LAC Chapter 1 Figures

Figura 1.1 Suministro de energía alimentaria y población desnutrida de los países de América Latina y el Caribe 2000 – 2002. Fuente:

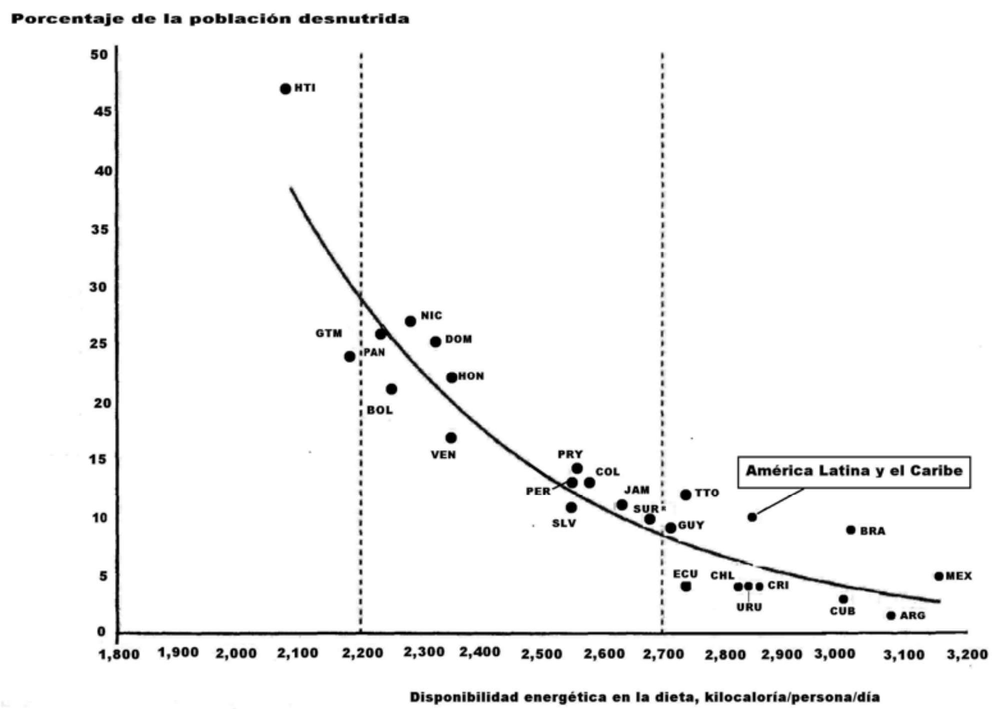


Figura 1.2 Diagrama del marco conceptual utilizado para la evaluación. Fuente:

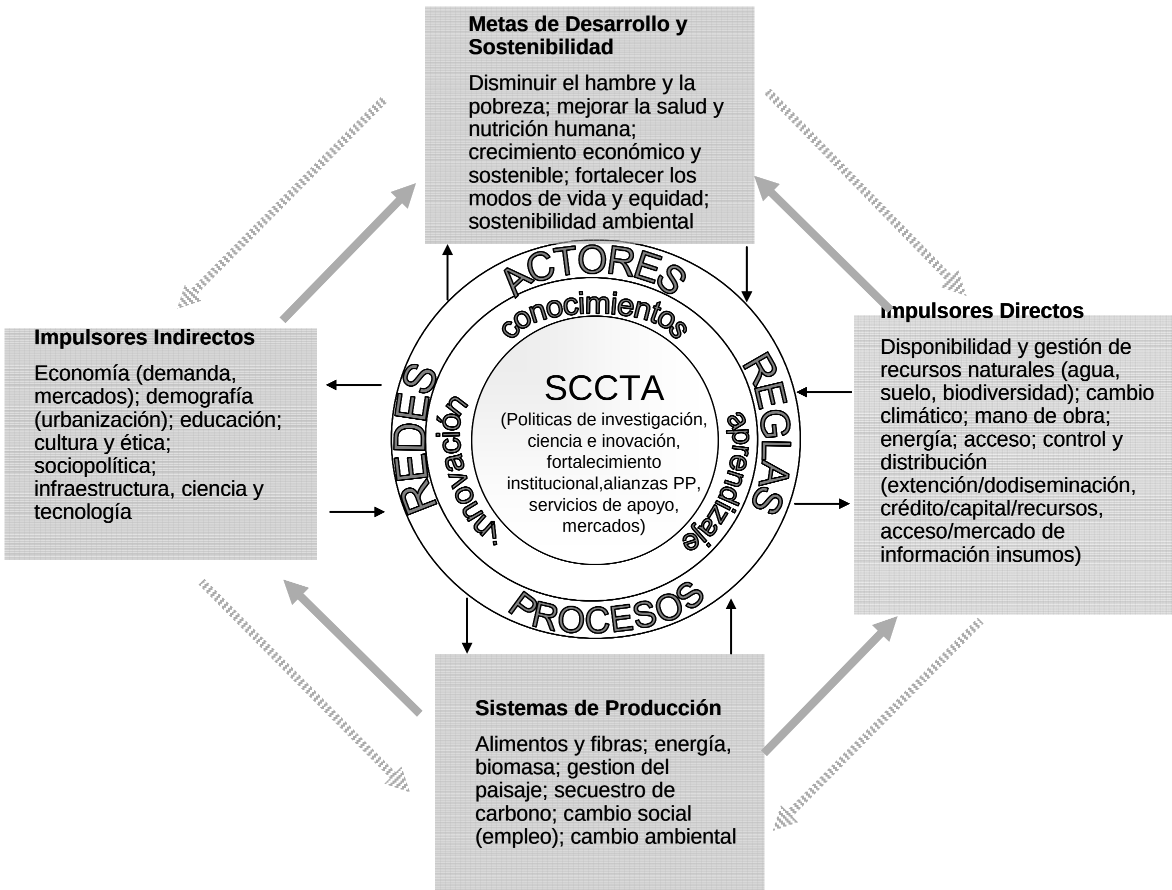


Figura 1.3 Cosmovisión Andina.

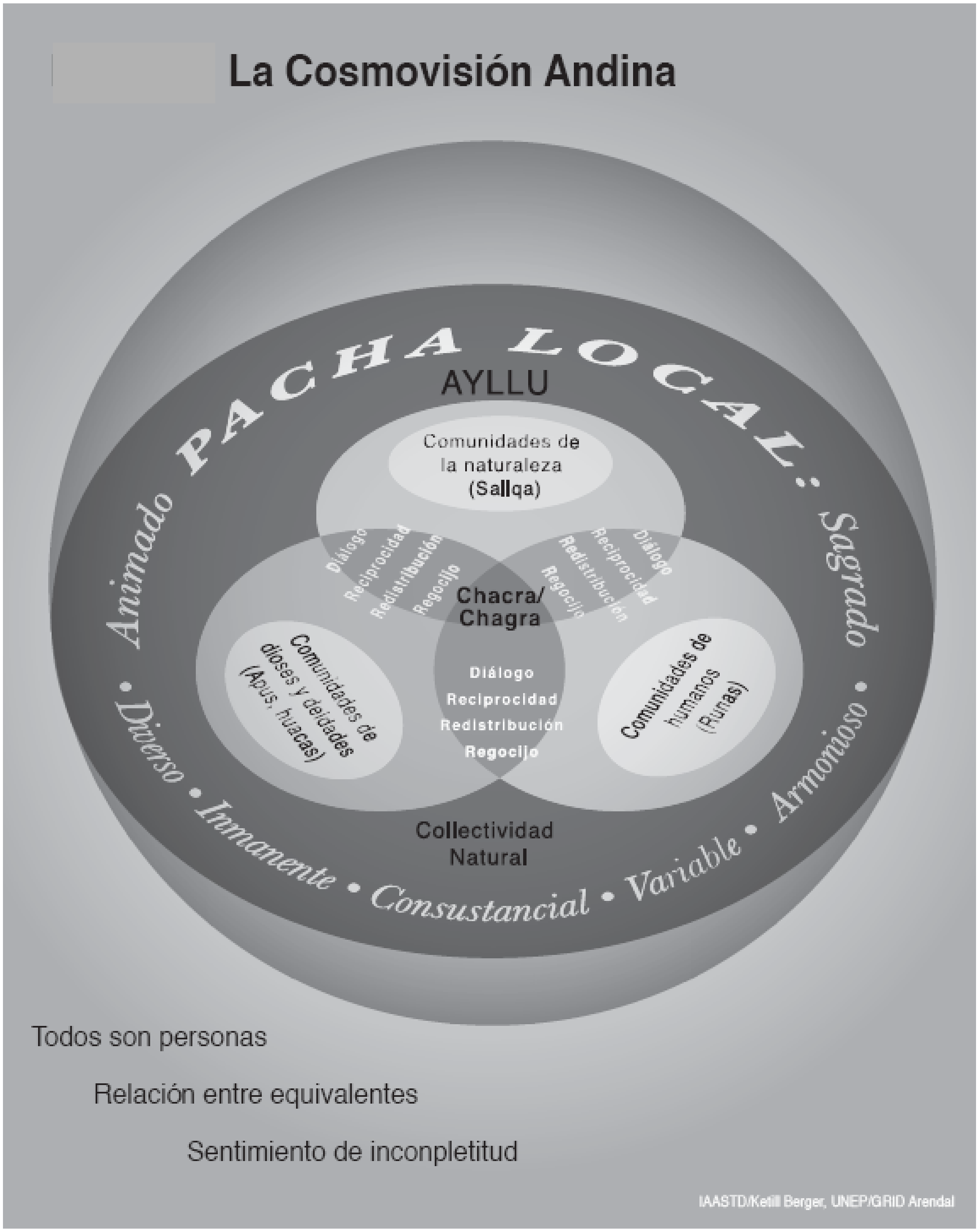


Figura 1.4 Distribución de tierra (coeficientes de Gini 1950 – 1994. Fuente: Deininger and Olinto 2002 and UNDP 1993.

