Agroecologically efficient farming systems for resilience and food sovereignty

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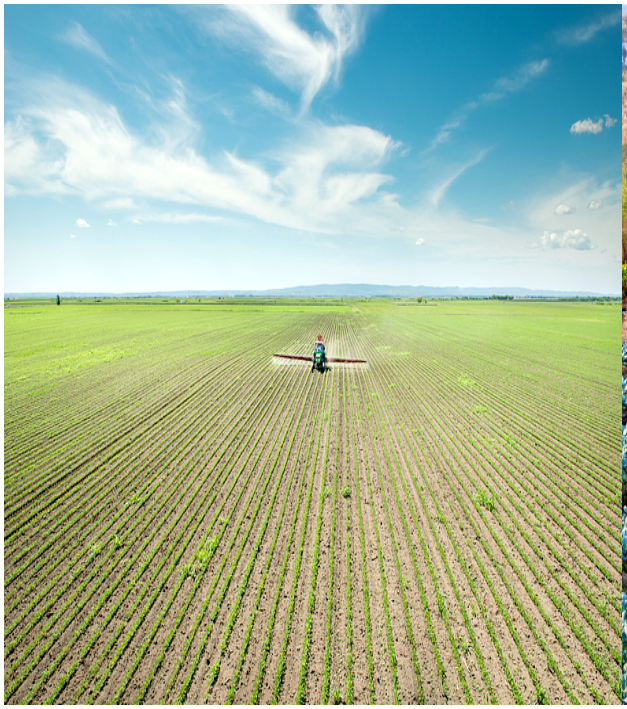
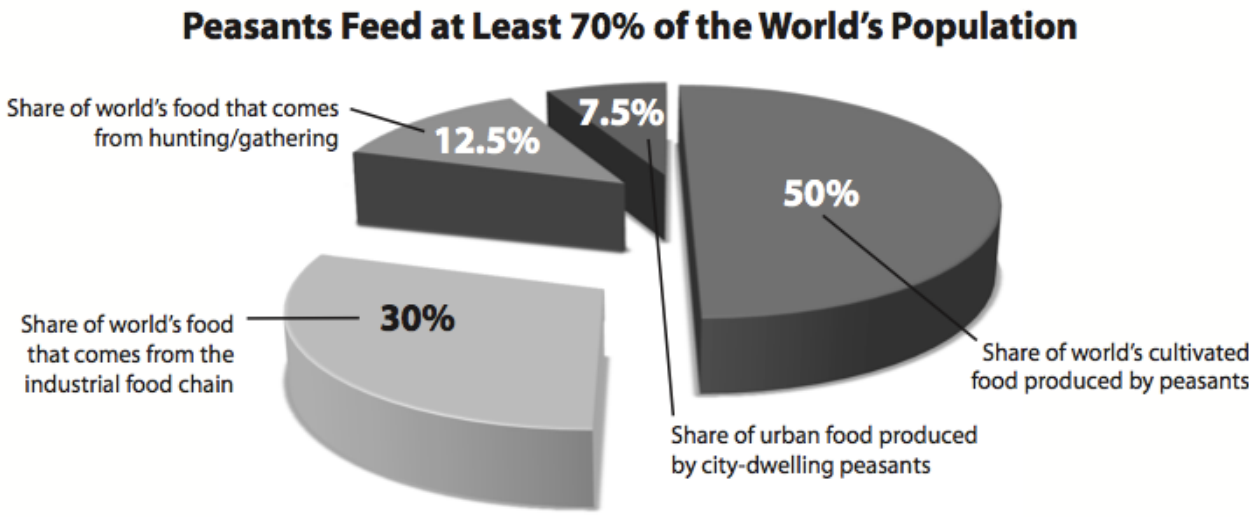
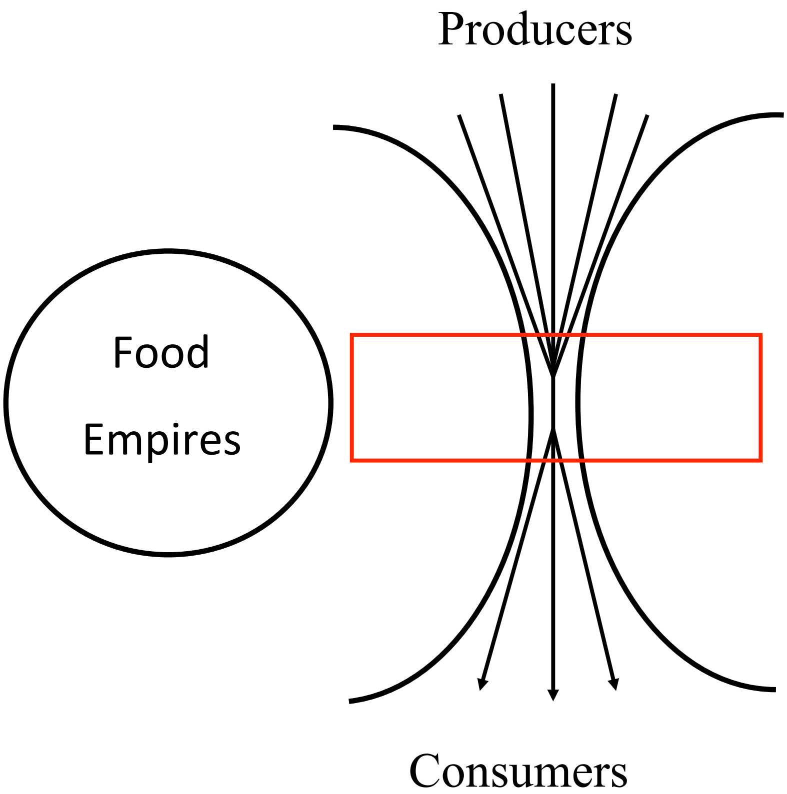
CLASH OF PARADIGMS
Peasant agriculture (Agroecology) vs Industrial agriculture (Green Revolution)



