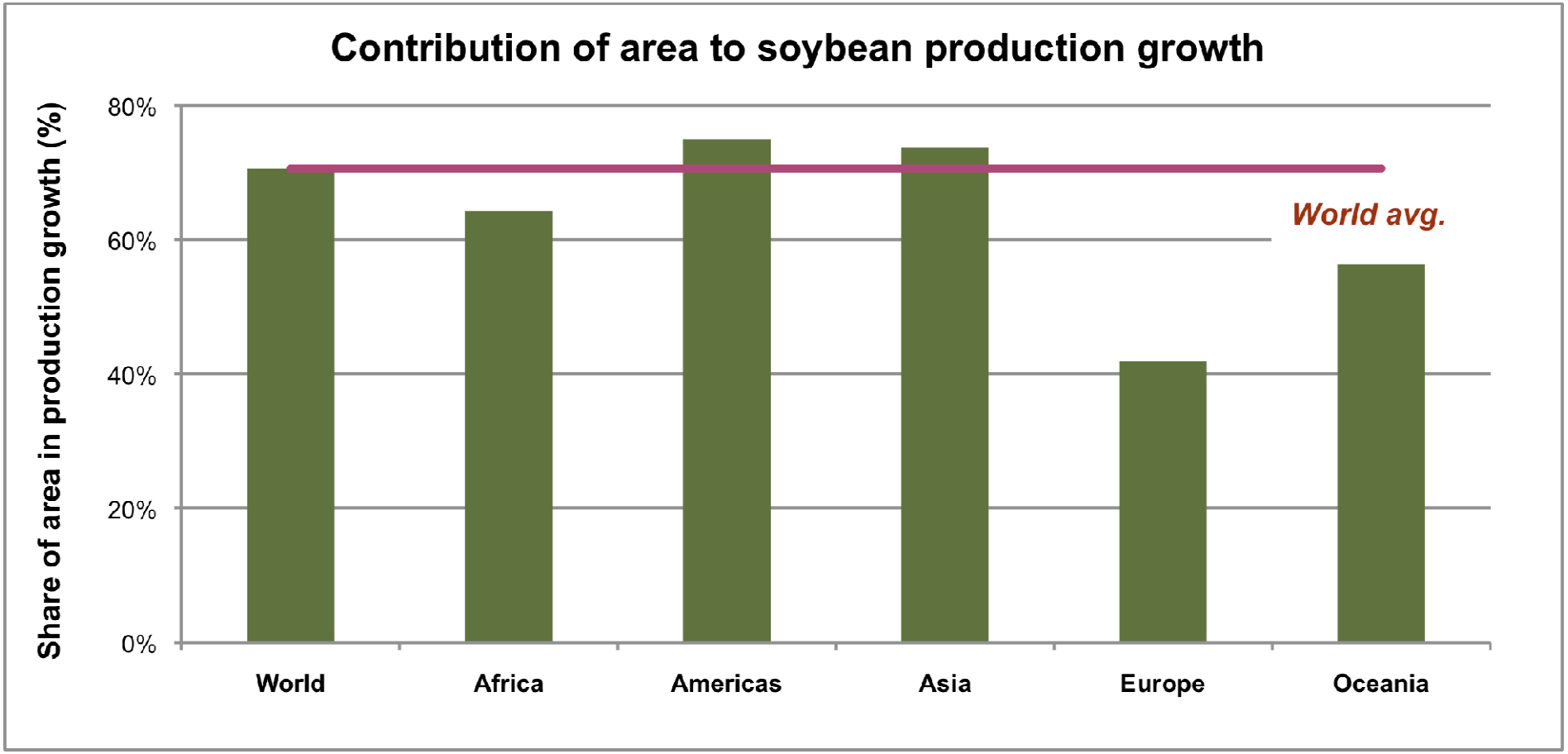
FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Soybean Area Growth

Countries	Unit	1970	2008	Growth	Share-growth (%)	Growth rate
World	ha	29.525.381	96.180.785	66.655.404	100,00%	3,16%
Africa	ha	222.501	1.220.731	998.230	1,50%	4,58%
Americas	ha	18.788.329	72.756.950	53.968.621	80,97%	3,63%
Asia	ha	9.554.126	20.486.590	10.932.464	16,40%	2,03%
Europe	ha	955.458	1.701.514	746.056	1,12%	1,53%
Oceania	ha	4.967	15.000	10.033	0,02%	2,95%

FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Factors of Growth (Soybean)



FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Corn Production Growth

Countries	Unit	1970	2008	Growth	Share-growth (%)	Growth rate
World	ton	265.831.145	826.224.247	560.393.102	100,00%	3,03%
Africa	ton	19.879.867	55.278.500	35.398.633	6,32%	2,73%
Americas	ton	146.202.805	439.020.367	292.817.562	52,25%	2,94%
Asia	ton	52.963.108	238.093.175	185.130.067	33,04%	4,03%
Europe	ton	46.532.672	93.225.951	46.693.279	8,33%	1,85%
Oceania	ton	252.693	606.254	353.561	0,06%	2,33%

FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Corn Yield Growth

Countries	Unit	1970	2008	Growth	Growth rate
World	t/ha	2,35	5,13	2,78	2,07%
Africa	t/ha	1,14	1,89	0,75	1,34%
Americas	t/ha	2,95	6,85	3,90	2,24%
Asia	t/ha	1,70	4,56	2,87	2,64%
Europe	t/ha	3,15	6,05	2,89	1,73%
Oceania	t/ha	2,82	6,62	3,80	2,27%

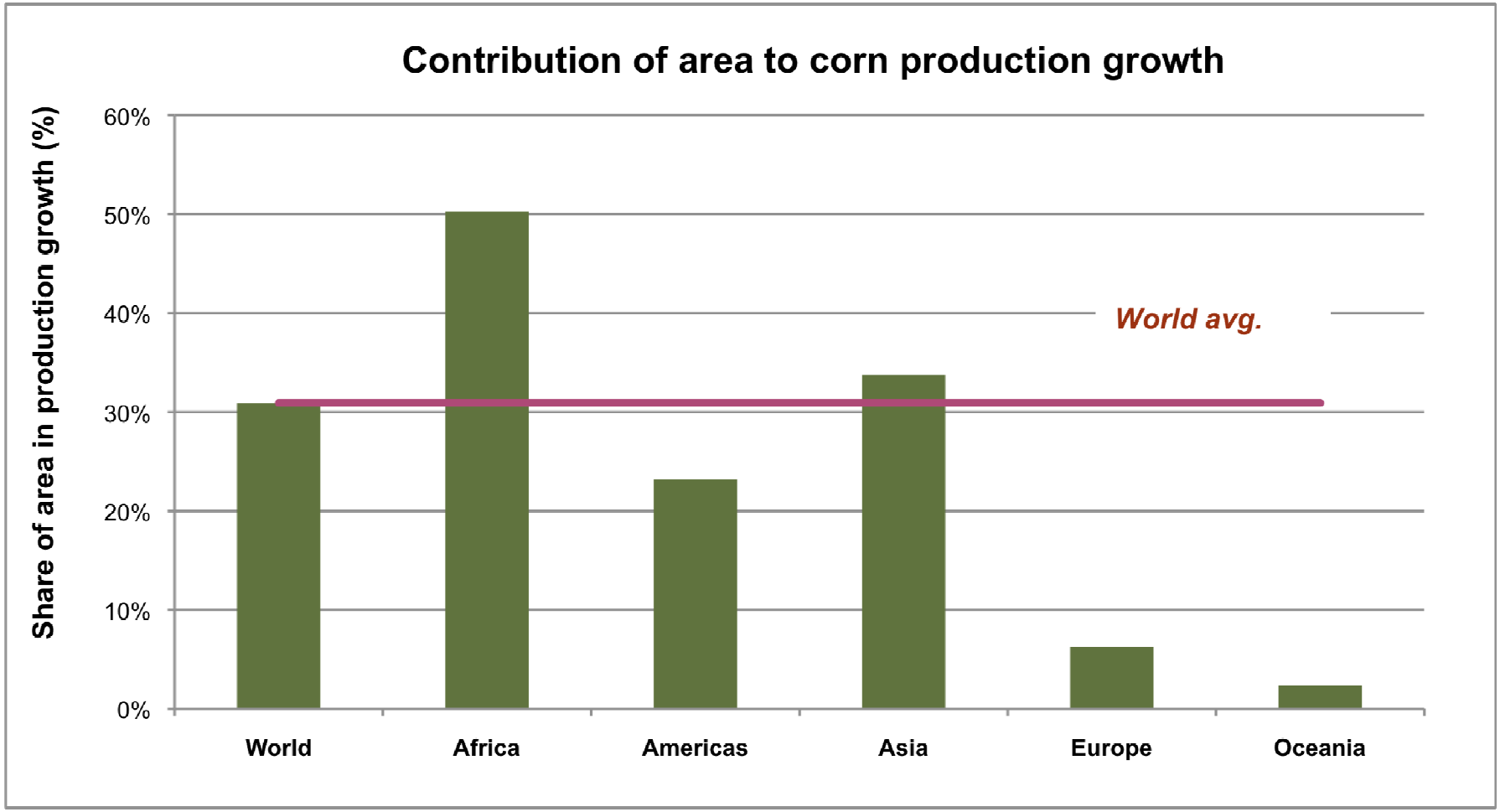
FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Corn Area Growth

Countries	Unit	1970	2008	Growth	Share-growth (%)	Growth rate
World	ha	113.076.179	161.105.730	48.029.551	100,00%	0,94%
Africa	ha	17.465.843	29.295.996	11.830.153	24,63%	1,37%
Americas	ha	49.555.266	64.127.871	14.572.605	30,34%	0,68%
Asia	ha	31.211.987	52.176.847	20.964.860	43,65%	1,36%
Europe	ha	14.753.317	15.413.406	660.089	1,37%	0,12%
Oceania	ha	89.766	91.610	1.844	0,00%	0,05%

FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Factors of Growth (Corn)



FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Outline

I – Livestock and land-use: a global perspective (focus on land-use);

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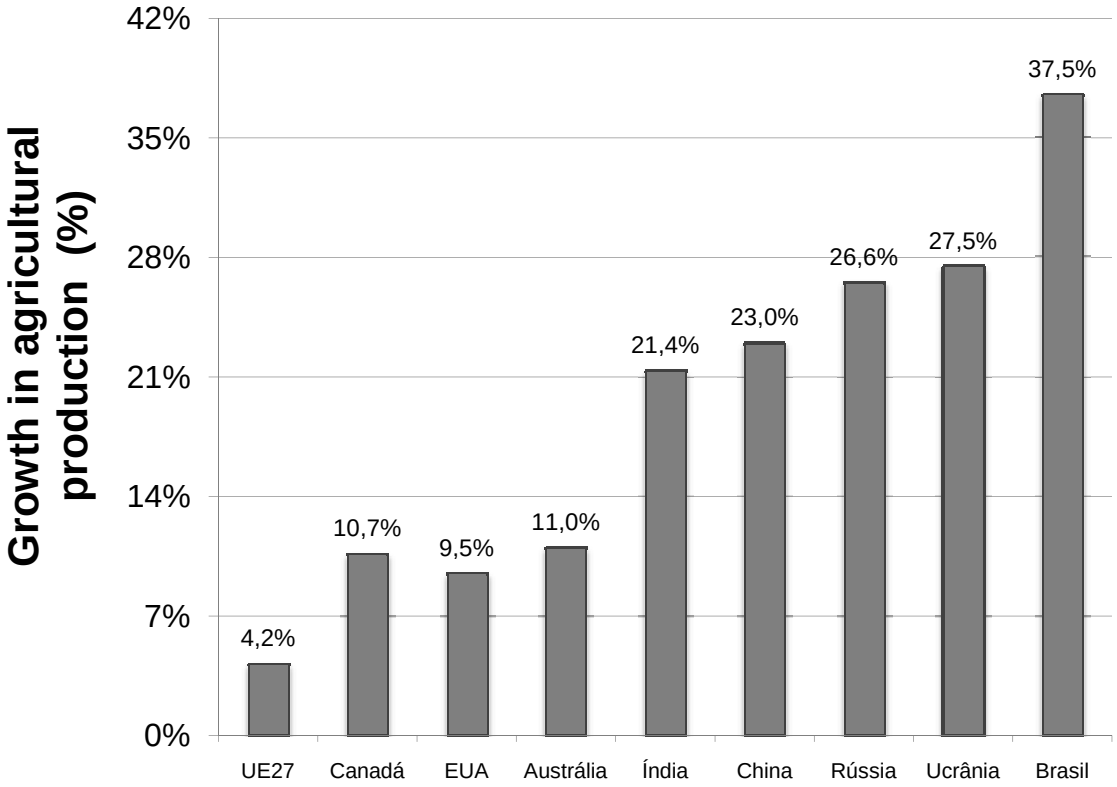
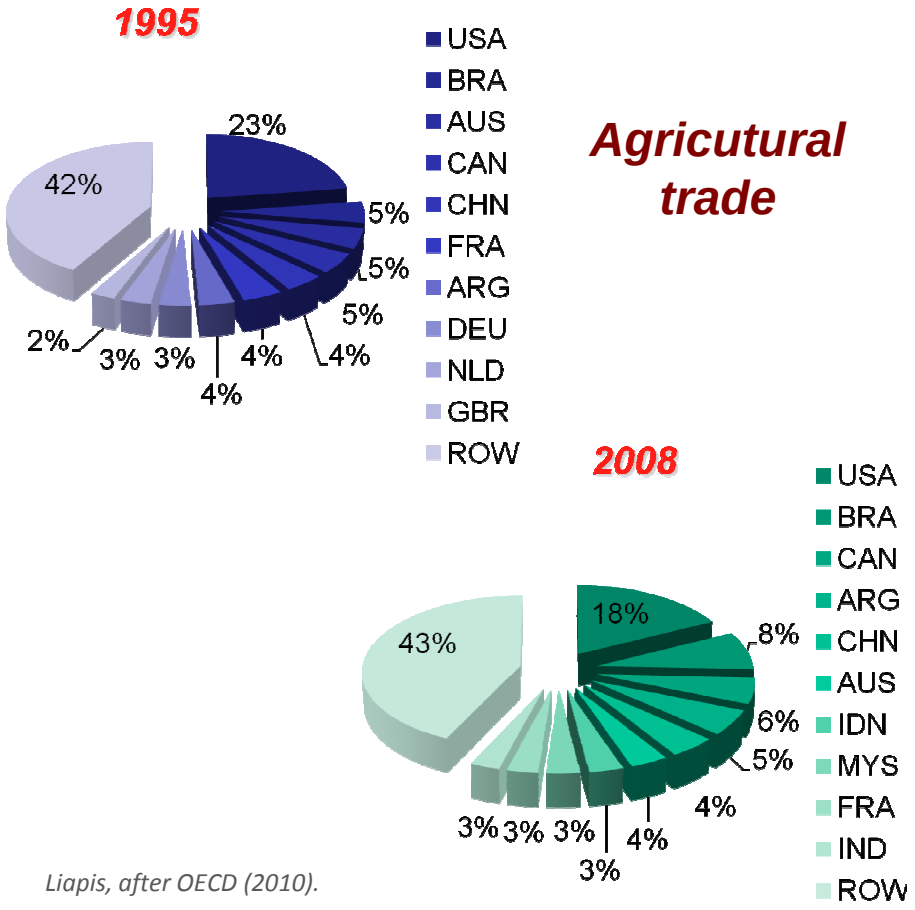
Brazilian Agriculture

- Importance in the international scenario will increase



OECD/FAO (2010).



Liapis, after OECD (2010).

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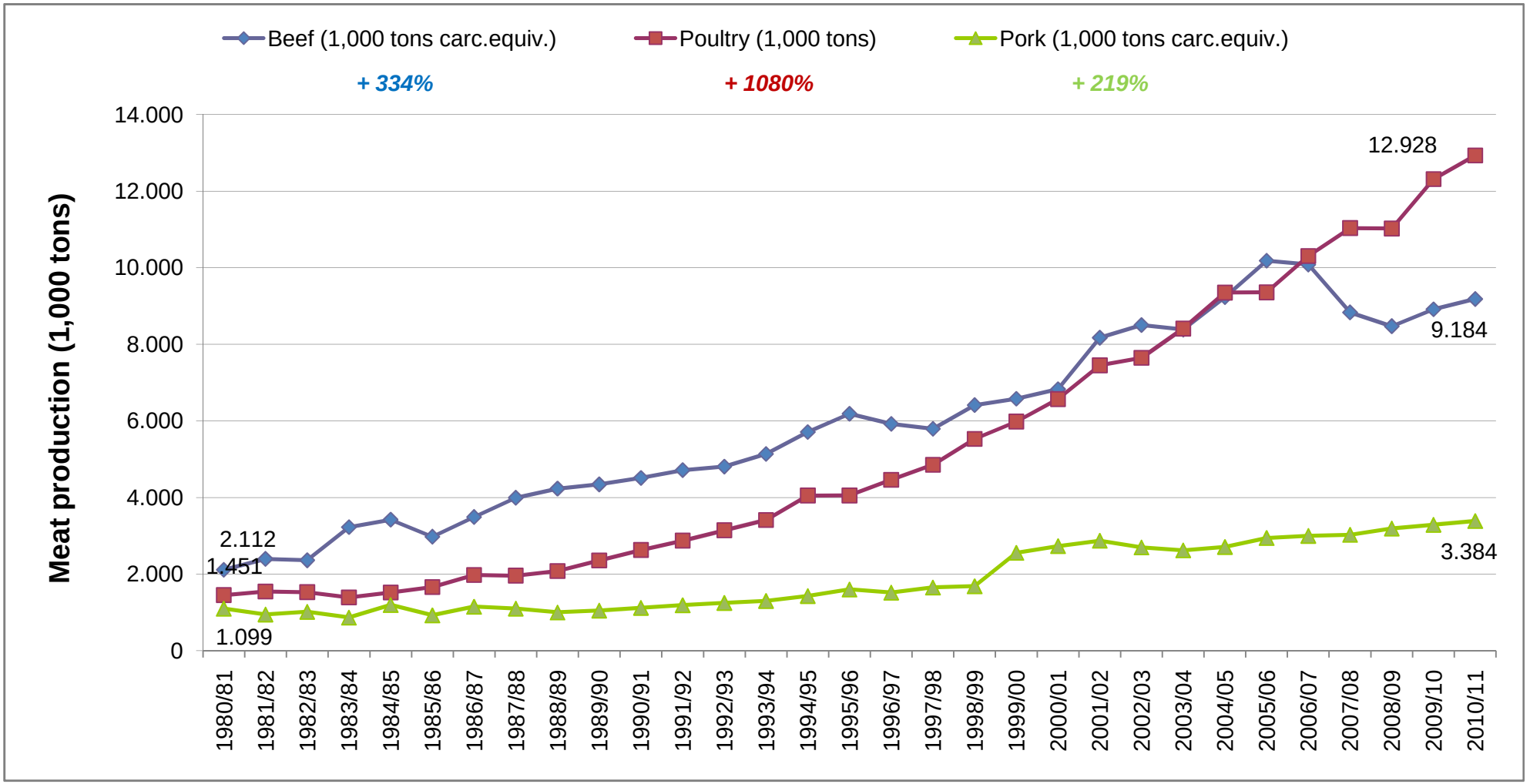
Brazil: Meat Production



Source: after Conab.