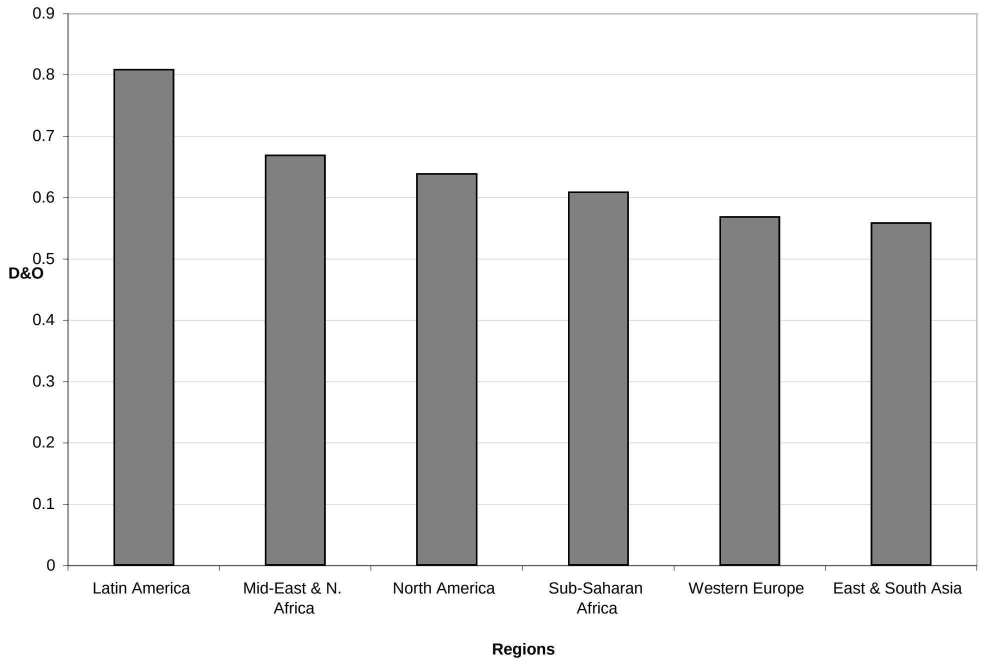


Figure 1.5 Remesas a América Latina y El Caribe, 2004 (% del PIB y US$ millones). Fuente: Acosta, P., C. Calderón, P. Fajnzylber, H. López. 2007

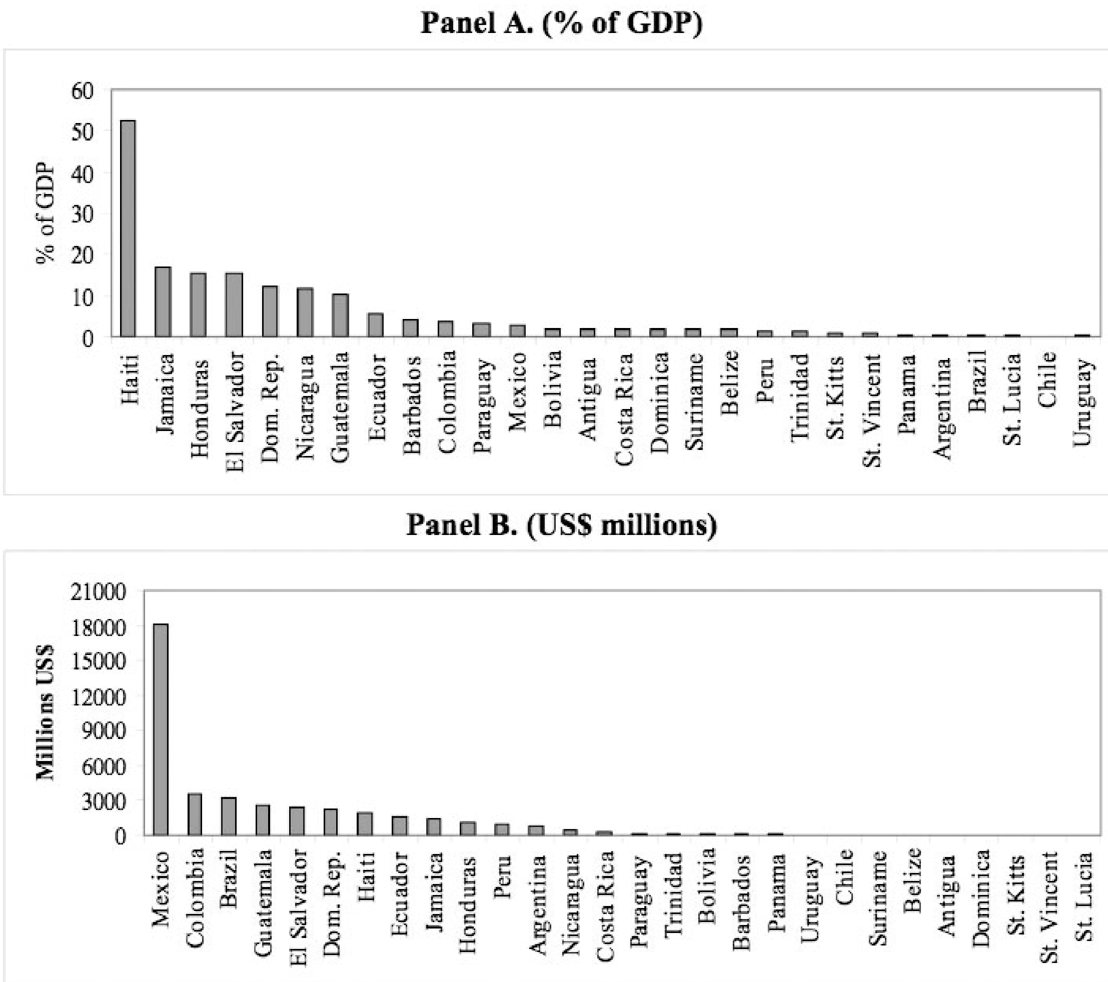


Figura 1.6 Cambio en el uso de la tierra en las 4 regiones geográficas de América Latina y El Caribe. Fuente: Elaboración propia sobre datos de FAOSTAT

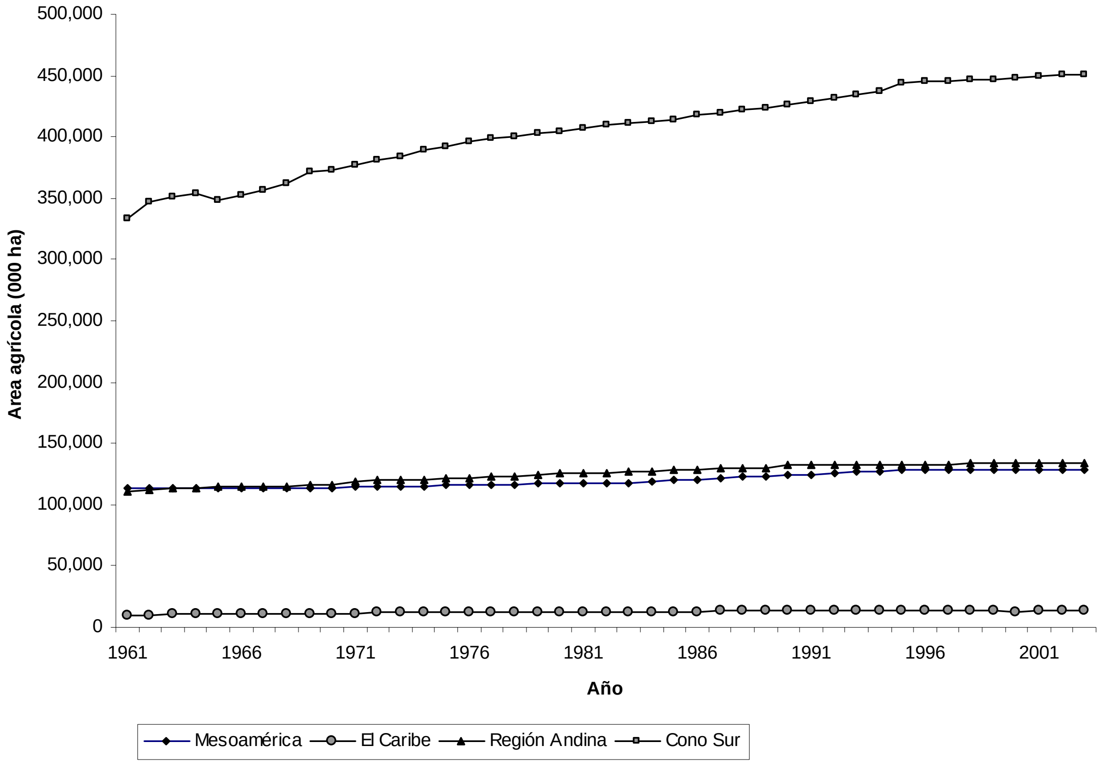
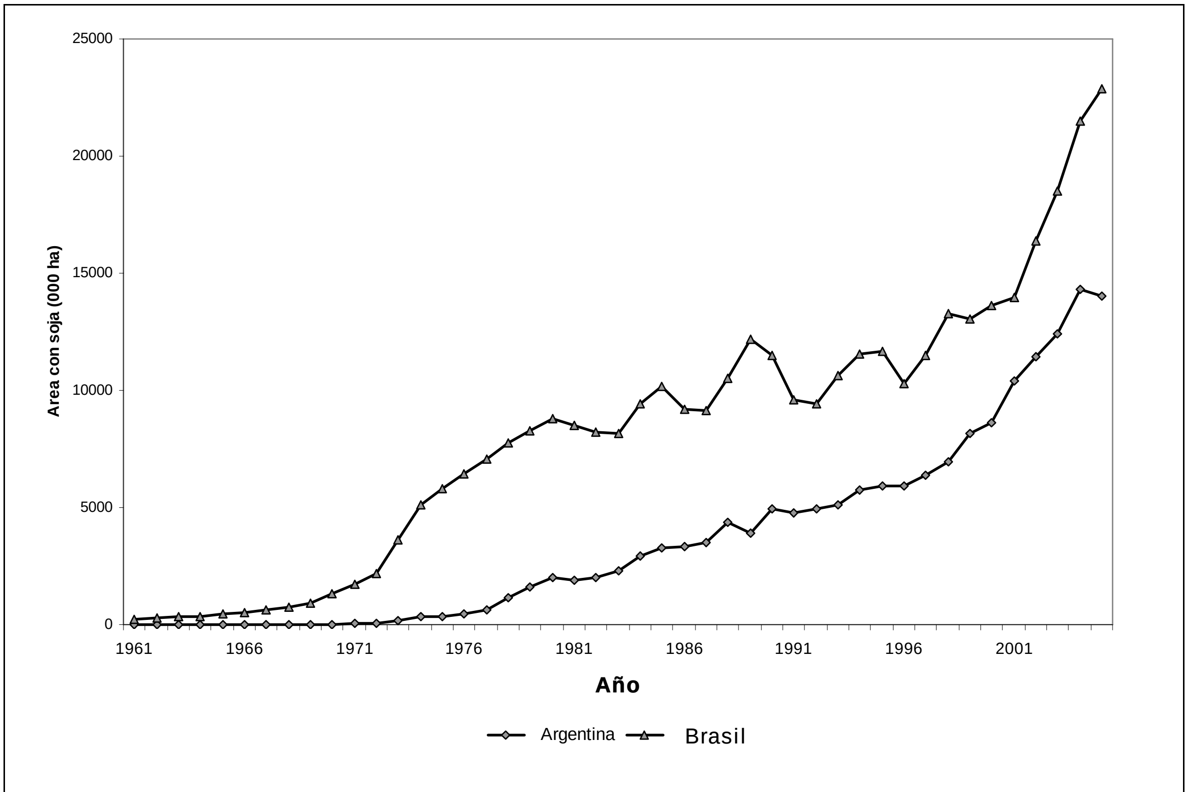


Figura 1.7 Crecimiento en la superficie cultivada con soya en los países con el mayor volumen de producción. Fuente: Elaboración propia con base en datos de FAOSTAT