Who feeds us today???

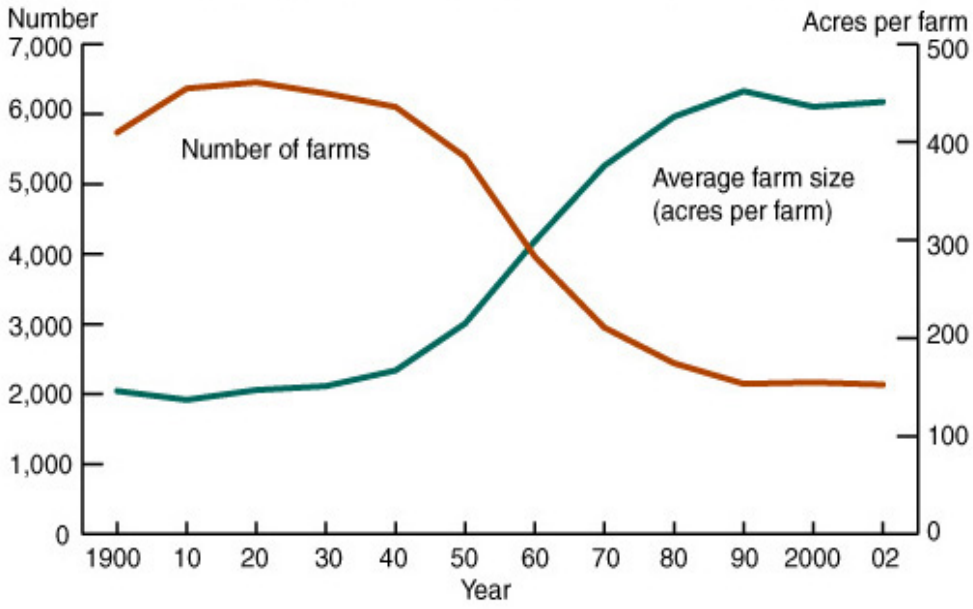


80% of 1.5 billion has under monocultures

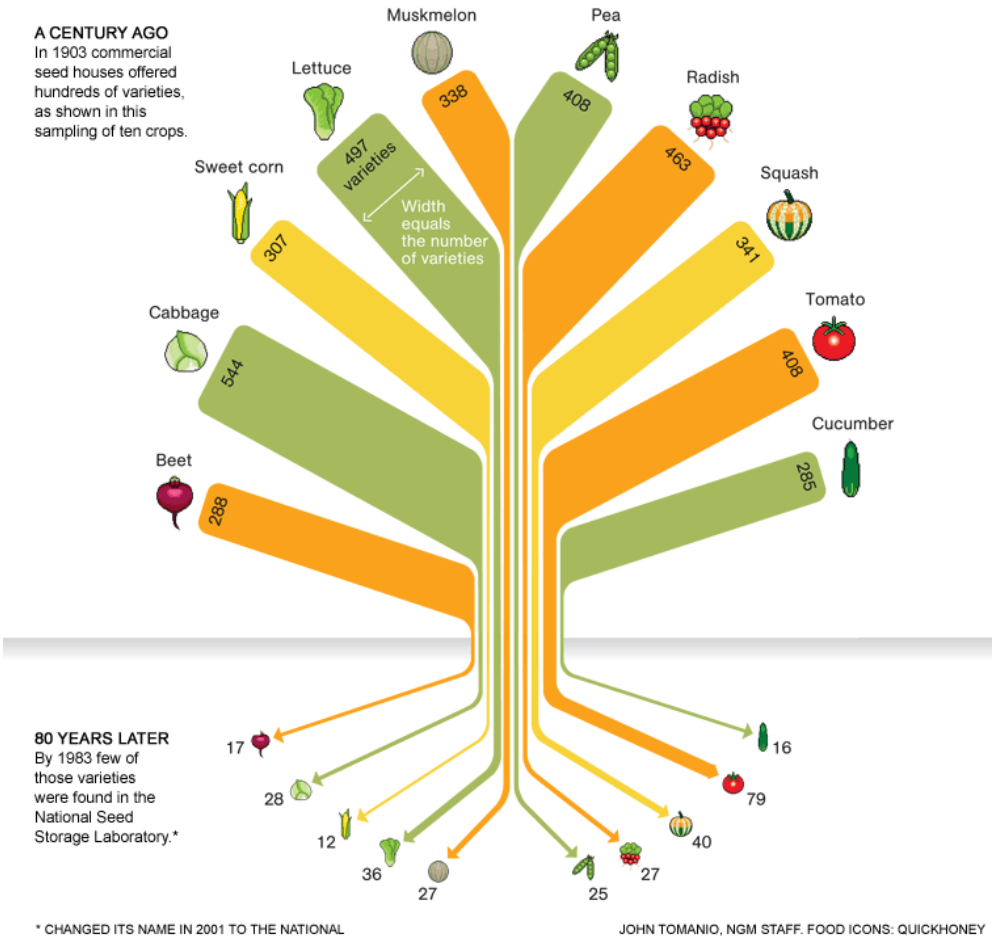

Producers
Food
Empires
Consumers


KRAFT
Coca-Cola
PEPSICO
Kellogg's
MARS
Nestlé
P&G
Johnson & Johnson
Unilever

As the number of farms declined, their average size increased



Source: Compiled by Economic Research Service, USDA, using data from *Census of Agriculture, Census of Population*, and *Census of the United States.*



* CHANGED ITS NAME IN 2001 TO THE NATIONAL

JOHN TOMANIO, NGM STAFF. FOOD ICONS: QUICKHONEY

GENETIC HOMEGENEITY=HIGH VULNERABILITY

TABLE 3 CROP FAILURES DUE TO GENETIC UNIFORMITY

Date	Location	Crop	Effects	Source
1846	Ireland	potato	potato famine	Hoyt, 1988
1800s	Sri Lanka	coffee	farms destroyed	Rhoades, 1991
1943	India	rice	Great Famine	Hoyt, 1988
1960s	United States	wheat	rust epidemic	Oldfield, 1984
1970	United States	maize	$1 billion loss	NAS, 1972
1970	Philippines and Indonesia	rice	tungo virus epidemic	Hoyt, 1988
1974	Indonesia	rice	3 million tons destroyed	Hoyt, 1988
1984	United States (Florida)	citrus	18 million trees destroyed	Rhoades, 1991

Source: World Conservation Monitoring Centre et al. 1992. *Global Biodiversity: Status of the Earth's Living Resources*. Brian Groombridge, ed. Chapman & Hall, London.

Genetic Uniformity and Vulnerability

- How uniform genetically are crops
  upon which the nation depends, and how vulnerable, therefore, are they to epidemics and climatic variability?
- The answer is that most major crops are impressively uniform genetically and impressively vulnerable.
- This uniformity derives from powerful economic interests and legislative forces shaped by those holding corporate power

US CORN LEAF EPIDEMIC IN USA, 1970

- Resulted in a decrease of the maize crop from 119,056,000 tonnes in 1969 to 105,471,000 tonnes in 1970(FAOSTAT).
- The actual yield in 1970 was 45,439 hg/ha, considerably less than in 1971 (55,297 hg/ha).
- With 23,211,600 ha sown in 1970, the projected production was 126,289,673 tonnes resulting in an actual shortfall of 20,818,673 tonnes from expected.
- The loss was equivalent to 18.5 trillion calories.