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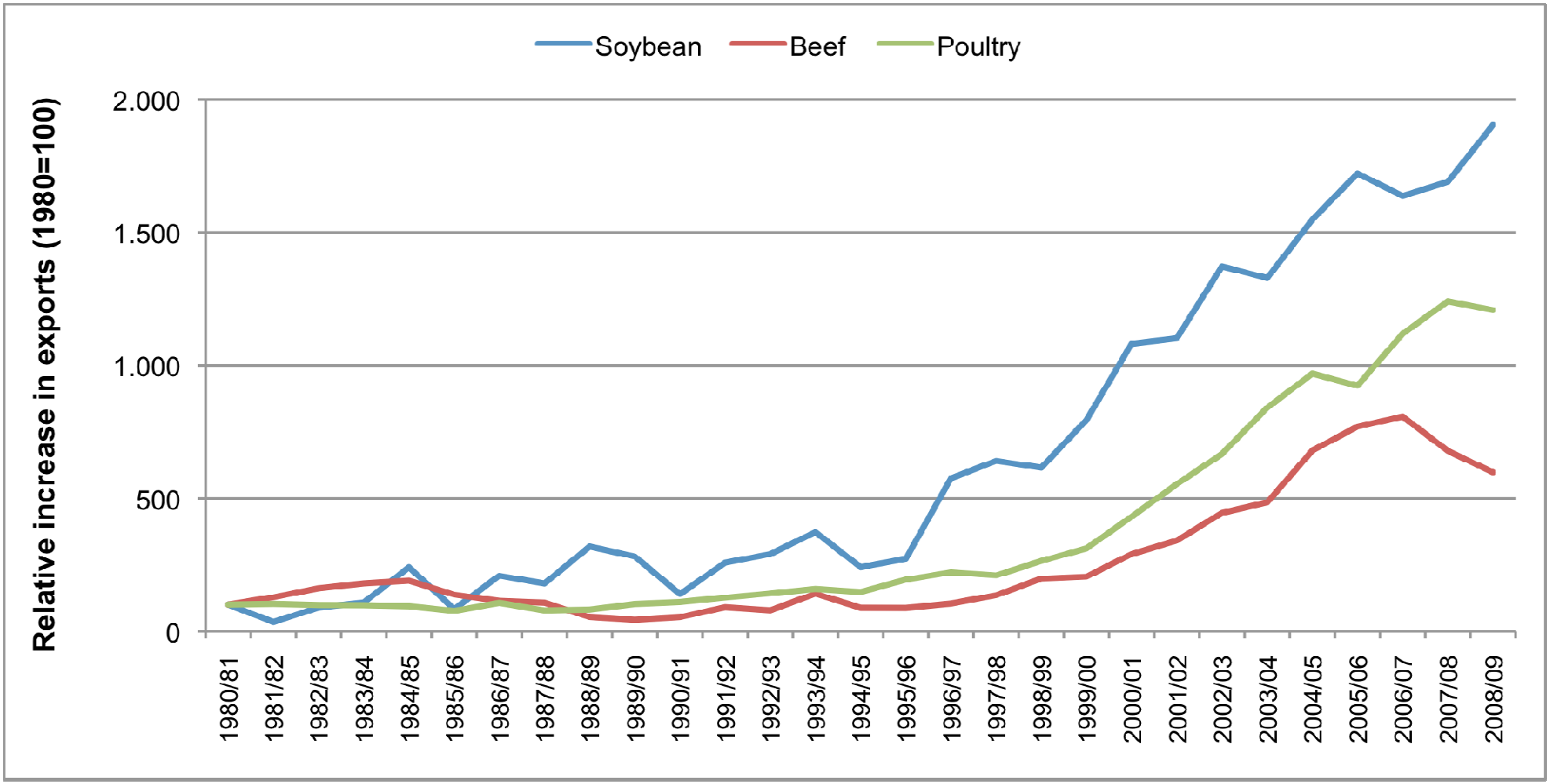
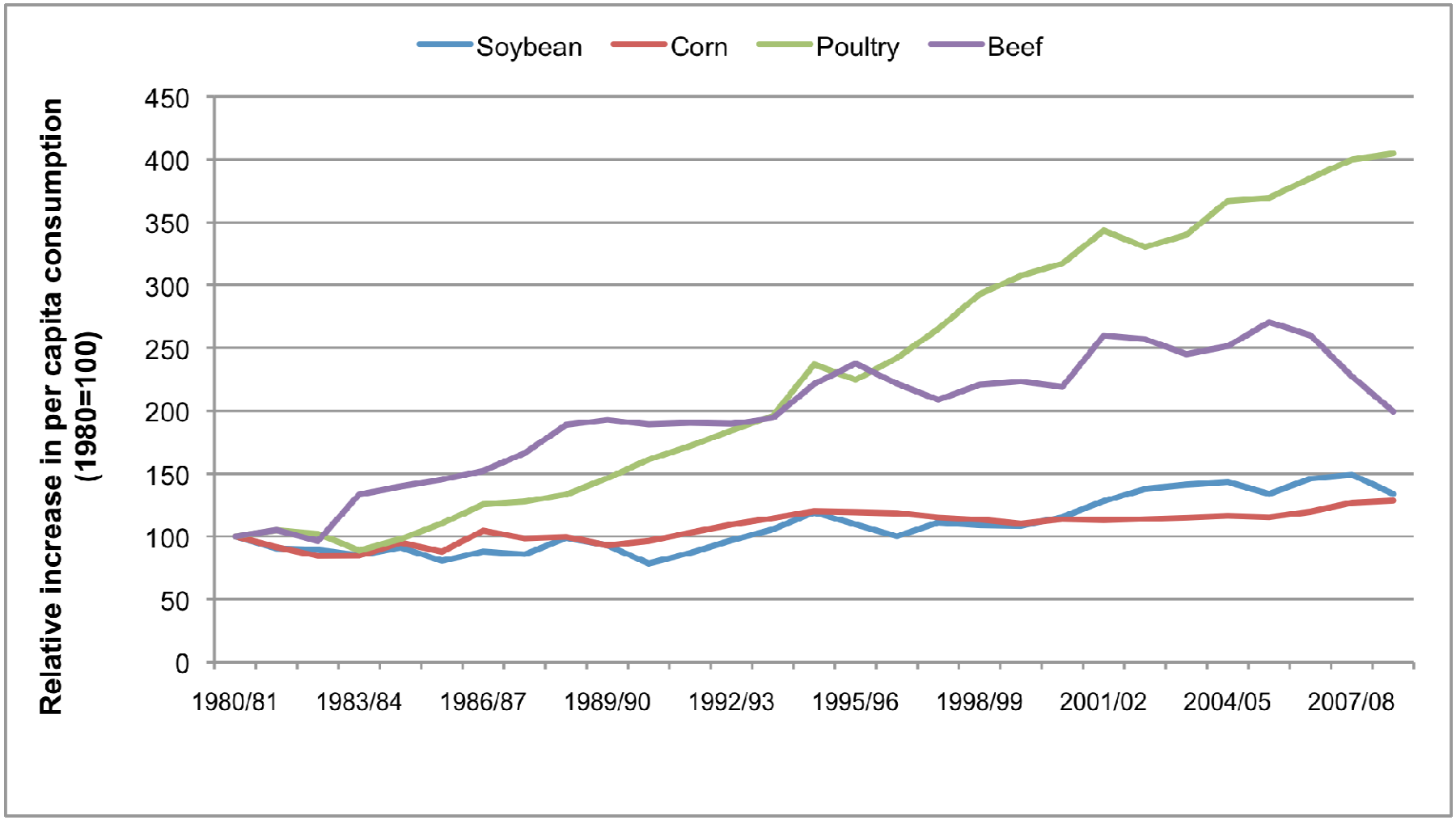
Brazilian Agriculture: Exports of Selected Products



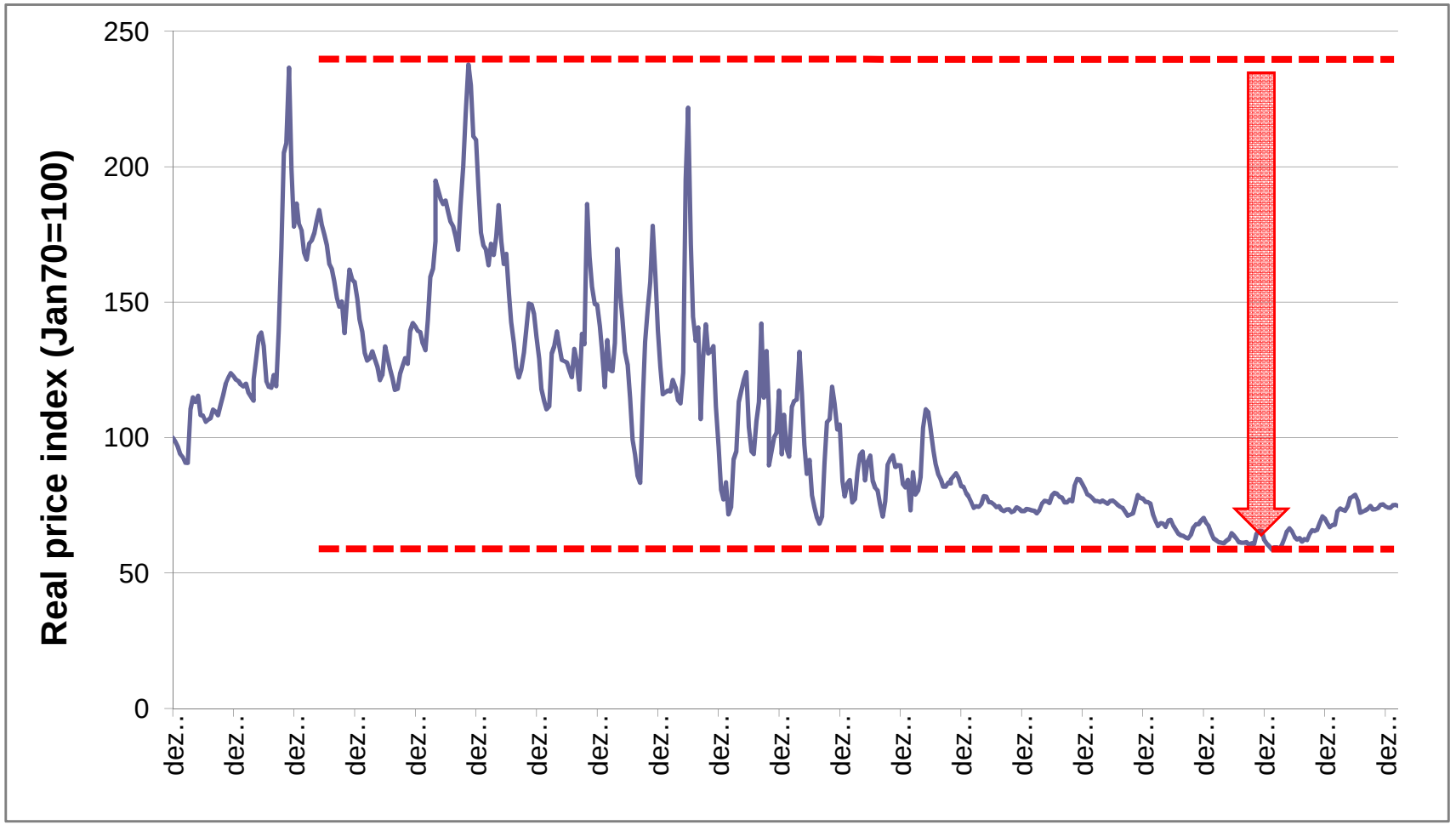
Data from Conab, G.B.Martha, Jr. (work-in-progress).