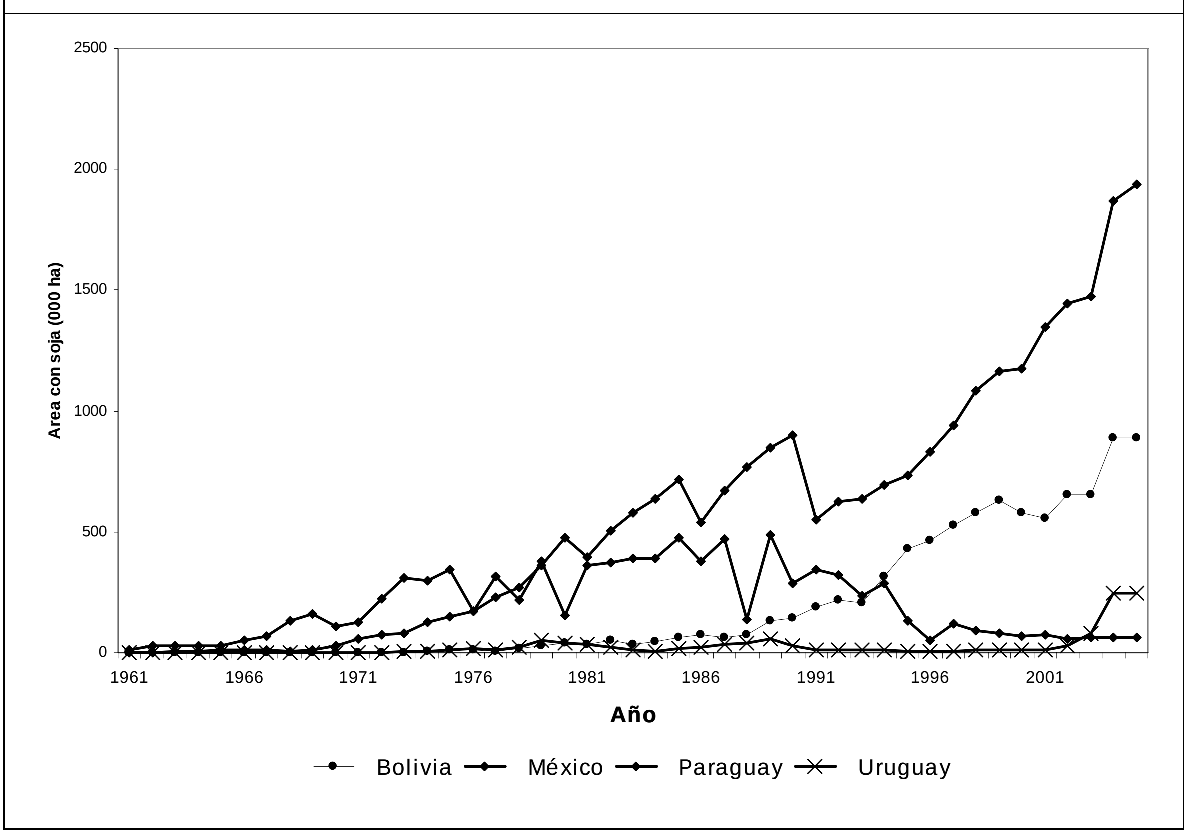


Figura 1.8 Evolución en el número de ganado vacuno en los países del Cono Sur. Fuente: Elaboración propia con base en datos de FAOSTAT

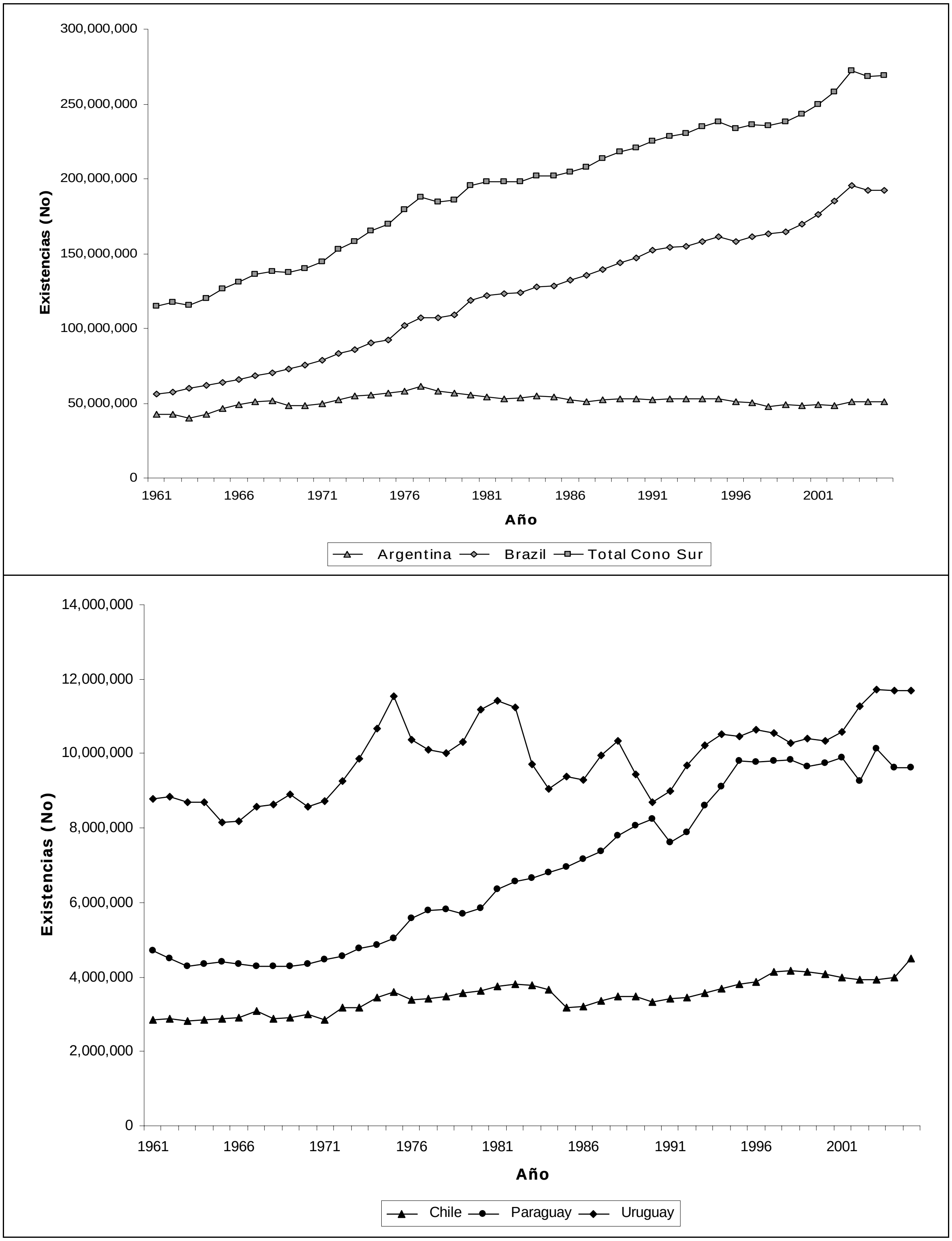
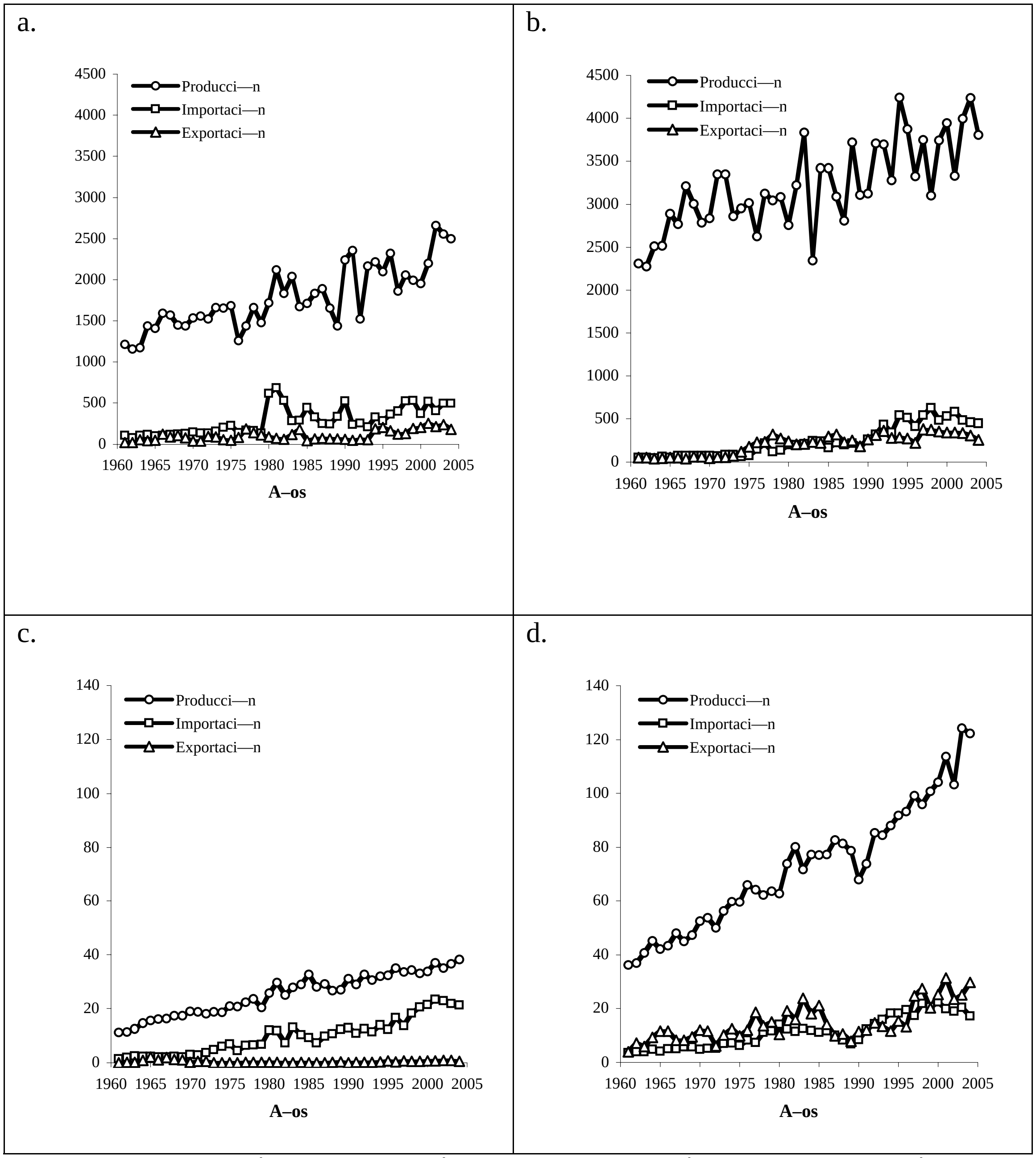


Figura 1.9 Las producción, importación y exportación de legumbres y cereales por el periodo de 1961-2004. Fuente: FAO 2005.