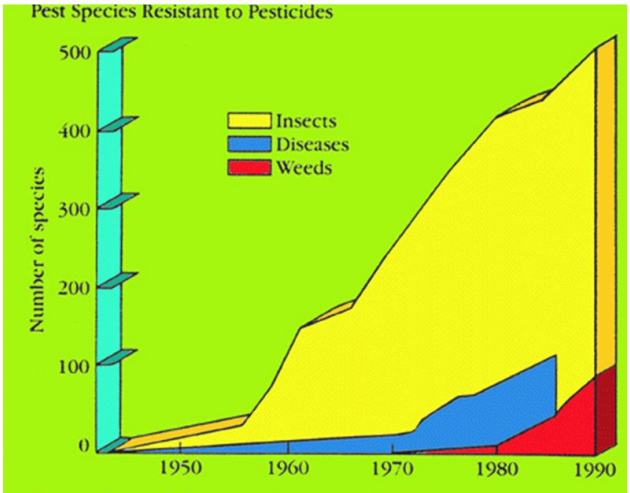
The addiction to pesticides

- **1,2 billion pounds of pesticides are applied annually in the USA.**
- **US spent US $34.1 billion dollars in pesticide use in 1998**

The futile chemical warfare against pests

- US agricultural losses to pests reached 32% between 1942-50 and 37% between 1984- 1990

- More than 450 species of arthropods resistant to > 1000 different pesticides



Source: George P. Georgton, University of California, Riverside, 1990.

Figure 18.4 *This graph shows the number of species of insects, disease organisms, and weeds that are resistant to at least one pesticide.*

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US CORN LEAF EPIDEMIC IN USA, 1970

- Resulted in a decrease of the maize crop from 119,056,000 tonns in 1969 to 105,471,000 tonns in 1970, well below the 143,421,000 tonns produced in 1971 (FAOSTAT).
- The actual yield in 1970 was 45,439 hg/ha, considerably less than in 1969 (53,908 hg/ha) and in 1971 (55,297 hg/ha).
- With 23,211,600 ha sown in 1970, the projected production was 126,289,673 tonns resulting in an actual shortfall of 20,818,673 tonns from expected.
- The loss was equivalent to 18.5 trillion calories.

Genetic Uniformity and Vulnerability

- How uniform genetically are other crops upon which the nation depends, and how vulnerable, therefore, are they to epidemics and climatic variability?
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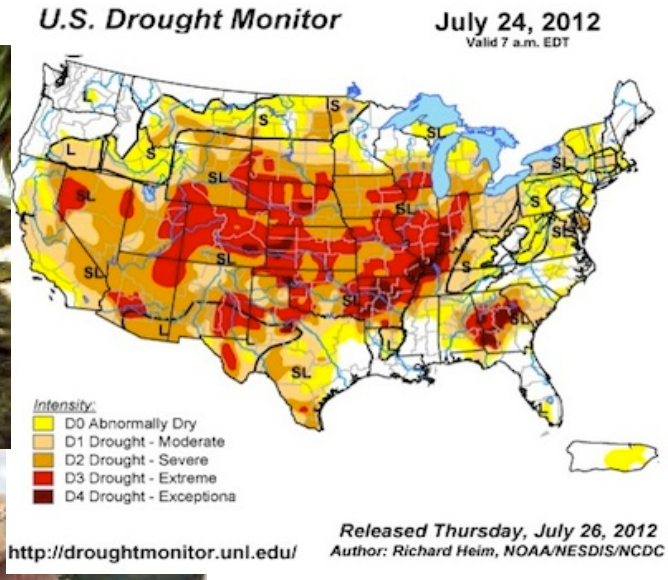
- This uniformity derives from powerful economic interests and legislative forces shaped by those holding corporate power