Domestic Per Capita Consumption of Selected Products



Data from Conab, G.B.Martha, Jr. (work-in-progress).

Beef Real Prices Index to Brazilian Consumers (Jan/1970=100)



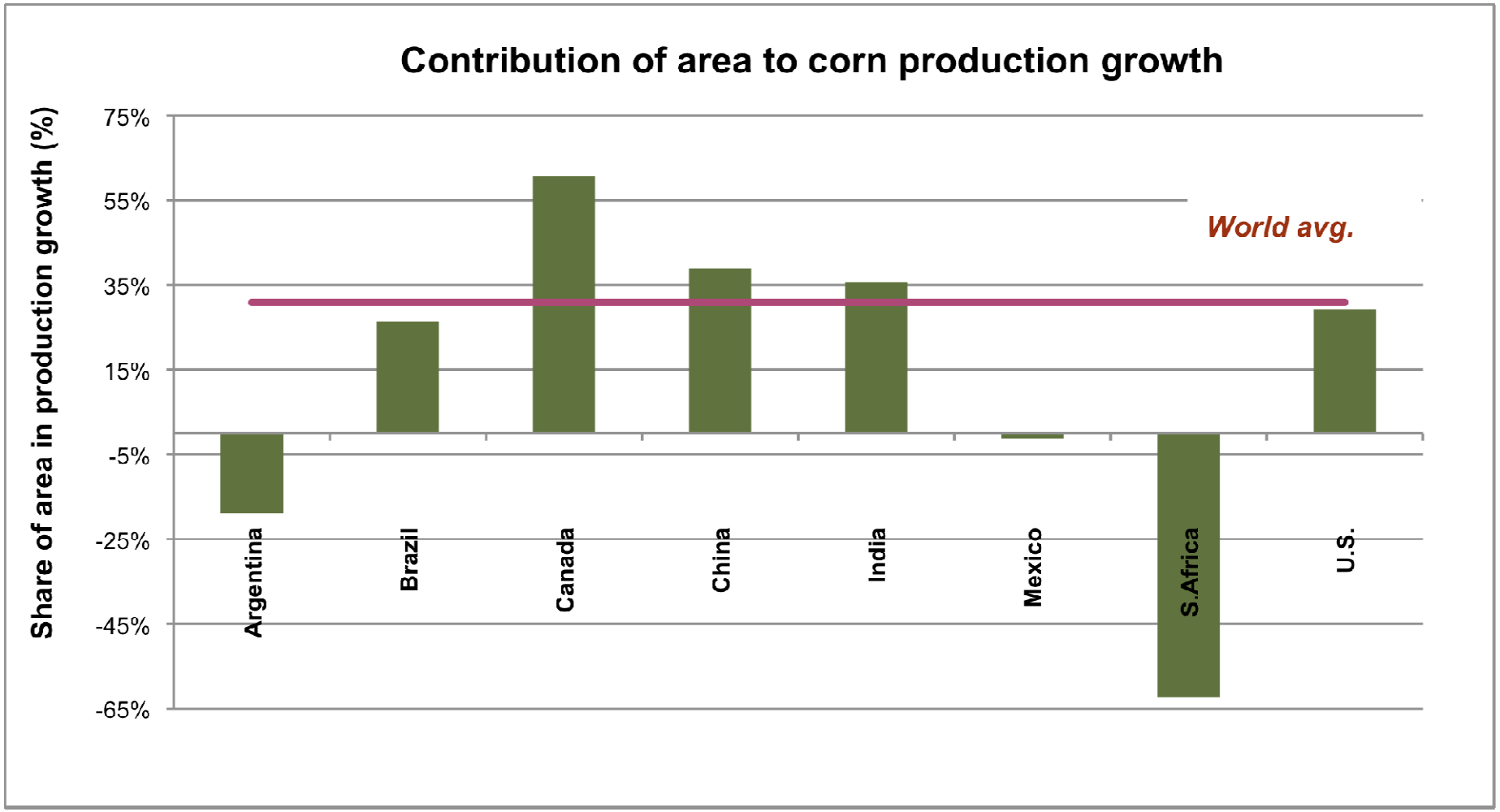
Data from DIEESE, G.B. Martha Jr. calculations.

Corn Area Growth

Countries	Unit	1970	2008	Growth	Share-growth (%)	Growth rate
Argentina	ha	4.017.330	3.412.155	-605.175	-1,26%	-0,43%
Brazil	ha	9.858.108	14.444.582	4.586.474	9,55%	1,01%
Canada	ha	499.294	1.168.800	669.506	1,39%	2,26%
China	ha	15.838.000	29.882.998	14.044.998	29,24%	1,68%
India	ha	5.852.300	8.300.000	2.447.700	5,10%	0,92%
Mexico	ha	7.439.684	7.353.940	-85.744	-0,18%	-0,03%
South Africa	ha	4.418.000	2.799.000	-1.619.000	-3,37%	-1,19%
United States of America	ha	23.211.632	31.796.493	8.584.861	17,87%	0,83%

FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Factors of Growth (Corn)



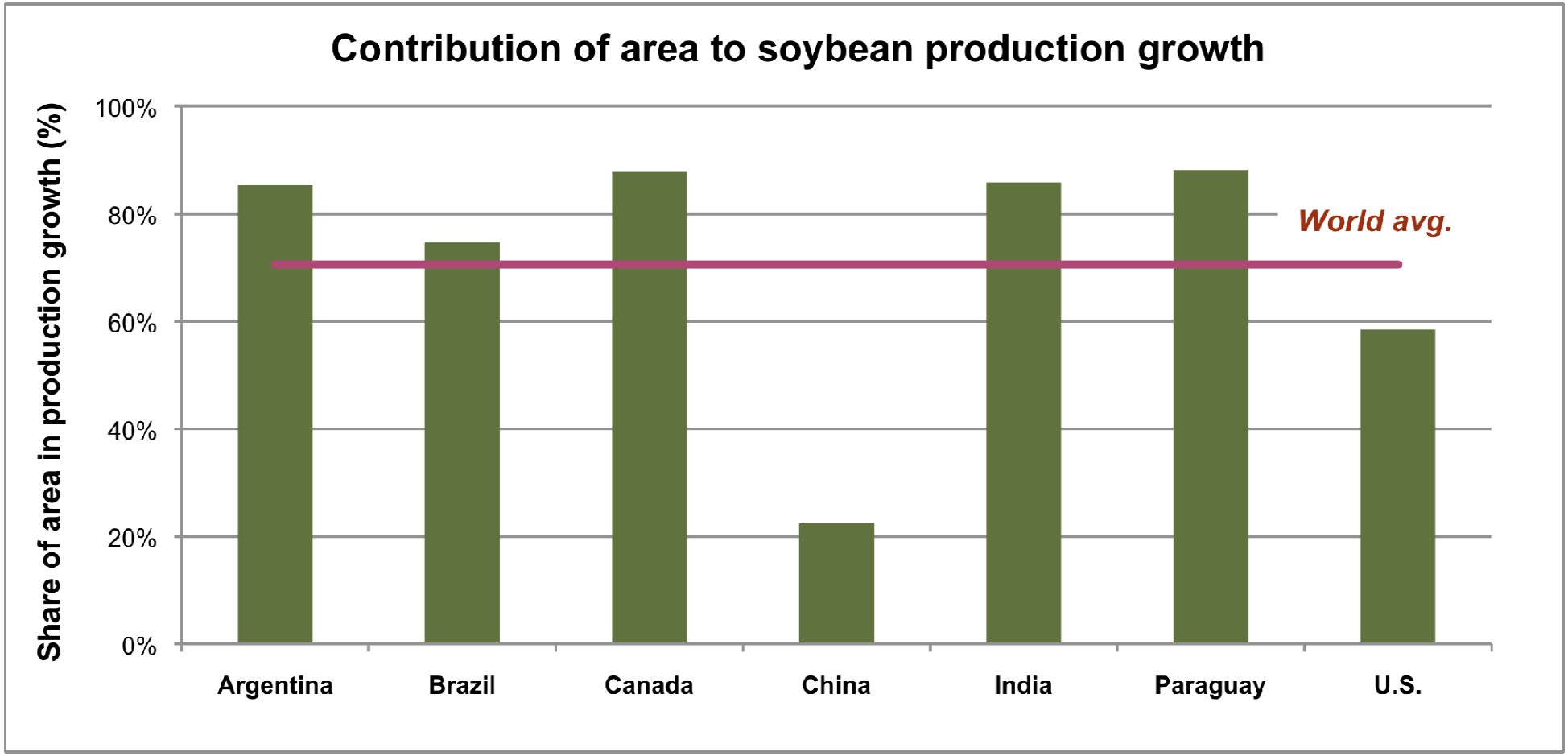
FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Soybean Area Growth