Datos de legumbres para países de a) Centro América y el Caribe, y b) Sudamérica, y de cereales para países de c) Centro América y el Caribe, y d) Sudamérica. Legumbres son todos tipos de vegetales leguminosas excepto de vezas y altramuces. Cereales incluyen trigo, cebada, maíz, centeno, avena, mijo, sorgo, arroz, trigo sarraceno, semillas de alpiste/canario, fonio, quinua, triticale, harina de trigo, también los cereales como componentes de alimentos mezclados. Las importaciones de cereales incluyen ayuda alimentaria además de cereales para comercio privado.

Figura 1.10 Enfoque Dominante Productivista/Convencional para la Agricultura y la Conservación de Arriba hacia Abajo. Fuente: Gonzales 2006. Elaborado por el autor en base a Escobar 1998, 1999, Pimbert 1994, Gonzales 1996, 1999

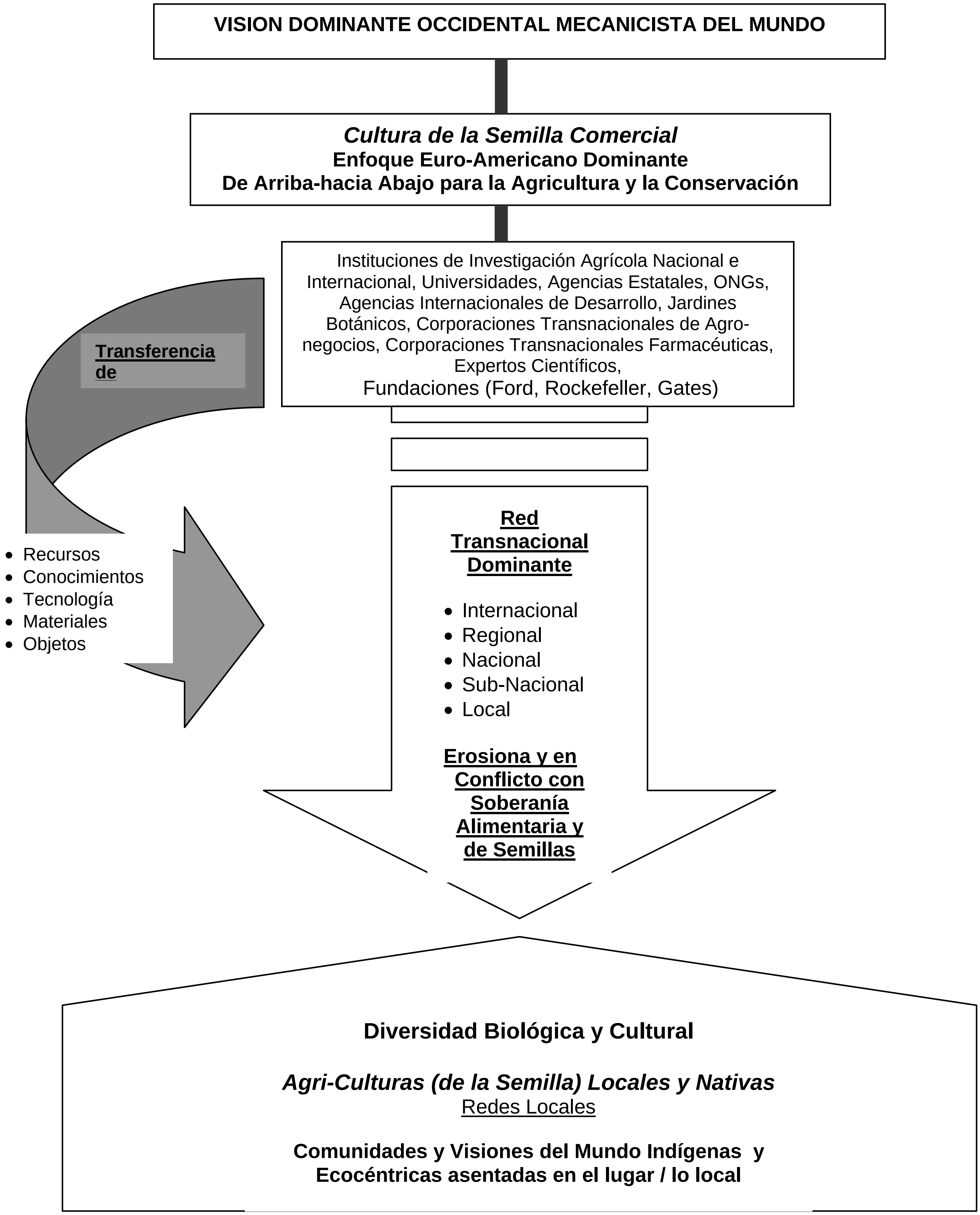


Figura 1.11 Dos visiones contemporáneas del mundo

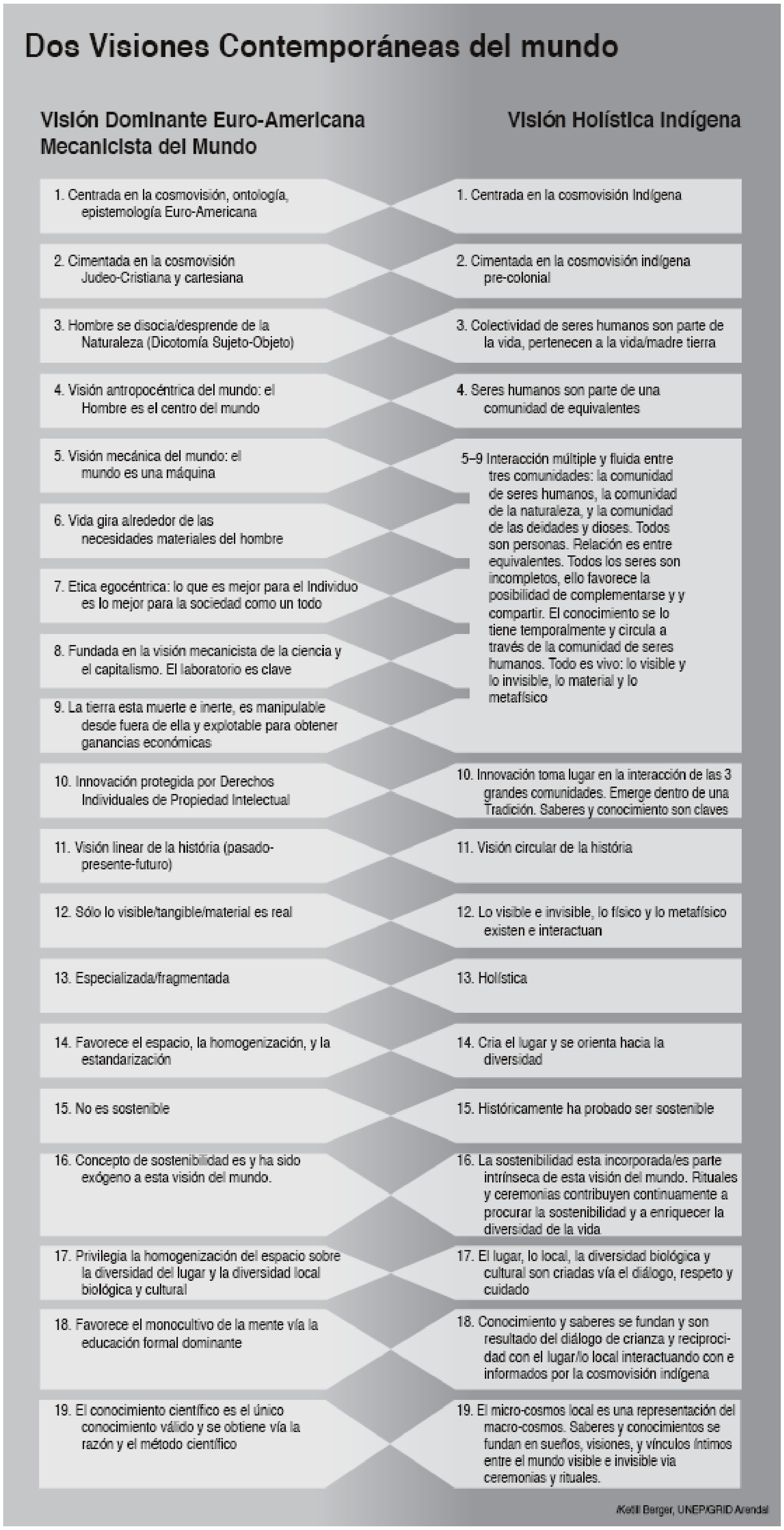
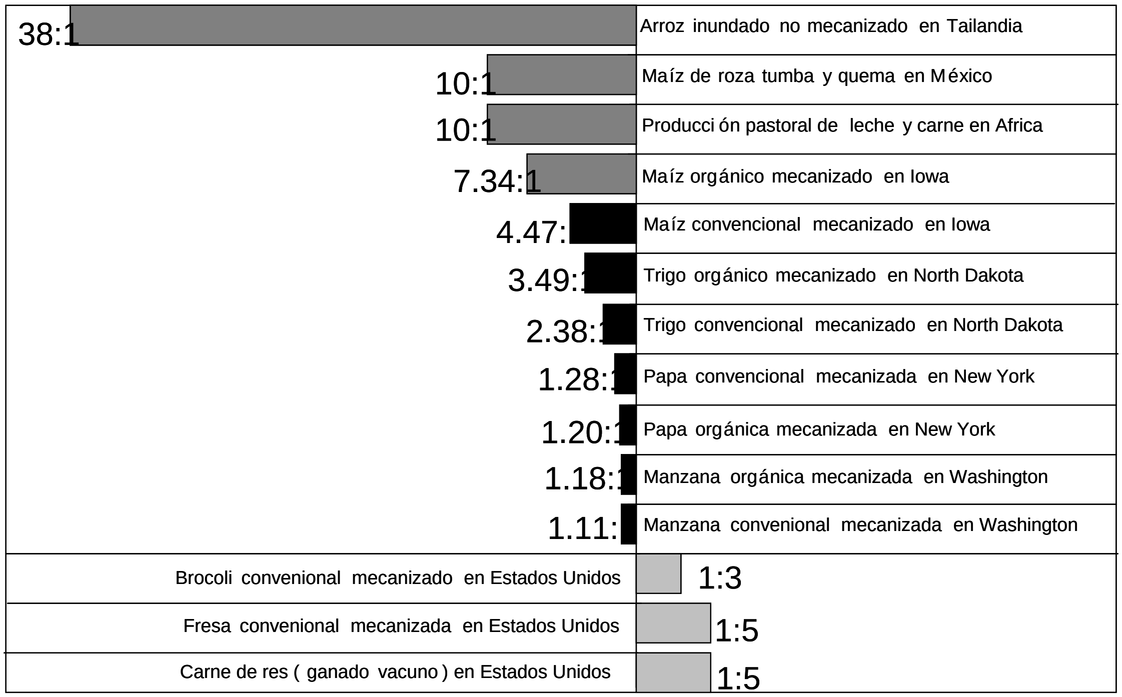


Figura 1.12 Eficiencia energética de diferentes sistemas de producción. Fuente: Elaboración propia sobre datos de: Pimentel 1980, Pimentel et al. 1983, Atkins 1979, Reganold 2001.