US drought 2012

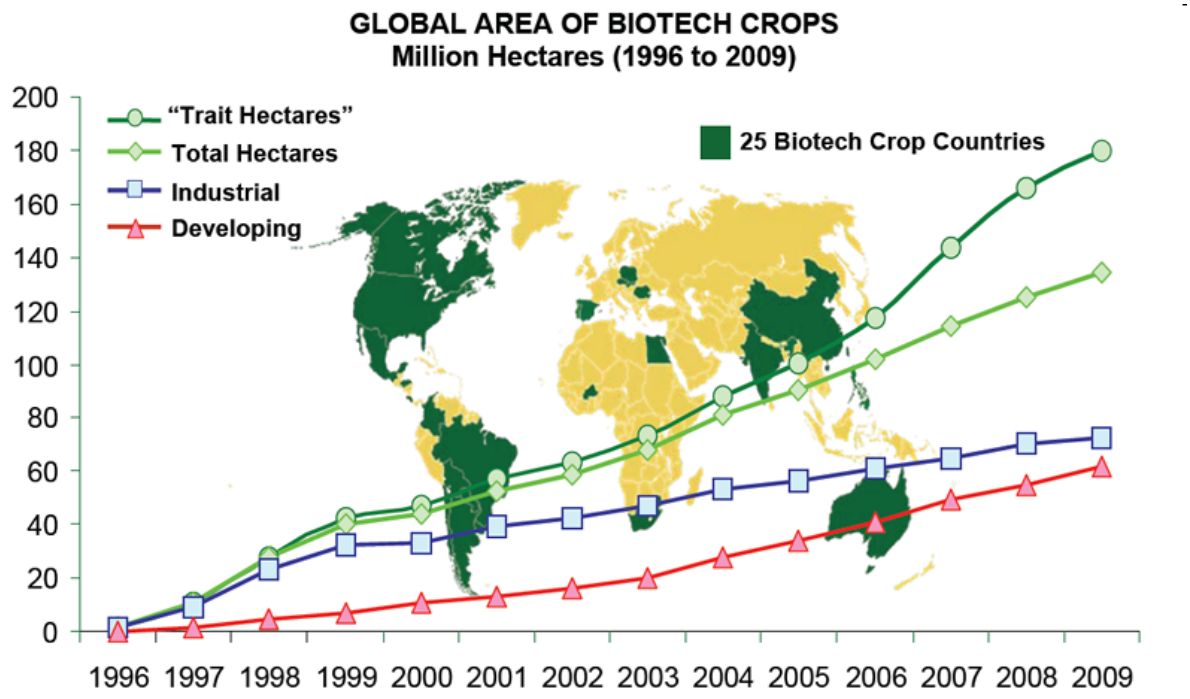
- The dry spell that hit the Midwest and Great Plains last summer was the worst since the 1950s. It covered 80 percent of U.S. farmland.
- Corn production dropped more than 13 percent in the 2012 growing season. Soybean production fell 8 percent
- The U.S. Department of Agriculture estimates that the drought will push retail food prices up by between 3% and 4% in 2013

Maize yields after recent droughts

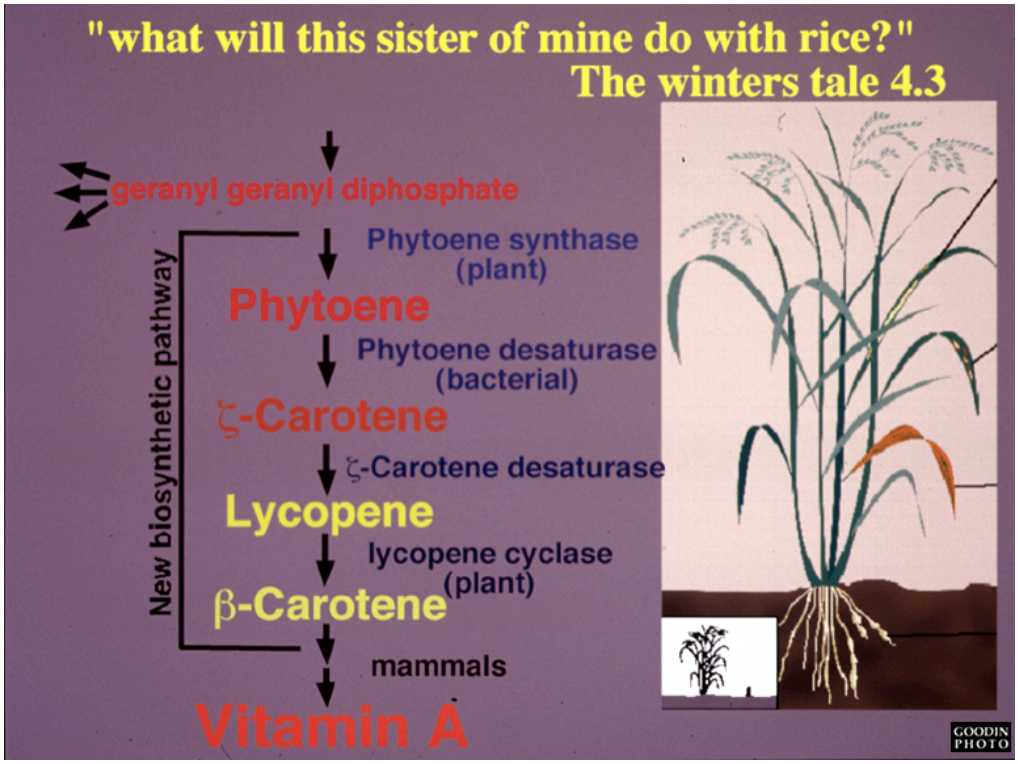
- Adverse high temperatures during maize pollination in 2010 in the United States caused a decline in yields from 2009 and the downward trend due to weather continued in 2011 to a level not seen since 2005
- By August 2012, the USDA projection was for a maize crop of 10.8 billion bushels and a yield of 123.4 bushels/acre (76,173 hg/ha USDA 2012e), the lowest since 1995 and a yield common in the 1980s (FAOSTAT).