Countries	Unit	1970	2008	Growth	Share-growth (%)	Growth rate
Argentina	ha	25.970	16.387.438	16.361.468	24,55%	18,49%
Brazil	ha	1.318.809	21.057.302	19.738.493	29,61%	7,56%
Canada	ha	135.568	1.195.400	1.059.832	1,59%	5,90%
China	ha	8.019.749	9.127.074	1.107.325	1,66%	0,34%
India	ha	32.000	9.520.000	9.488.000	14,23%	16,17%
Paraguay	ha	28.300	2.463.510	2.435.210	3,65%	12,47%
United States of America	ha	17.097.328	30.222.654	13.125.326	19,69%	1,51%

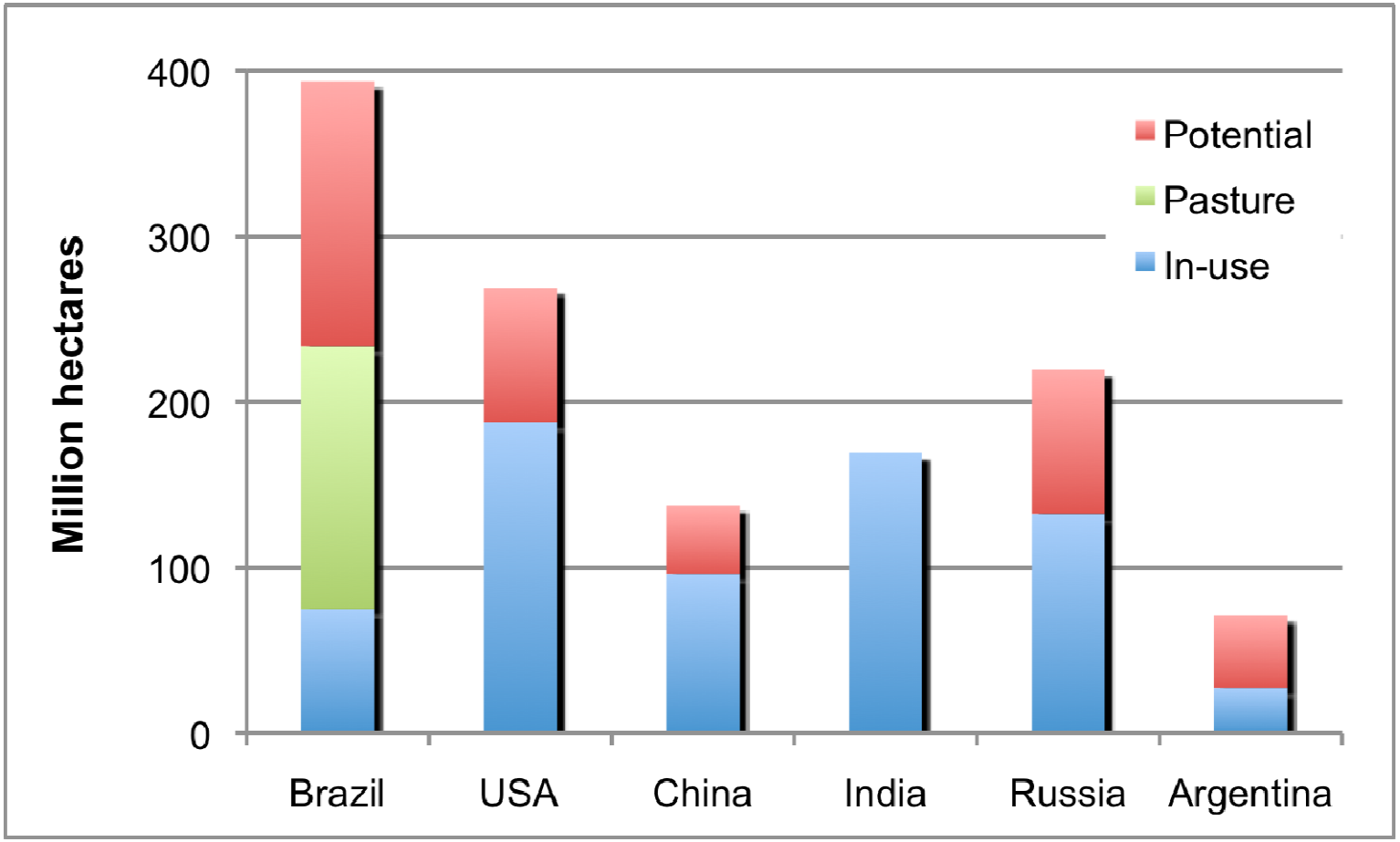
FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Factors of Growth (Soybean)



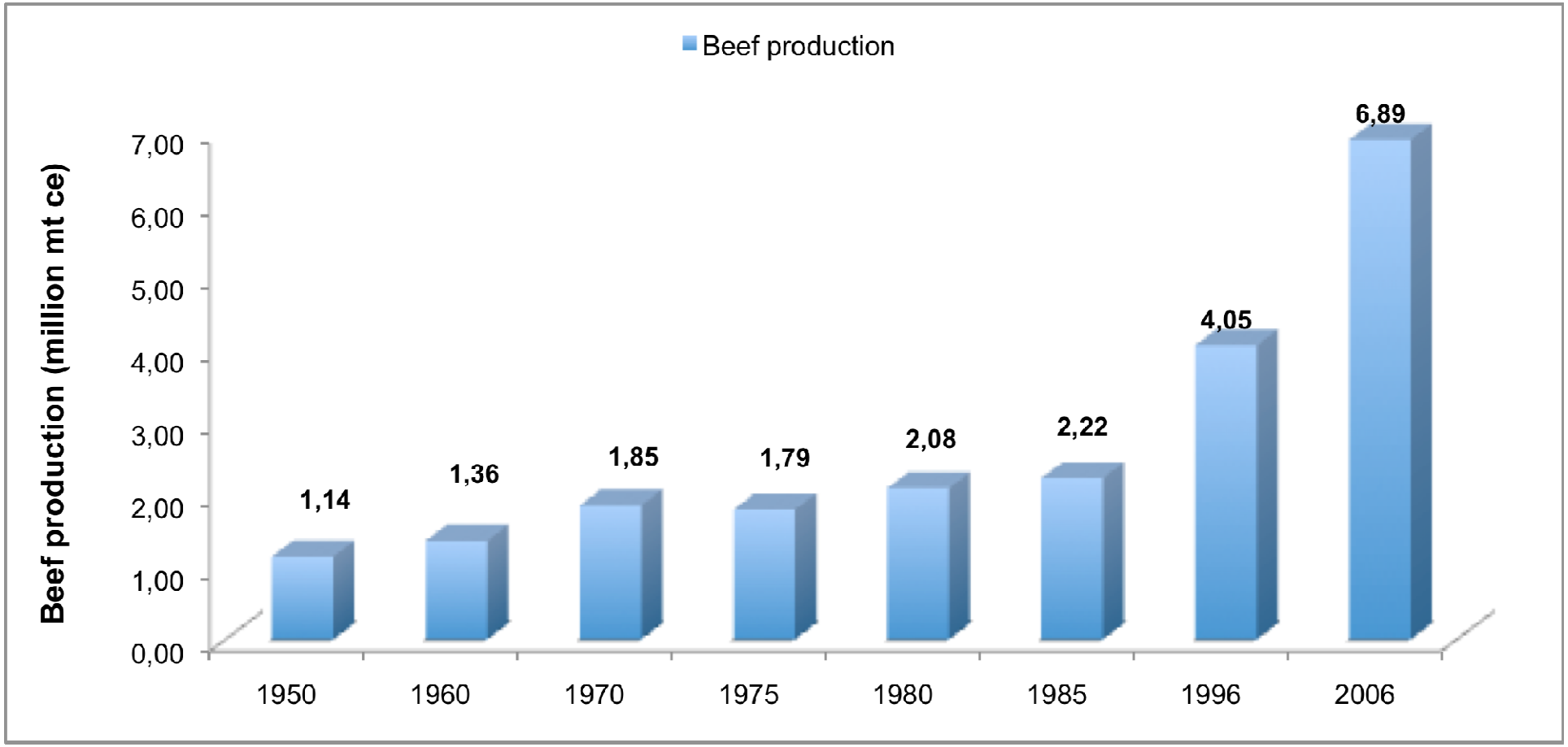
FAO database, G.B.Martha, Jr. calculations (work-in-progress).

Agricultural Land-Area Use



Data from FAO, except for Brazil (IBGE), elaboration G.B.Martha.

Beef Production in Brazil



Data from IBGE.