*Los números indican unidad energética de producto por unidad energética de insumo. Barras en gris oscuro indica un balance positivo, mientras que las barras en gris claro indican un balance negativo. (Excepto por los colores sólidos, los patrones iguales indican estudios comparativos)

Tabla 1.1 Main characteristics of agricultural systems considered in the assessment.

	System		
	Indigenous / traditional/	**Conventional /productivist**	**Agro ecological**
Main direct member	Indigenous communities (originals), afro descendants y peasants.	Agribusiness, small, medium and large producers	Small, medium and large producers; professionals
Inputs (type y origin)	Low external input, local technology	Chemical inputs, technological machinery and tools, externally bought fossil fuel	Low dependency of external inputs. Biological inputs produced from sub products from the system. High technology integrated to endogenous, natural, physical and energetic processes.
Knowledge and know how	Local/ancestral knowledge. Strongly rooted to the territory	Academic/technological knowledge	Academic/technological knowledge and know how with emphasis in the Local/ancestral knowledge. Scientific knowledge strongly based on ecological science.
Diversification of production	Multi-crops, High biological diversity	Great scale single-crops with spatial and temporal rotations	Multi-crops, with spatial and temporal integration
Link to the market	Little or nil linking with input/output markets. Production largely oriented to family consumption	Strong articulation with production chains with linking to national and international markets.	Little articulation with production chains, but strong linking with markets of differentiated products.
Labor	Family and communal labor using different forms of labor exchanges.	Dominated by hired labor	Family and hired labor

Source: Authors elaboration

Table 1.2. Geographic regions and countries in Latin America and the Caribbean.

Region	Countries	Area territorial (1,000 ha)
Southern Cone	**Total**	**1, 297, 040**
	Argentina	273, 669
	Brazil	845, 942
	Chile	74, 880
	Islas Malvinas	1, 217
	* French Guiana	8, 815
	*Guyana	19, 685
	Paraguay	39, 730
	*Suriname	15, 600
	Uruguay	17, 502
Andean region	**Total**	**456,197**
	Bolivia	108, 438
	Colombia	103, 870
	Ecuador	27, 684
	Peru	128, 000
	Venezuela, Rep. Bolivariana	88, 205
Central America and Mexico	**Total**	**241, 943**
	Belize	2, 281
	Costa Rica	5, 106
	El Salvador	2, 072
	Guatemala	10, 843
	Honduras	11, 189
	Mexico	190, 869
	Nicaragua	12, 140
	Panamá	7, 443
The Caribbean	**Total**	**22, 895**
	Antigua y Barbuda	44
	Aruba	19
	Bahamas	1, 001
	Barbados	43
	British Virgin Islands	15
	Cayman Islands	26
	Cuba	10, 982
	Dominica	75
	Dominican Republic	4, 838
	Grenada	34
	Guadeloupe	169
	Haiti	2, 756
	Jamaica	1, 083
	Martinique	106
	Montserrat	10
	Antillas Holandesas	80
	Puerto Rico	887
	Saint Kitts y Nevis	36
	Saint Lucia	61
	Saint Vincent/Grenadines	39
	Trinidad y Tobago	513
	Turks and Caicos Is	43
	US Virgin Islands	35
Total		2, 018, 075

* These countries although located in South America are frequently considered as part of the Caribbean due to their cultural affiliation with the rest of the Caribbean region.

Tabla 1.3. Agro ecological Areas / Types of Production in Latin America and the Caribbean

Agro ecological Areas / Types of Production	Countries or regions with these types of production or ecosystems	Total area (m ha)	Cropped Area %	Population (millions)	Regional percentage	Main subsistence forms	Poverty index
1. Irrigated	North of Mexico, coast and internal valleys of Peru and Chile, Argentina	200	3,7	11	9	Horticulture, fruit culture, livestock	Low-moderate
2. Forest	Cuenca del Amazonas (Brasil, Bolivia, Perú, Ecuador, Colombia, Venezuela, Surinam y Guyana) y zonas selváticas de México y Centro América	600	1	11	9	Subsistence agriculture (migratory), cattle	Low-moderate
3. Coastal plains/plantations	Central America, Mexico, the Caribbean and northeast coast and nor occidental area of South America	186	10,7	20	17	Plantations of export crops, fisheries, tubers, tourism.	Variable
4. Mixed intensive	Central region of Brazil	81	16	10	8	Café, horticulture, fruit culture, employment outside the farm	Baja (except between daily workers)
5. Mixed cereals and livestock	South of Brazil, north of Uruguay	100	18	7	6	Rice and livestock	Low-moderate
6. Template humid. Mix with forest.	Coastal area of the center of Chile	13	12,3	<1	1	Dairy, livestock, cereals, silviculture and tourism	Low
7. Maize-beans	Mexico and Central America	65	9,2	<11	10	Maize, beans, coffee, horticulture and employment outside the farm	Generalized and extreme
8. Mix of mountain (North of Andes)	Andean region of Colombia, Ecuador and Venezuela	43	10,2	4	3	Horticulture, maize, coffee, cattle and pigs, cereals, potatoes, employment outside the farm	Low-Generalized (particularly in high altitude)
9. Mix extensive (cerrados, plains)	Southeast of Amazonia in Brazil and Bolivia, north of Amazonia in Venezuela and Guyana	230	13,5	10	9	Livestock, oilseeds, grains, coffee	Low-moderate (small producers and landless)
10. Template mix (north of the Pampas)	East -central region of Argentina and part of Uruguay	100	20	7	6	Livestock, wheat, soybean	Baja
11. Mix dry	North oriental coast of Brazil and the Yucatán Peninsula of Mexico	130	13,8	10	9	Livestock, maize, yuca, employment, seasonal migration l	Generalized (drought)
12. Mix dry extensive (Gran Chaco)	Central region of Argentina, north of Paraguay	70	11	<2	<2	Livestock, cotton, subsistence crops	Moderate
13. Mix highlands (Andes C.)	East of Bolivia	120	1,1	>7	>7	Tubers, sheep, grains, llamas, horticulture, employment outside the farm	Generalized and Extreme
14. Pastures (South of the pampas)	Andean region of Peru and Bolivia	67		<1	<1	Cattle and sheep	Low-moderate

15. Template forest	Chile and Argentina	60	<0,5	<4	3	Sheep, cattle, silviculture and tourism	low

Source: Dixon et al., 2001

Table 1.4 Gini coefficient of the income distribution around the years 1999, 2002 and 2005 [a/]

Inequality level	Around 1999	Around 2002	Around 2005
Very High 0,580 – 1	Brazil 0,640 Bolivia 0,586 Nicaragua 0,584	Brazil 0,639 Bolivia 0,614 Honduras 0,588	Bolivia (2002) 0,614 Brazil 0,613 Honduras 0,587 Colombia 0,584
High 0,520 – 0,579	Colombia 0,572 Paraguay 0,565 Honduras 0,564 Chile 0,560 Guatemala 0,560 Dominican Rep 0,554 Peru 0,545 Argentina b/ 0,539 México 0,539 Ecuador b/ 0,521	Nicaragua 0,579 Argentina b/ 0,578 Paraguay 0,570 Colombia 0,569 Chile 0,559 Dominican Rep 0,544 Guatemala 0,542 El Salvador 0,525 Peru 0,525 Panama b/ 0,515	Nicaragua (2001) 0,579. Dominican Rep 0,569 Chile 0,550 Guatemala (2002) 0,542 Paraguay 0,536 México 0,528 Argentina b/ 0,526
Medium 0,470 – 0,519	El Salvador 0,518 Panama b/ 0,513 Venezuela (Rep. Bol. de) 0,498 Costa Rica 0,473	México 0,514 Ecuador b/ 0,513 Venezuela (Rep. Bol. de) 0,500 Costa Rica 0,488	Ecuador b/ 0,513 Peru 0,505 Panama b/ 0,500 El Salvador 0,493 Venezuela (Rep. Bol. de) 0,490 Costa Rica 0,470
Low 0 – 0,469	Uruguay [b/] 0,440	Uruguay b/ 0,455	Uruguay b/ 0,451

Source: CEPAL 2006, based on special tabulation of the household surveys in each country.
a/ The limit values of each category of the Gini coefficient are the same employed in chapter I of: "*Panorama social de América Latina 2004*". b/ Urban areas.

Table 1.5. Evolution of urban and rural poverty in Latin America and the Caribbean (Absolute and relative numbers)

Poor Population	**Years**					
	1970	**1980**	**1986**	**1990**	**1994**	**1997**
Total	119.800	135.900	170.200	200.200	201.500	204.000
Urban	44.200	62.900	94.400	121.700	125.900	125.800
Rural	75.600	73.000	75.800	78.500	75.600	78.200
Urbanization of poverty	36.9	46.3	55.5	60.8	62.5	61.7
Percent of poor households						
Total households	45	35	-	41	38	36
Urban Area (a)	29	25	-	35	32	30
Rural Area (b)	67	54	-	58	56	54
Rural/Urban relation (b/a)	2.3	2.2	-	1.6	1.7	1.8

Source: CEPAL (1994b y 1999)
Note: percent of poor households (100: Total households according to area of residence)

Table 1.6. Extent and change of forest area in Latin America, 1990-2005

Subregion	Area (1 000 ha)			Annual change (1 000 ha)		Annual change rate (%)	
	1990	**2000**	**2005**	**1990-2000**	**2000-2005**	**1990-2000**	**2000-2005**
Caribbean	5, 350	5, 706	5, 974	36	54	0.65	0.92
Central America	27, 639	23, 837	22, 411	-380	-285	-1.47	-1.23
South America	890, 818	852, 796	831, 540	-3, 802	-4, 251	-0.44	-0.50
Total Latin American and the Caribbean	**923, 807**	**882, 339**	**859, 925**	**-4, 147**	**-4, 483**	**-0.46**	**-0.51**
World	**4, 077, 291**	**3, 988, 610**	**3, 952, 025**	**-8, 868**	**-7, 317**	**-0.22**	**-0.18**

Source: FAO. 2007. State of the World's Forests 2007. Food and Agriculture Organization (Rome).

Table 1.7. Current and future temperature and precipitation (^oC, mm/day, annual average). Selected LAC countries/regions

Country	Temperature		Precipitation	
	Current (1961-1990)	Future (2070 – 2099)	Current (1961-1990)	Future (2070 – 2099)
South Cone				
Argentina	14.65	17.89	1.63	1.66
Brazil: Amazons	26.04	30.38	5.97	5.84
Brazil: Northeast	25.58	29.46	3.58	3.52
Brazil: South	22.04	25.90	3.98	4.15
Chile	9.01	11.91	1.52	1.43
Andean Zone				
Colombia	24.31	27.81	7.25	7.44
Ecuador	22.15	25.36	5.52	6.01
Peru	19.52	23.34	4.22	4.42
Venezuela	22.44	29.17	5.33	5.31
Others				
Central America	24.23	27.76	6.51	6.18
México	20.66	24.71	2.09	1.84
Cuba	25.25	28.19	3.57	3.50

(Source: Cline, 2007)

Table 1.8. Land use by region

	Southern Cone	Andean Region	Mesoamerica (include Mexico)	The Caribbean
Terrestrial Total	1,297,040	456,197	241,943	22,895
Agriculture Total	450,362	133,923	128,815	13,044
% del Total	**34.7%**	**29.4%**	**53.2%**	**57.0%**
Annual Crops	93,842	13,263	30,736	5,327
% of Total	**7.2**	**2.9**	**12.7**	**23.3**
Permanent Crops	9,107	4,538	4,435	1,825‡
% of Total	0.7	1.0	1.8	8.0‡
Areas with Pasture	347,413	116,122	93,644	5,892‡
% of Total	**26.8**	**25.5**	**38.7**	**25.9‡**
Forests and y forestation#	675,670	255,900	72,142	4,465‡
% of Total	**52.1**	**56.1**	**29.8**	**19.6‡**

(Fuente: FAOSTAT, 2005)*
Notes:
* More recent year with data on land use is 2003
# More recent year with data on land in forest and forestation is 1995.
‡ With the exception of the total terrestrial area the data for the Caribbean does not include Aruba, The Dutch Antilles, Turcas Islands nor Caicos.