Soybean and cotton yields under drought

- The projected 2012 US yield of 40.5 bushels/acre is the second lowest since 2003 (27,000 hg/ha).
- US cotton had its second lowest yield since 2003 at 785 lbs/acre (8800 hg/ha) USDA 2012d).



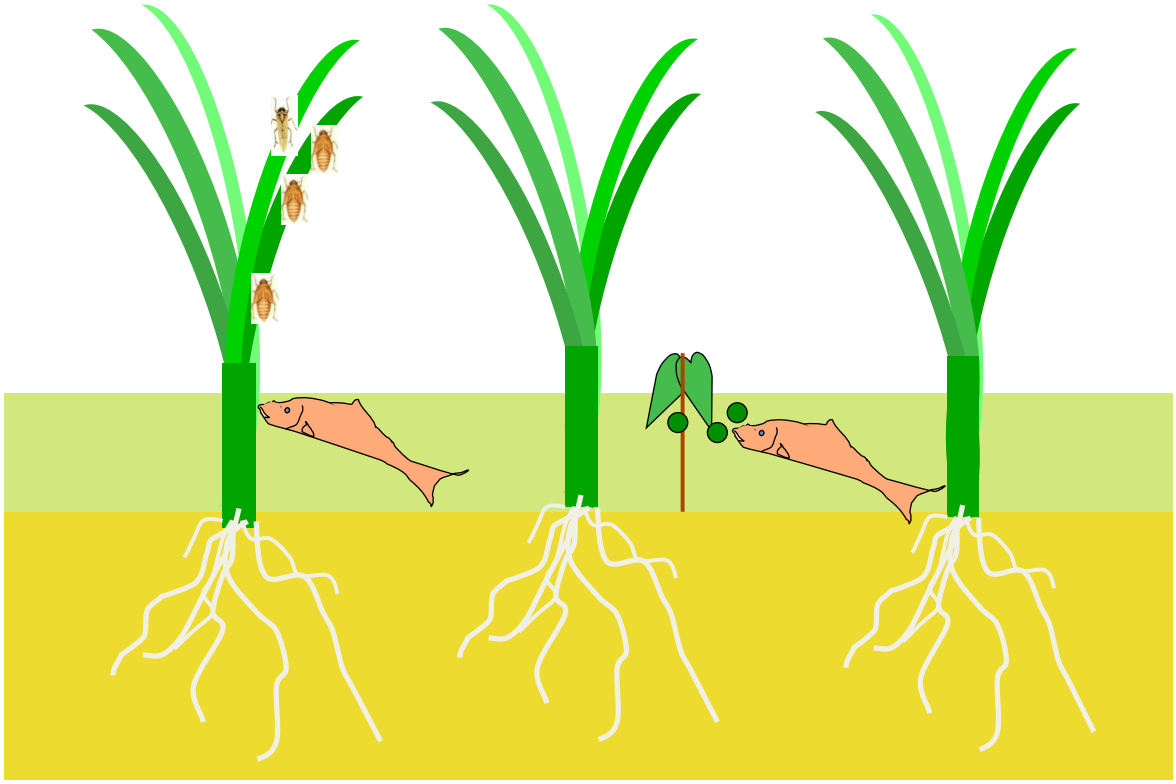
A record 14 million farmers, in 25 countries, planted 134 million hectares (330 million acres) in 2009, a sustained increase of 7% or 9 million hectares (22 million acres) over 2008.