Factors of Growth in Beef Cattle Production (1950-2006)

Beef Production — **3.36%**

Pasture Area — ~ 21%

X

Animal Productivity — ~ 79%

Land-saving effect: 525 M ha

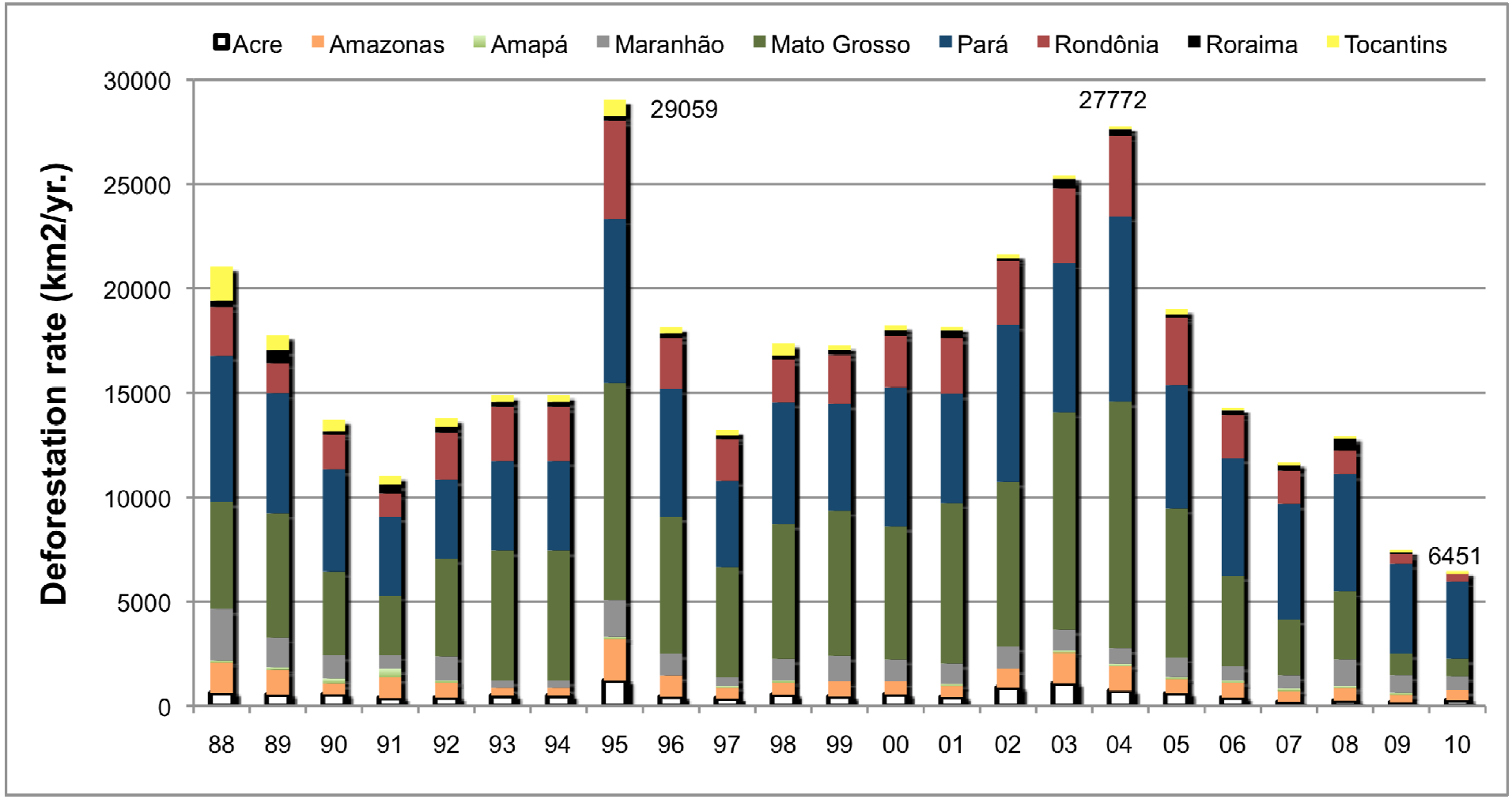
Animal performance — ~ 38%

X

Stocking rates — ~ 62%

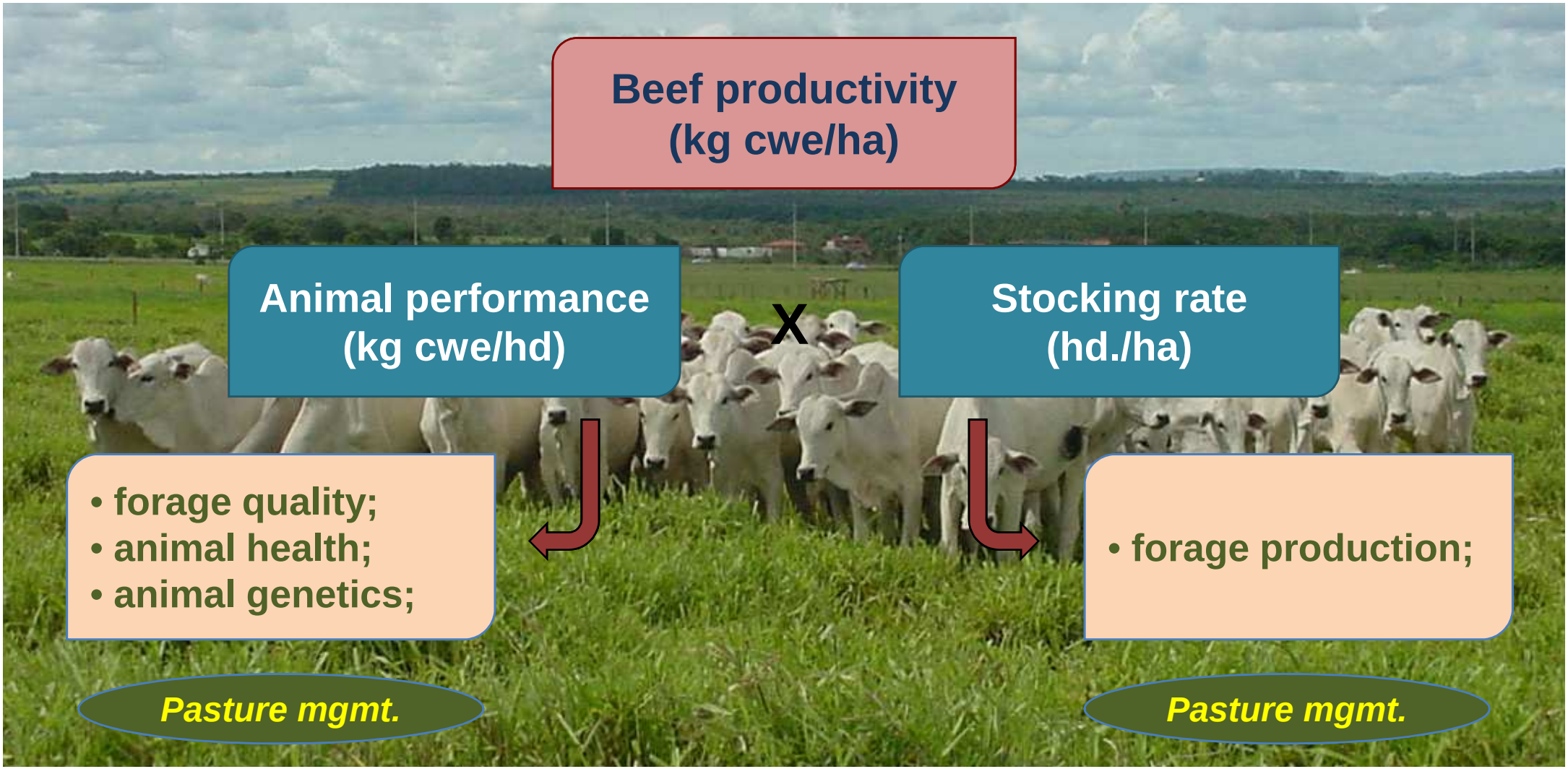
G.B. Martha Jr., E.Alves, E.Contini (under review).

Deforestation in Legal Amazon (1988-2010)

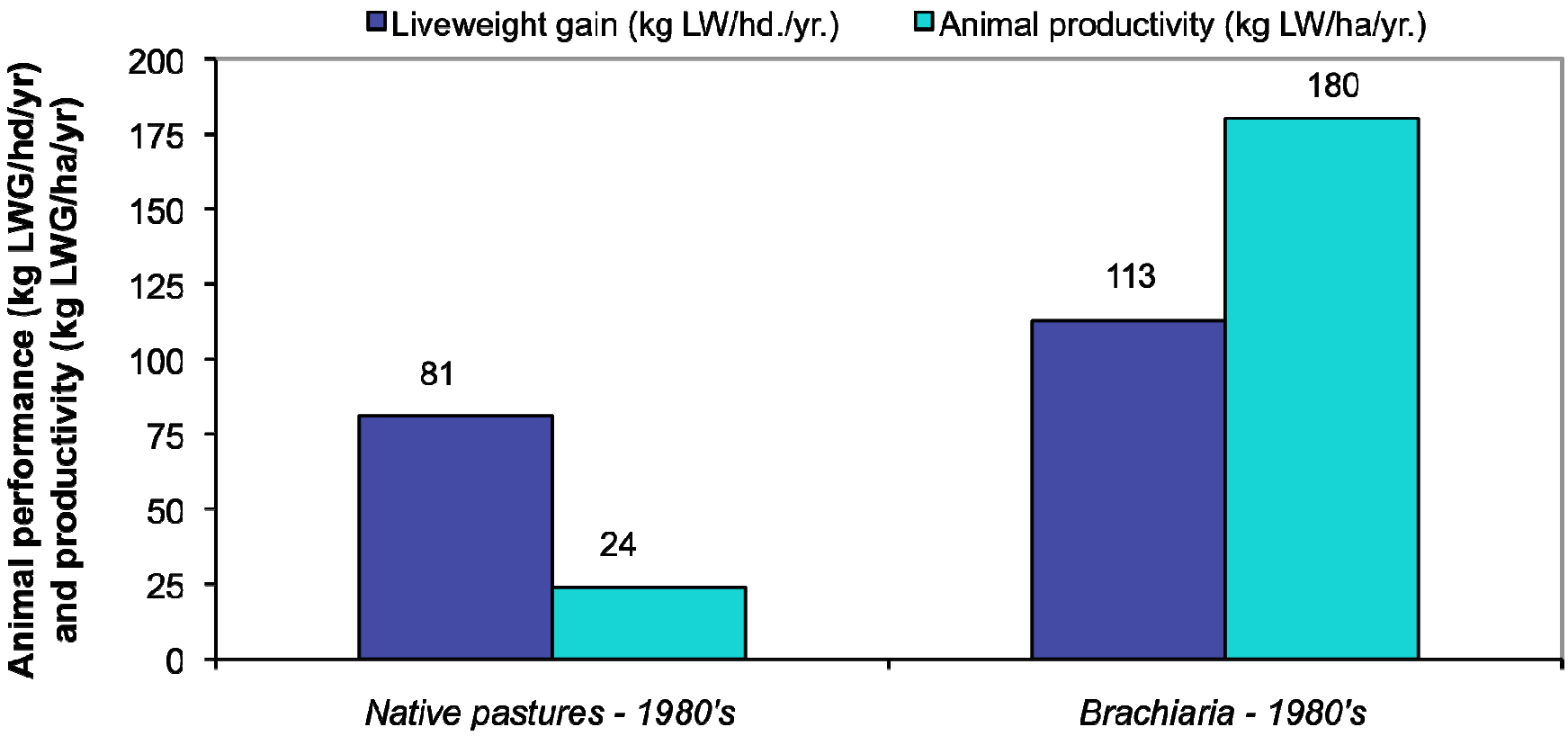


Data from INPE.