Table 1.9 Production de transgenic crops in LAC.

Global Ranking	Country(*)	Area (millions of hectares)	Crop
2*	Argentina	18.0	soybean, maize, cotton
3*	Brazil	11.5	soybean, cotton
7*	Paraguay	2.0	soybean
9*	Uruguay	0.4	soybean, maize
13*	México	0.1	cotton, soybean
15	Colombia	<0.1	cotton
18	Honduras	<0.1	maize
Total		32.2	

Source: James, 2006.

Table 1.10. The reduction/disappearance of the home place: Area under the control of indigenous people of Mexico and Central America.

Country	National areal (Has)	Area under indigenous people control (Has)	%
México	195,820,000	29,399,430	15
Guatemala	10,899,000	No determined	No determined
Belice	2,296,550	No determined	No determined
Honduras	11,209,000	16,180.7	14
El Salvador	2,104,100	Not studied	Not studied
Nicaragua	13,000,000	5,900,000	45.3
Costa Rica	5,110,000	320,321	6.2
Panama	7,551,700	1, 657,100	2.2

Source: Toledo, Alarcón Chaires and Moguel 2001

Table 1.11. Two central contemporary views of the world

Dominant Western Mechanistic Worldview: Colonizer's Model (From Above)	**Indigenous Local/Place-based Model (From Below)**
1. Western epistemology, ontology, cosmovision 2. Grounded in the Judeo-Christian & Cartesian cosmovision 3. Man dissociates/is detached from nature (Subject-Object) 4. Anthropocentric vision of the world: Man is the center of the world. 5. Mechanistic worldview 6. Life moves around men's material needs 7. Egocentric ethic: what is best for the individual is best for society as a whole 8. Based on western mechanistic science and capitalism. Lab based. 9. Earth is dead and inert, manipulable from outside, and exploitable for profits 10. Innovation protected by Individual Property Rights 11. Linear vision of history (Past-Present-Future) 12. Only the visible/tangible/material is real 13. Specialized/fragmented 14. Space. Homogenizing/standardizing 15. Non-sustainable 16. Sustainability concept has been foreign to this dominant view of the world for the last 500 years. 17. Privileges space homogenization over place/local diversity 18. Favors "monocultures of the mind" through formal dominant education. True knowledge is based on mechanicistic science.	1. Indigenous Peoples' epistemologies, ontologies, cosmovisions 2. Grounded in indigenous, pre-colonial cosmovision 3. Human beings are part of life as a whole (We all are but one) 4. Human beings are part of a community of equivalents. 5- 9. Multiple interaction among three communities: the community of human beings, the community of nature, and the community of deities/gods. Their relation is among equivalents. All beings are incomplete therefore the possibility of complementing each other and sharing. Knowledge is hold temporarily, and it circulates through the community of human beings. In this view everything is alive—the visible and the invisible. 10. Innovation takes place within the interaction of the 3 major communities. Emerges within a tradition. 11. Circular vision of history 12. Both the visible and invisible, the physical and the metaphysical exist and interact 13. Holistic 14. Place-diversity oriented 15. Sustainable 16. Sustainability is incorporated in their world view. Rituals and ceremonies contribute to procure it. 17. Place/local cultural and biological diversity are nurtured through dialogue, respect and care. 18. Local/place-based knowledge and wisdom is the result of an intimate dialogue of nurturance and reciprocity interacting with and informed by the indigenous cosmovision 19. The local micro-cosmos is a representation of the macro-cosmos.

Source: Adapted from Merchant 1992, Posey 1999, Shiva 1993, Pimbert 1994, Gonzales 1996, Gonzales, Chambi and Machaca 1999, Gonzales 1999, Norgaard 1999

Tabla 1.12: Mineral level in biological and conventional grown foods

Type of food	Mineral content in miliequivalent/100 grams						
	Calcium	Magnesium	Potassium	Sodium	Manganese	Iron	Cupper
	LETUCCE						
Biological	40.5	60	99.7	8.6	60	227	69
Conventional	15.5	14.8	29.1	0	2	0	3
	TOMATOES						
Biological	71	49.3	176.5	12.2	169	516	60
Conventional	16	13.1	53.7	0	1	9	3
	BEANS						
Biological	96	203.9	257	69.5	117	1585	32
Conventional	47.5	46.9	84	0.8		19	5

Source: Vida Sana Bulletin 2002. Adapted by J. Restrepo from a study from Rutgers University

Table 1.13 Estimated environmental and health costs associated to the use of pesticides in LAC

Effects en human health due to pesticides	**Total costs (US$)**
Costs for poisoning with hospitalization: 60.000 X 3 days x US$2,000/day	360,000,000
Costs of treatments of patients without hospitalization (include hospital, compensations and transportation): 3,000,000 x US$1,000	3,000.,000,000
Labor lost due to poisoning: 60.000 workers x 5 days x US$80/day	24,000,000
Cancers due to pesticides: Total population 400 millions x 0,02% x US$100,000/case	8,000,000,000
Costs due to fatalities: 30,000 x US$3.7 millions (Value of a human life according to EPA)	111,000,000,000
Sub-Total	**122,384.,000,000**
Other loses (*)	8,505,000.000
Total approximated environmental and health costs	**130,889,000,000**

Source: Adapted from Pimentel, 2004 (Nivia, 2005)

Notes:
(*) There is not data for LAC therefore the figure is that estimated for the United States. This figures may underestimate the true value for LAC since the larger biodiversity makes

Box 1.1. The MST and Land Tenure in Brazil

Since the early 1980s more than one million people in Brazil have transformed their lives by gaining access to land. This has been possible thanks to a strategy of organizing and peaceful protest that has forced the government to redistribute more than eight million hectares of cropland to some 350,000 families and help them develop new ways of life. These families belong to what many call the largest social movement in Latin America and the Caribbean, the Movement of Landless Rural Workers (MST: Movimento dos Trabalhadores Rurais Sem Terra).

The MST's strategy is based on forcing the government of Brazil to enforce the law. For almost five centuries Brazil has been plagued by major economic inequality, in particular with respect to land tenure. Large estate owners have controlled vast rural areas with impunity, in some cases falsifying documents and in others by recourse to violence (see figure). Much of this land is not used efficiently and has resulted in stagnant development in rural areas. To combat this problem, since the early 19th century successive governments of Brazil promoted the idea that to claim legal title to property, an owner must show that the land is serving a "social function." Today this concept has been incorporated into the Brazilian Constitution.

Brazil is an emerging economy, and also the eighth largest economy in the world. Nonetheless, most Brazilians live in poverty. Brazil has the most stark economic inequality in the world, as well as very unequal land distribution (the Gini coefficient for land distribution was 0.85 in 1994). For example, three percent of landowners hold two-thirds of the country's arable lands. The highest levels of poverty and illiteracy are in rural areas, where the main problem is land tenure.

The MST has 1.5 million members in 23 of Brazil's 27 states. Today, there are 2,000 MST settlements and more than 80,000 additional persons are currently living in camps awaiting government recognition. Cooperative farms, houses, schools for children and adults, and clinics have been built in these settlements.

According to the MST, its success is based on its ability to organize and educate. The members gain access to land, and therefore to food security for their families; in addition, many of them continue to participate in the design of a sustainable socioeconomic development model that offers specific alternatives to the model of neoliberal globalization.

Result of the organizational efforts of the MST with respect to production and marketing:

- 400 associations of small producers in the area of production, marketing, and services. These include:
  - 49 farming and ranching cooperatives
  - 32 service cooperatives
  - 2 regional cooperatives for marketing
  - 3 credit unions
- 96 small and medium cooperatives for processing fruits, vegetables, dairy products, coffee, cereal grains, meat, and sugar

These economic enterprises of the MST generate employment and salaries that directly or indirectly benefit 700 small towns in the Brazilian interior.

The leaders of the MST argue that production cannot be considered in isolation from education; accordingly, many of its programs are geared to educating its members.

Results of the MST's organizing efforts with respect to education:

- 160,000 children are studying in grades 1 through 4 in public schools located in MST settlements
- 3,900 educators paid by the local (municipal) governments are developing teaching methods specifically tailored to the MST's rural schools
- In collaboration with UNESCO and some 50 universities, the MST is developing literacy programs for some 19,000 adolescents and adults in the settlements
- In collaboration with several Brazilian universities, training is being provided to teachers, administrators of settlements and cooperatives, and nurses
- In collaboration with the government of Cuba, 48 members of the MST are studying medicine in Cuba

The MST is also promoting sustainable development. For example:

- In 1999, members of the MST developed the Bionatur seeds, which are for organic production.
- Several settlements are involved in the production of medicinal plants.
- In Pontal do Paranepanema, families from the settlements work together with environmental organizations to conserve the forest.

The MST is not free of controversy. Its critics assert that the members are mainly people from the cities who end up living in worse conditions than when they lived in the city. It is also argued that the establishment of settlements in the Amazon region contributes to deforestation. Nonetheless, a recent survey (cited by The Economist, 2007) revealed that 94 percent of those living in settlements have prior agricultural experience, and 79 percent stated that their lives had improved as a result of having obtained land and joining the MST. With respect to the accusations regarding impact on deforestation, the MST argues that its activities in the Amazon region are mainly in areas already deforested, particularly relatively unproductive cattle ranches.

Independent of the controversy that surrounds the MST, one cannot question the impact that this social movement has had in Brazil, or its influence in the rest of Latin America and the Caribbean. The successes and failures of this massive movement may serve as an example for the governments and social movements of the other countries of the region as they seek to solve the problems associated with the stark inequalities in land tenure in LAC.

Box 1.3. Food as a Human Right

The Millennium Development Goals include slashing world hunger by half by the year 2015. In the document "The Millennium Development Goals: A Latin American and Caribbean Perspective," the section on eradicating hunger in the region emphasizes food as a human right (UNDP, 2005a). The document establishes that the problem of eradicating hunger should be understood in the context of food as a right. This right is recognized in the International Covenant on Economic, Social and Cultural Rights, which entered into force on January 3, 1976, and to which almost all the countries of Latin America and the Caribbean are signatories.