"what will this sister of mine do with rice?"
The winters tale 4.3
geranyl geranyl diphosphate
Phytoene synthase (plant)
Phytoene
Phytoene desaturase (bacterial)
ζ-Carotene
ζ-Carotene desaturase
Lycopene
lycopene cyclase (plant)
β-Carotene
mammals
Vitamin A
New biosynthetic pathway
GOODIN PHOTO

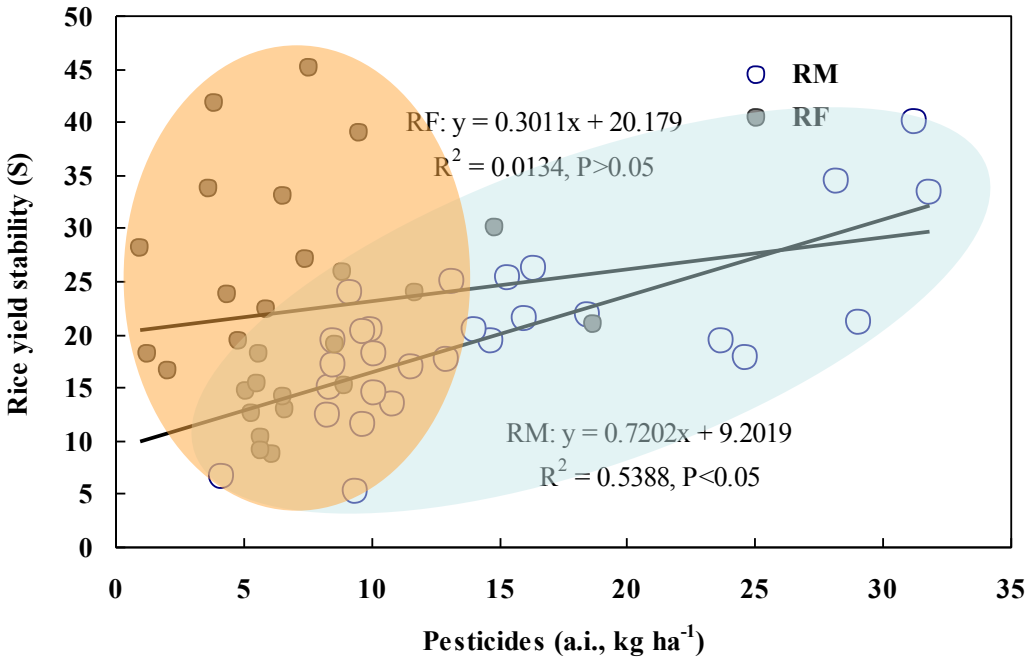
Examples of beta-carotene sources

Food source	beta-carotene [microgram per gram fresh weight]
Refined red palm oil (as used as vitamin A supplement)	92.8
Carrot, raw	46-125
Leafy vegetable (32 types)	10-444
Sweet potato (orange variety)	11.4
Cassava (yellowish)	up to 7.9
Mango	up to 6.15
Papaya, watermelon	2.28-3.24
Golden Rice (Ye et al. 2000)	1.6