Beef Productivity in Pastures



Native Pastures (Brazilian Cerrado) x Brachiaria



Zoby et al. (1987).

Productivity in Tropical Pastures (Brazil as an Example)

Grazing System	Stocking rate (hd./ha)	Liveweight gain (kg cwe./hd.)	Productivity (kg cwe./ha)	Area needed (1 ton cwe.)	Land-saving effect (ha / t cwe.)
Native savannahs	0.1 - 0.4	60 - 90	10 - 30	50,0	-
Cultivated pastures, extensive	0.5 - 1.5	80 - 120	40 - 160	10,0	40,0
Cultivated pastures, moderate productivity	1.0 - 2.0	100 - 140	120 - 200	6,3	43,8
Cultivated pastures, high productivity	2.0 - 5.0	120 - 180	250 - 800	1,9	48,1
Crop-livestock systems, high productivity	2.0 - 5.0	120 - 180	250 - 800	1,9	48,1

After G.B.Martha et al. (2006).

Outline

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ABC Program – Targets to 2010/2020

Resource-saving technologies

(land, nutrients, water)

Action	Total Area (M ha)	GHG Emission Reductions (M t CO2-e/yr.)	Est. Cost (R$ billions)
No-till planting	8	16 a 20	2,40
Biological N fixation	5,5	16 a 20	0,30
Recovery of Degraded Pastures	15	83 a 104	19,65
Integrated Crop-Livestock Systems	4	18 a 22	34,20

Source: Brazilian Ministry of Agriculture, Livestock and Food Supply.

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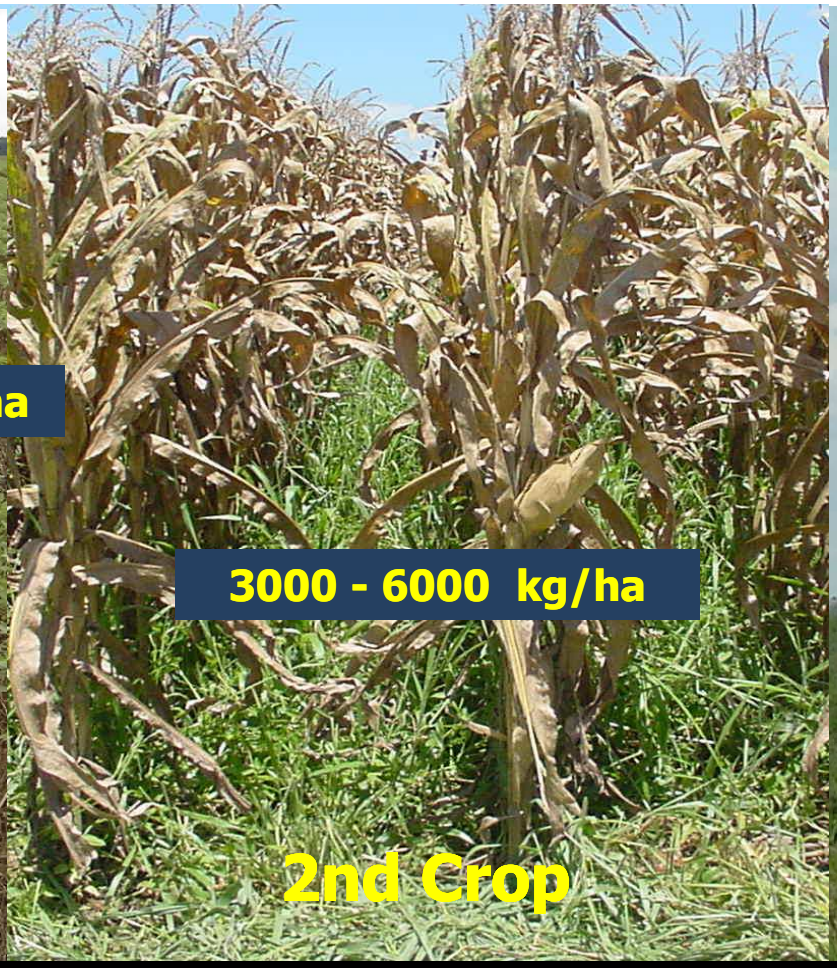
Integrated Crop-Livestock Systems (ICLS) Alternatives

O/N — F/M — J/J — S/O

3000 - 4500 kg/ha

1st Crop



3000 - 6000 kg/ha

2nd Crop

90 - 180 kg CE/ha

"Cattle", 3rd crop

Activities/Time

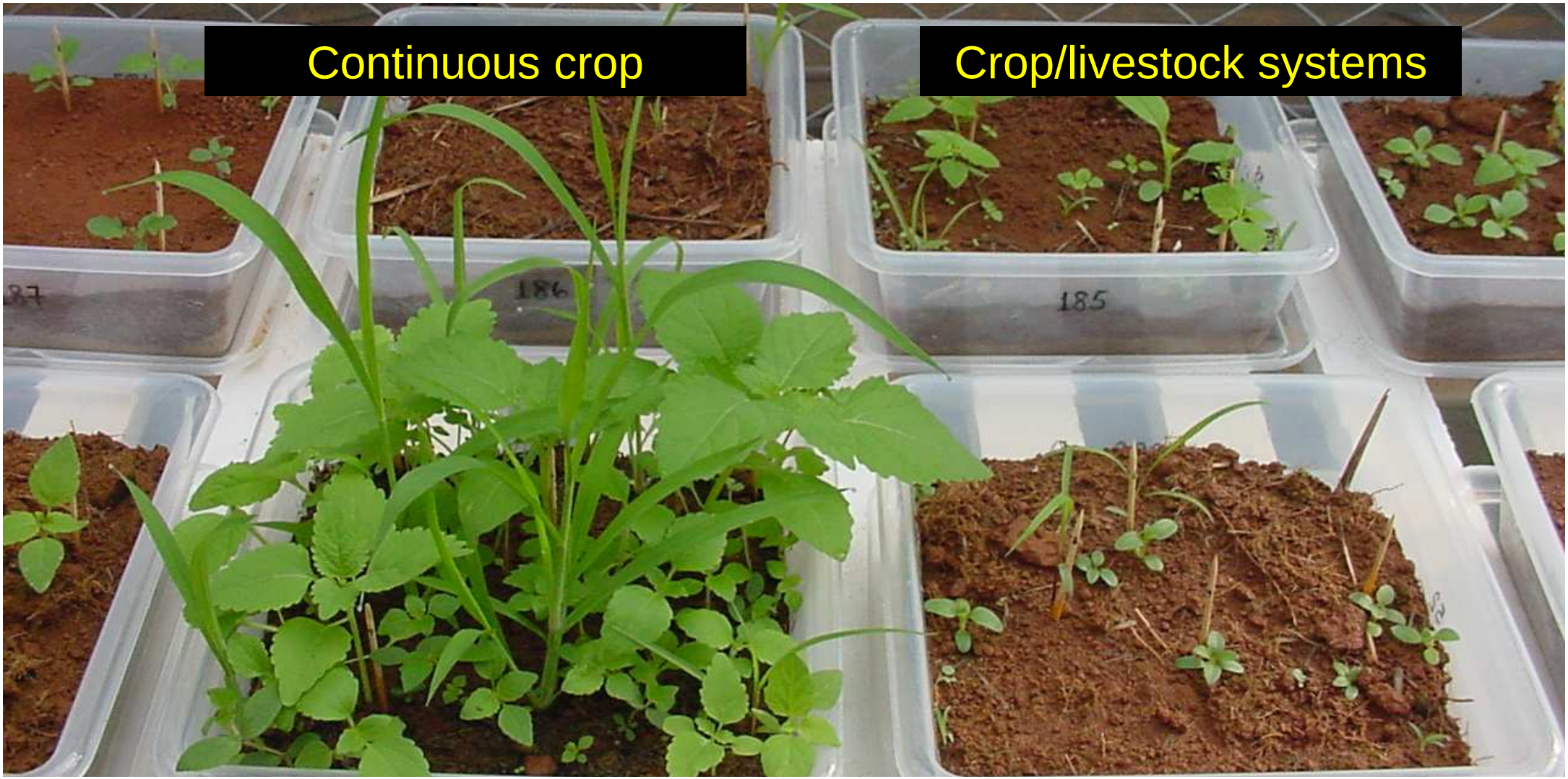
Avoided Deforestation

1 ha of low-productive pasture (0.4 hd./ha, 45 kg CE/hd.)