Article 11 of the Covenant establishes as follows:

"1. The States Parties to the present Covenant recognize the right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions. The States Parties will take appropriate steps to ensure the realization of this right, recognizing to this effect the essential importance of international co-operation based on free consent.

2. The States Parties to the present Covenant, recognizing the fundamental right of everyone to be free from hunger, shall take, individually and through international co-operation, the measures, including specific programmes, which are needed:

(a) To improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge, by disseminating knowledge of the principles of nutrition and by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilization of natural resources;

(b) Taking into account the problems of both food-importing and food-exporting countries, to ensure an equitable distribution of world food supplies in relation to need."

Today, the following countries of Latin America and the Caribbean are signatories to the Covenant: Antigua and Barbuda, Argentina, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, St. Vincent and the Grenadines, St. Lucia, Suriname, Trinidad and Tobago, Uruguay, and Venezuela.

Box 1.4. Emergence of infectious diseases and agriculture

One of the main threats to agricultural development internationally is the emergence of diseases associated with the changes in the environment necessary for agriculture (Wilson, 2002). In Latin America and the Caribbean, the association of agricultural activities with certain diseases has been relatively little studied in comparison with the other regions such as Africa and Southeast Asia (Norris, 2004). Following are four examples that illustrate the importance of this association:

1) Coffee and cutaneous leishmaniasis: Scorza et al. (1985) documented how coffee-picking increases the risk of infection by *Leishmania* parasites, due to the coincidence in time of this agricultural activity with the maximum activity of the insects that are vectors of this disease.

2) Irrigation and malaria: Zoppi de Roa et al. (2002) found densities of malaria vectors much greater in irrigation canals than in bodies of water whose origin is not attributable to human activities. The density of vectors that transmit a disease tends to be linearly correlated with the risk of acquiring the disease, which is why agricultural activity increases the risk in two ways: by increasing the number of mosquitoes, and spatially, by the proximity of irrigation canals to centers of human settlement (Norris, 2004).

3) Deforestation and malaria: Agricultural development can lead to increases in temperature that facilitate the development of parasites that cause malaria in the vectors, especially when natural forests are cut down to promote agriculture (Lindblade et al., 2000). The rates of mosquito bites can be up to 278 times greater in highly deforested areas as compared to natural forest areas (Vittor et al., 2006).

4) Rural houses and Chagas' disease: One of the fundamental aspects in the epidemiology of Chagas' disease is its association with rural dwellings in precarious conditions (Rabinovich et al., 1979). In general, the more precarious the conditions of the housing units (thatched roof, clay walls) the greater the densities of vectors one can expect to find, increasing the risk of acquiring a disease (Rabinovich, 1995).

The four examples presented above show the need to incorporate knowledge of infectious diseases into agricultural activities. Certainly the problem has a dimension in which knowledge of the disease's biology may begin to have an immediate impact on agricultural practices by diminishing activities that increase the risk of acquiring disease. For example, to diminish the incidence of cutaneous leishmaniasis one can change the hours during which coffee is picked. Nonetheless, other problems suggest other aspects of the development of the disease in an agricultural environment as a whole, since problems related to agriculture are linked to the social models that govern our contemporary world.

Box 1.6. Medicinal herbs and plants in the Caribbean

The Caribbean is habitat for 2.3% (7,000) of all endemic plants worldwide, and 2.9% (779) of the vertebrate species of the world, even though it accounts for only 0.15% of the earth's land mass. This makes the Caribbean deserving of being classified as one of the most important "hotspots" in the world (Myers, et al. 2000). In 1988 Norman Myer defined a hotspot as a region of the earth characterized by exceptional levels of endemic species: A hotspot should be habitat for at least 1,500 species of vascular plants (the Caribbean has at least 2.3% = 7,000 plants), which represent 0.5% of the total of endemic plants in the world (as of 2000). Another characteristic of a hotspot is having lost at least 70% of its original endemic species, which is also considered a requirement that the Caribbean meets, for the region has seen major deforestation, soil erosion, and water pollution, taking with it vast natural resources above 70%. In countries such as Haiti and the Dominican Republic, only 5% and 17%, respectively, of their cover, remains.

This natural wealth of the Caribbean has not been economically exploited, even though one sees a trend towards the popularization of the medicinal herbs and plants business, reflected in the number of products available on the shelves of pharmacies, natural products and health stores, aromatherapy establishments, and supermarkets **(**Denzil Phillips International, http://www.denzil.com/).

For the time being, the Caribbean is known primarily for a small number of products derived from medicinal and aromatic herbs, despite the abundance of species. The range of products includes teas, exotic drinks made of herbs, traditional herbal remedies, nutraceutics, phytomedicines, essential oils, plant extracts such as cosmetics, condiments, tinctures, and liquid extracts, and functional foods. Among the best known products are pepper, nutmegs, and chili peppers. Progress has also been made adding value, with the efforts of some companies to produce recognized products such as Angostura, Pickapeppa Sauce, Busha Browne's, and Walkerswood.

Nonetheless, it is reasonable to argue that the biggest beneficiaries of the wealth from Caribbean spices are the companies that import dry herbs from the region in markets such as Europe, the United States, and Japan. Some 85% of the herbs are exported as dry herbs. The global market for herbs is estimated at US$ 12 billion, with the trade in raw extracts coming to US$ 8 billion. The business in Caribbean spices includes about 90 firms.

The 25 hotspots of the world
Source: NATURE | VOL. 403 | 24 FEBRUARY 2000 | www.nature.com

Box 1.7. Transgenic Soy in Argentina

Argentina is the second leading producer of transgenic crops, with 18 million hectares planted. This represents more than 5.5% of Argentina's area, larger than all of Nicaragua. One cannot separate the development of transgenics in Argentina from the expansion of the soybean crop. Today Argentina plants 15 million hectares of transgenic soybean, mainly Roundup® resistant (RR), producing 38.3 million tons (Altieri and Pengue, 2005). The low cost of the herbicide, the possibility of retaining and reusing the seed, the lower consumption of energy, the simplicity of the methods of application, and a major publicity campaign made this technological package attractive to many producers (Trigo and Cap, 2003; Qaim and Traxler, 2005; Souza, 2004). It is estimated that from 1996 to 2001, the technology of RR soybean generated profits of US$ 5.2 billion, 80% of it captured by the producers and the rest by the supplier corporations (Trigo et al., 2002). In 2002, soybean accounted for 20% of Argentina's export revenues.

This technology has caused major changes in the environment and in Argentina society. The economic benefits have been accompanied by social changes such as migration, concentration of landholdings and agribusinesses, and the loss of food sovereignty (Altieri and Pengue, 2005; Souza, 2004; Pengue, 2005). For example, at the same time as the production area of RR soybean tripled, some 60,000 units engaged in the production of food crops were abandoned. The replacement of traditional activities such as cattle-raising, vegetable production, fruit production, dairy production, and production of other cereal grains (maize and wheat) by the soybean crop is resulting in a lower supply of these products in the market, with the consequent rise in prices and less access for the more economically vulnerable sectors (Alteri and Pengue, 2005; Souza, 2004). From 1998 to 2002, 25% of the country's farms were lost, most of them small producers (Altieri and Pengue, 2005, 2006). From 1992 to 1999 the number of farms in the Pampas was reduced from 170,000 to 116,000, while the average size of a farm increased from 243 to 538 hectares in 2003 (Pengue, 2005).

Transgenic soybean has had environmental benefits related to the practice of zero-tillage (Trigo and Cap, 2003; Qaim and Traxler, 2005). Nonetheless, these effects are overshadowed by the dramatic increase in the use of herbicides (mainly glyphosate) (Trigo and Cap, 2003) (Figure 1); the appearance of glyphosate-tolerant weeds (Papa, 2000); the increase in the use of synthetic fertilizers; the depletion of soil nutrients; the degradation of the soil structure; and the loss of habitat and biodiversity (Altieri and Pengue, 2005; Pengue, 2005). The expansion of this model has even occurred on non-farm lands, not only in the Pampas but also in susceptible and high-biodiversity ecoregions such as the Yungas, the Gran Chaco, and the Mesopotamian Forest (Pengue, 2005). Since the introduction of transgenic soybean, 5.3 million hectares of non-farm lands have been converted to soybean production, and the rate of conversion of forest to agriculture is three to six times the global average (Jason, 2004).

Glyphosate, the active ingredient in Roundup ®, is a broad-spectrum herbicide classified as low (category IV) or medium (category III) toxicity. Nonetheless, there is ample evidence that glyphosate is not innocuous, as was once thought (Table). Most toxicological studies are done exclusively with the active ingredient (i.e. glyphosate) and not with the commercial formulations that contain the so-called inert ingredients. Roundup® contains glyphosate and the surfactant polyoxy-ethyleneamine, or POEA, which is three times more toxic than glyphosate alone (USEPA, 2002).

On the whole, transgenic soybean has been an economic success in Argentina. Nonetheless, it has not helped meet the goals of reducing hunger, poverty, or inequality, nor has it helped increase sustainability in Argentina.

Table Studies that show negative effects of glyphosate or Roundup ®

- High degree of morality in amphibians (Relyea, 2005 a,b).
- Reduction in the wealth of aquatic species, including fish (Henry et al., 1994; Wan et al., 1985; WHO, 1994).
- Direct and indirect negative effects on beneficial soil organisms (spiders, earthworms, and others) (Asteraky et al., 1992; Burst, 1990; Hassan et al., 1988; Mohamed, 1992; Springert and Gray, 1992).
- Toxicity in nitrogen-fixing bacteria, mycorrhizal fungi, and actinomycetes (all important in recycling nutrients and other ecological soil processes) (Carlisle and Trevors, 1998; Chakravarty and Chatarpaul, 1990; Estok et al., 1998).
- Stimulating effect on populations of the pathogenic fungus *Fusarium*, including *Fusarium graminearum*, which affects soybean (Levesque et al., 1987; Hanson and Fernández, 2003; Fernández et al., 2005; Sanogo, 2000).
- Synergetic effect when combined with other pesticides (Relyea, 2003).

- May accelerate the process of eutrophication of bodies of water, since it acts as a source of phosphorus (Austin et al., 1991).

Box 1.9. Biopharmaceutical Crops and Possible Impacts in Mexico, Center of Origin of Maize

Biopharmaceutical crops are plants that have been genetically modified to express substances with therapeutic properties, for example viral proteins for vaccines, hormones, or antibodies (Gomez 2001, Ellstrand 2003, Ma 2003). The first recombinant pharmaceutical proteins derived from plants were the human growth hormone expressed in tobacco in 1986 (Barta et al*.* 1986) and the human seroalbumin also from that crop, and in potato crops in 1990 (Ma et al. 2005). Twenty years later, the first drugs produced in transgenic plants are already being marketed. Although some developments use cell cultures from plants, insects, animals, or microorganisms to express these molecules, others use complete plants of rice, tobacco, and maize, in confined or open field crops, the latter promising lower costs. Over time, the technology has improved considerably, contributing to improve the economic feasibility of this application (Ko and Koprowski, 2005; Stewart and Knight, .2005). Of all these systems, expression in seeds has turned out to be of enormous utility for accumulating proteins in a relatively small volume; they do not degrade because the endosperm conserves the proteins without any need for low temperatures, which is a great advantage for the production, for example, of oral vaccines (Han, et al. 2006). Among cereals, maize along with rice and barley are interesting alternatives; but maize has a greater annual yield, moderately high protein content in the seed, and a shorter crop cycle, which gives it greater potential protein yield per hectare overall (Stoger et al., 2005). Though the developers recognize that maize has the disadvantage of being a cross-pollinating plant, no other cereal grain reaches its yield (Stoger et al., 2005), which makes it the most used system of expression, and it holds more than 70% of the permits issued by APHIS from 1991 to 2004 (Elbeheri, 2005). There are more than 20 firms in the United States, Canada, and Europe specialized in these production platforms (Huot, 2003; Colorado Institute of Public Policy, 2004). Its costs are much lower than those of microbial systems (Elbeheri, 2005). These economic criteria and technical feasibility combined with the perception of maize as an industrial raw material have resulted in it being the most widely used biopharmaceutical crop. Nonetheless, these criteria do not consider the potential risks for millions of people who have a maize-based diet. What might these risks be? The first is that the grains that contain the compound may pass into the food production chain in industrial operations, because from just looking at them it is impossible to distinguish them, and they could become mixed inadvertently. Careless handling in industrial processing cannot be discarded because it has already happened with Starlink maize in 2000, and with rice (USDA, 2006), although they are not biopharmaceuticals. This has happened in the United States, where the rules on biosafety are well-established, though they are not necessarily implemented adequately (USDA, 2005). This contamination may have a potential negative effect in the populations that consume these grains: in Mexico per capita maize consumptions varies from 285g to 480g daily, and is the source of as much as 40% of proteins, given its low cost (Bourges, 2002: 97-134; FAO, 2006). The potential effect may be disastrous if added to the second great risk, the risk of genetic flow. This is not a physical mix of grains, but rather the release of a pharmaceutical transgene that is inherited in the offspring, where it can endure for several generations in an open seed exchange system as one finds in Mexico (Cleveland and Soleri, 2005). The potential dangers of exposure to recombinant compounds by this means would affect practically the entire population of Mexico, with a greater possibility in the segment that produces maize for subsistence or on a semi-commercial basis. The genetic contamination of maize may be devastating in Mexico since it is one of the centers of genetic diversification of this crop, and its culture is closely bound up with this crop. Using maize for the production of pharmaceuticals and non-edible industrial products, which also pose health hazards, is the result of a series of decision in which Mexicans do not participate but which may directly affect them: these are decisions that have been made by companies and policy-makers in the more technologically developed countries where lobbying has led to prohibitions on developments in animals because public opinion – which in these countries is often the driving force behind regulatory changes – considers them more similar to humans, though containing them is easier (NAS, 2002), and they have been used for a long time to produce vaccines and serums, antibodies, etc. This situation, among other things, has accorded priority to production in plants worldwide, which is also cheaper. The consortia and their experts argue that there are no appreciable or verifiable risks in these crops. Nonetheless, even if the risks are low, which is debatable, if the food chain is contaminated with pharmaceutical maize grains, the food supply of 100 million Mexicans would be tainted. If maize in Mexico is contaminated by genetic flow, it would not be easy to eliminate, and it would affect 60% of the non-commercial and commercial productive units in the country, i.e. production for family consumption in Mexico, which uses 33% of the area planted in maize, and produces 37% of domestic maize production (Nadal, 2000; Brush and Chauvet, 2004). This would directly affect the safety of the food base of millions of Mexicans, not to mention the impact on megadiversity in a center of origin. Although there are methods of biological containment of trangenes such as the transformation of chloroplasts, which are inherited from the mother plant (Daniell et al., 2005), inducing the expression with substances that must be added to the crop (Han et al., 2006), and other systems of genetic containment (Mascia and Flavell, 2004), no containment system is infallible. In a case such as this, where there are possibilities of contamination, and where the consequences would be disastrous for millions of human beings, one should apply the precautionary principle.

If there is contamination, what would the potential effect be on human health?

- Plants and animals process proteins in different ways. Biopharmaceuticals may be perceived by the human body as foreign substances and cause allergic reactions, including a potentially deadly anaphylactic shock.
- Growth factors such as erythropoietin are active in concentrations of one billionth of a gram when injected, and could cause harm if inhaled, ingested, or absorbed through the skin.
- The chemical/insecticide avidin causes vitamin deficiency and coagulation of blood, aprotin may cause diseases of the pancreas in animals and probably in humans. These two chemicals are produced in transgenic maize cultivated in open fields.
- Industrial enzymes that are produced in transgenic maize (trypsin and antitrypsin) are allergens.

Can biopharmaceuticals affect the environment?

- Apritinin and other enzymes that inhibit digestion shorten the life of honeybees, while avidin directly kills or has a chronic effect on 26 insect species.
- There is no way to prevent wildlife from consuming these crops that contain high concentrations of biopharmaceuticals.
- These substances have not been tested for effects in the macroorganisms and microorganisms of the soil, although it is known that other proteins in transgenic crops leach from the roots and persist in the soil for months.

Box 1.10. Integration of the soybean food chain in Latin America: From the producers to the consumers

Only a small fraction of the soybean is consumed directly as food for humans; the rest is processed mainly to produce oil for the food industry and as high-protein tablets for animal feed.

In Brazil, it is estimated that the soybean crop employs one million persons directly and that the soybean industrial complex employs some five million people.

In the 1980s soybean production shifted from the south and southeastern regions, with small and medium producers (average 30 hectares) to the region of Mato Grosso and Goiás, including the *cerrado* region, with an average farm size of 1,000 hectares.

A single company, Andre Maggi, has 150,000 hectares and produces one million tons of soybean per year. The consequence of this concentration in farm size has led to an increase in rural unemployment and food insecurity, spurring migration to the cities.

The soybean market is characterized by a high degree of integration, as large corporations control the production, processing, and marketing, in both exporting and importing countries (see Figure).

The four corporations that dominate soybean market, Bunge, ADM, Cargill, and Dreyfus, also process soybeans. Cargill claims to be the largest company worldwide engaged in the extraction of soybean oil. Cargill is also the largest exporter of vegetable oil and soy protein in Argentina. Dreyfus is the third leading company in terms of volume that processes vegetable oil in South America, and is the owner of and operates the giant port on the Paraná river and the giant company General Lagos crushing plant.

Box 1.11. Trends in Organic Agriculture in Latin America and the Caribbean

Organic agriculture has seen enormous growth in the last 10 years in Latin America and the Caribbean, geared mainly to the export market and focused on just a few crops, mainly coffee and bananas in Central America and the Andean region, sugar in Paraguay, and cereal grains and meat in Argentina and Uruguay. Other products are certified at low levels, such as fruits, vegetables, aromatic and medicinal herbs, and apiculture. Today there are 5.8 million hectares certified organic, and almost all the countries of the region have an organic sector, though the development of this sector has been mixed. The countries with the largest areas certified are Argentina (54%), Brazil (15%), Uruguay (13%), Bolivia (6%), and Mexico (5%). The largest share of the almost 3.9 million hectares certified in Argentina and Uruguay are lands used for extensive grazing.

Areas in organic production in Latin America and the Caribbean.

In general the organic movement in LAC has grown by its own efforts and with very little government support. With the exception of Cuba, no government provides direct subsidies or economic aid for organic production. Nonetheless, in some countries the state is supporting the organic sector in several ways. For example:

- Brazil – the government announced the interagency Plan Pro Orgánico, providing incentives for research on organic production, forming associations, and stimulating the market for organic products.
- Costa Rica – government funds for research and teaching in organic production.
- Argentina and Chile – The government export agencies support the organic producers' participation in international shows and print catalogs of organic products.
- Mexico – There is growing interest on the part of government agencies.

Box 1.12 Sustainable Agriculture and Food Security in Cuba: Lessons for the Rest of Latin America and the Caribbean

In 1989-1990, the collapse of trade relations between Cuba and the Soviet bloc plunged this small Caribbean nation into an economic and food crisis. Today Cuba has succeeded in overcoming that crisis and its experience illustrates that it is possible to feed a nation with a model based on small and medium producers, and ecological technology with low external inputs.

The Cuban agricultural system was based on the conventional/productivist model of agriculture, highly dependent on external inputs (chemical fertilizers, pesticides, oil, machinery, etc.), as well as large and inefficient state farms. With the change in the favorable terms of trade Cuba had enjoyed with the other socialist countries, there was an almost immediate 53 percent reduction in oil imports, a 50 percent reduction in imports of wheat and other cereal grains for human and animal consumption, and an 80 percent reduction in fertilizer and pesticide imports.

Suddenly, a country with high levels of inputs in its agricultural sector was submerged in a food crisis. It is estimated that as of the early 1990s, the daily average consumption of calories and proteins of the Cuban population had fallen to levels 30 percent below those of the 1980s.

Fortunately, for years Cuba had invested in the development of its human resources and had a highly educated population, as well as scientists and researchers who were mobilized to provide alternatives for the country's agricultural production and food security. The alternative model adopted rests on four pillars:

- ***Agroecological technology and diversification instead of chemical inputs and homogenization***. Among the practices successfully used are:

Diversification of production and of the farm, by intercalated crops, associated crops, multicropping, and agroforestry.

Biopesticides (microbial products), locally produced natural enemies, and multicropping to control pests; resistant varieties, crop rotation, and microbial antagonists to control pathogens; rotation and cover (living or dead) for weed management.

Biofertilizers (e.g. *Azotobacter*, *Azosprillum*), increase in populations of mycorrhyzogenic fungi, use of microorganisms that make phosphorus soluble, manure, compost, and earthworm humus, green fertilizers, natural zeolites, and minimum tillage for agroecological soil management.

Integration of stock-raising and crop-farming for better use of the energy byproducts generated by both sectors.

Use of draft animals to replace tractors, which use fossil fuels.

- ***Fair prices for farmers.*** Cuban farmers increased production in response to the high prices farm products fetch. Through other programs and policies to bolster food security, the government is seeing to it that the population in general, and the urban population in particular, has access to food despite the high prices.

- ***Redistribution of the land.*** The main redistribution of land in Cuba consisted of dividing up large state properties into smaller units. The arable area in the hands of the state dropped from more than 75 percent in 1992 to less than 33 percent in 1996. The small farmers and urban horticulturalists have been the most productive of all the Cuban producers under low-input conditions.

- ***Major emphasis on local production, including urban agriculture.*** The food produced locally and regionally offers greater food security, since the population does not depend on the caprices of prices in the world economy, transportation over long distances, or the good will of other countries. Production is also more energy-efficient since so much energy is no longer consumed in transportation. Finally, in Cuba, urban and peri-urban agriculture has been an important component of the strategy of supporting local food production.

Cuba's situation is very particular and it cannot be indiscriminately applied to other countries. Nonetheless, Cuba offers us a specific example of a country that was able to transform its agriculture towards a more sustainable agriculture. The most important lesson of this example is that agroecological practices, along with fair prices for producers, agrarian reform, and local production, including urban agriculture, can make a significant contribution to food security and to improving the standard of living of both urban and rural small producers.