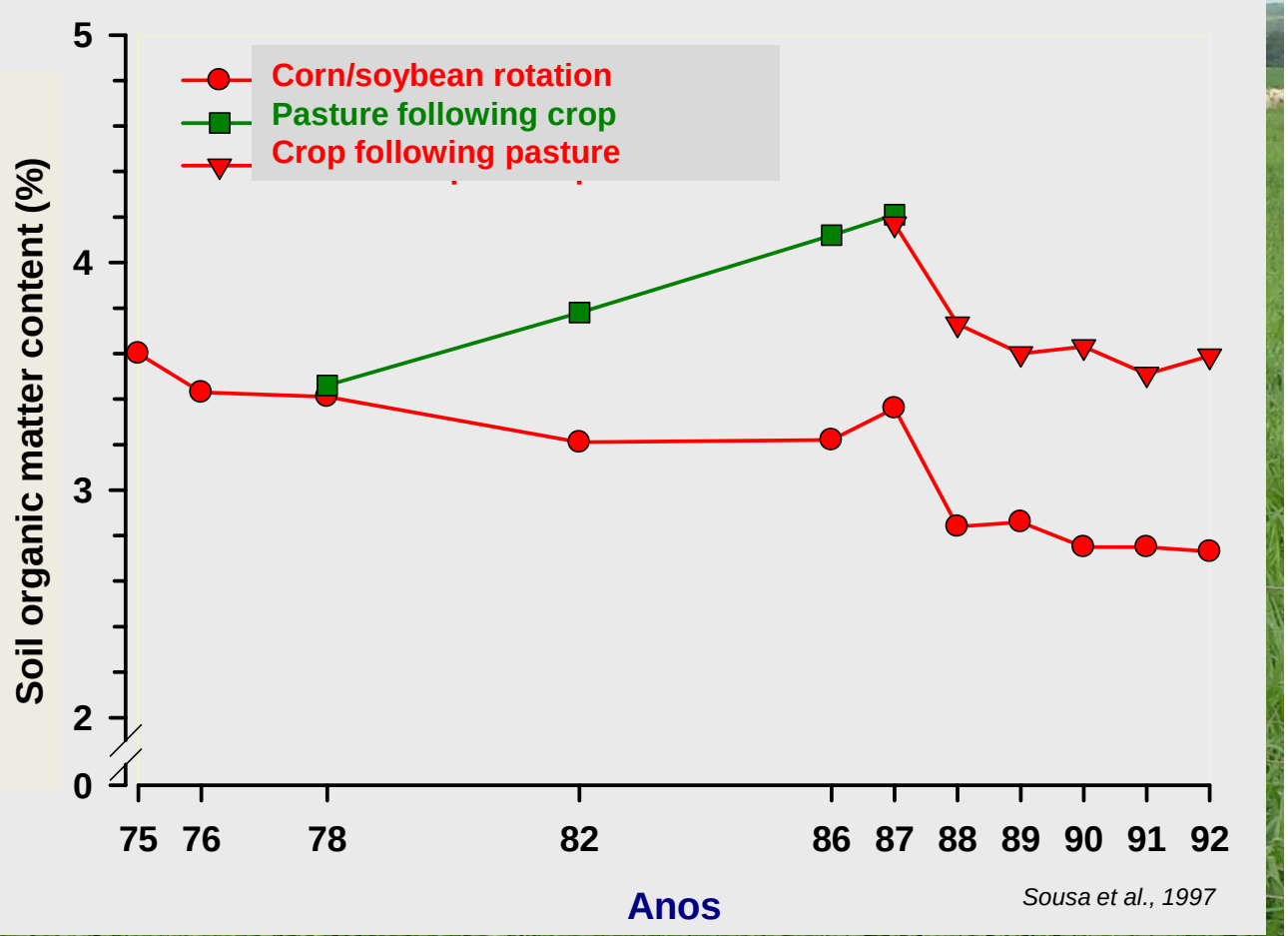
%pasture in the farm	Stocking Rates (hd./ha)			
	2,00	3,00	4,00	5,00
30%	1,90	2,65	3,40	4,15
40%	2,20	3,20	4,20	5,20
50%	2,50	3,75	5,00	6,25
60%	2,80	4,30	5,80	7,30
70%	3,10	4,85	6,60	8,35

Martha & Vilela (2009).

Weeds x ICLS



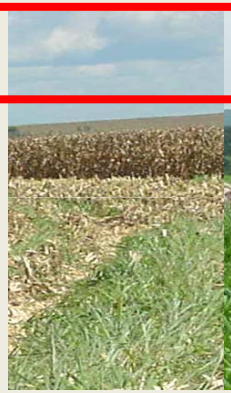
Carbon mitigation x ICLS



Sousa et al., 1997

Nutrient-Use Efficiency x ICLS

P_2O_5 kg.ha^{-1}.yr^{-1}	P apparent recovery (% of the P applied)		
	Corn-soybean[1]	Crop-pasture[2]	Increase
100	44	85	*93%*
200	40	82	*105%*
400	35	70	*100%*
800	40	62	*55%*
Average	40	75	*88%*



[1] - 10 yrs. Soybean, 1 yr. corn, 4 cycles corn-soybean, 2 yrs. corn, 1 yr. soybean.

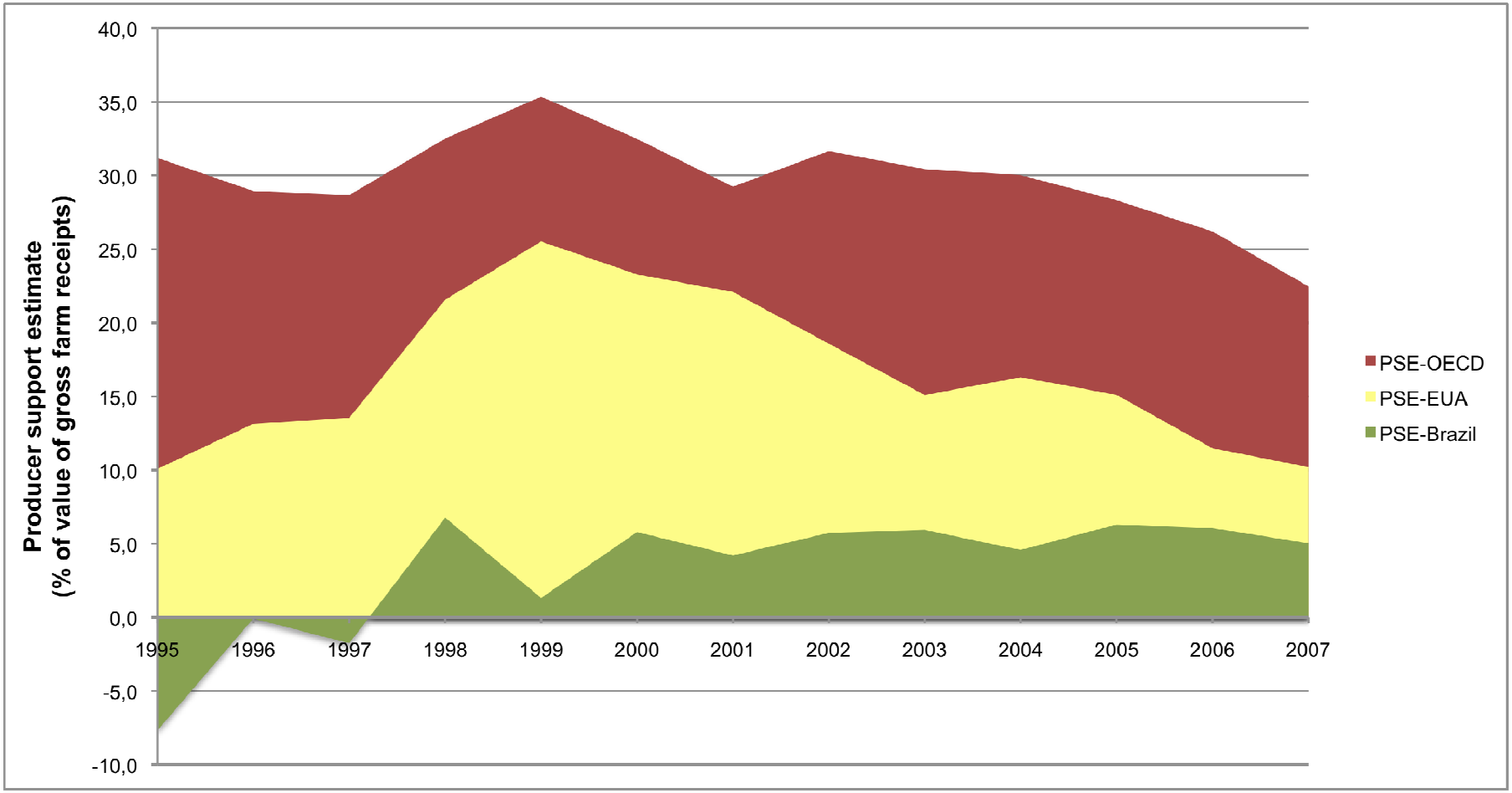
[2] - 2 yrs. Soybean, 9 yrs. *Brachiaria* , 2 yrs. Soybean, 2 cycles corn-soybean, 5 yrs. *Brachiaria* .

Sousa et al., 2007

Key-factors Contributing to the Development of Brazilian Agriculture

- **Entrepreneurship of farmers**
- **Government commitment**
- **Availability of basic infrastructure**
- **Climatic conditions**
- **Large extension of arable lands**
- **Landscape suitable for mechanization**
- **Good physical charact. of the soils**
- **Availability of mineral resources (limestone and phosphate)**
- **Science-based tropical agriculture**

Producer Support Estimate: Brasil x EUA x OCDE



OECD (2009).

Concluding Remarks

- **Major corn and soybean producers responded in a similar way in terms of the factors of growth (area expansion and productivity);**

- **Beef production expansion in Brazil was predominantly based on productivity gains;**

- **There are clear opportunities to expand food, biofuels and fiber production in a sustainable way. Intensifying pastoral systems will be of central importance;**

- **Tecnologies for a low-carbon agriculture: availability x capacity strengthening x adoption, relative prices, investment needs (financing), period of repayment, ...;**

Embrapa

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