China Rice Fish

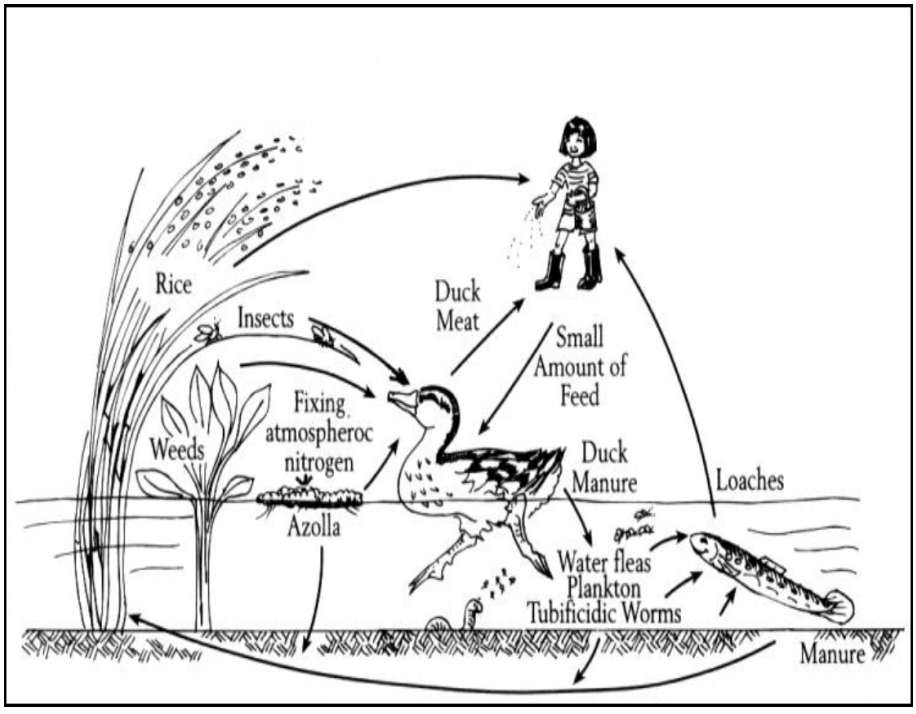


(1) The effects of RF system



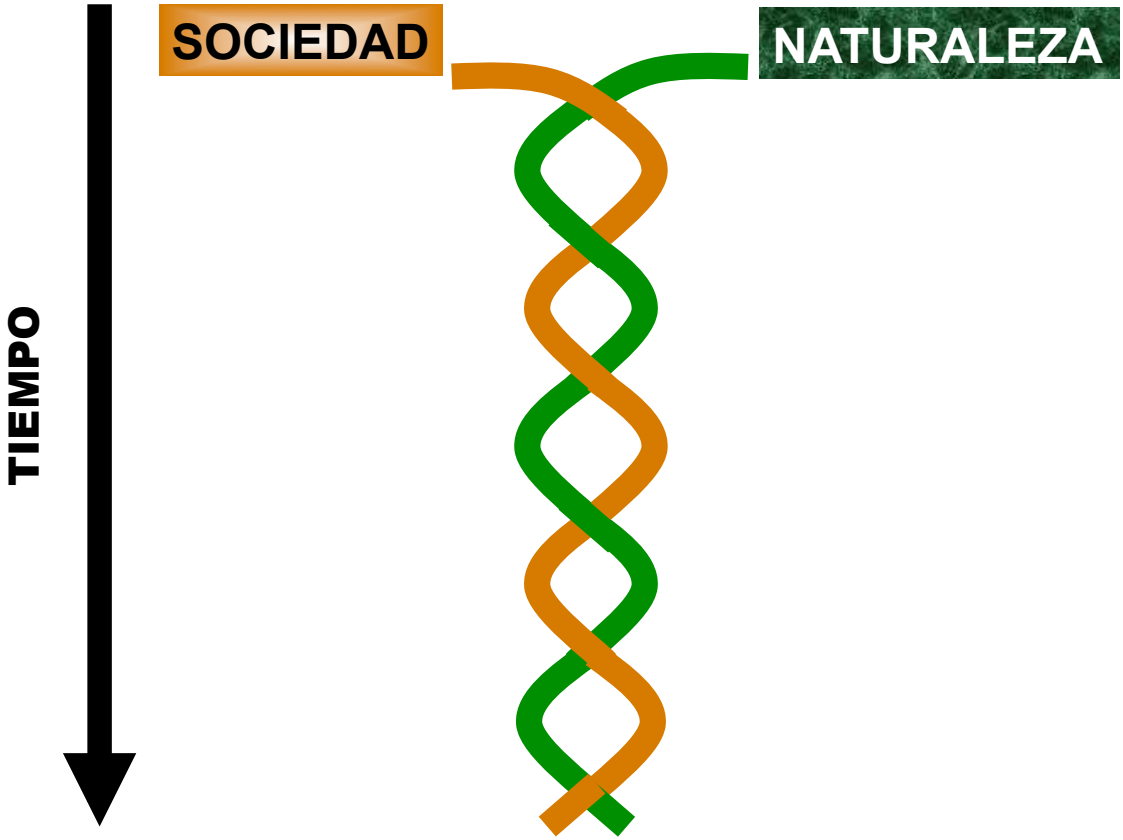
Prof. Chenxin from Zhejiang University has conduct her research in the site for 6 years from 2005.

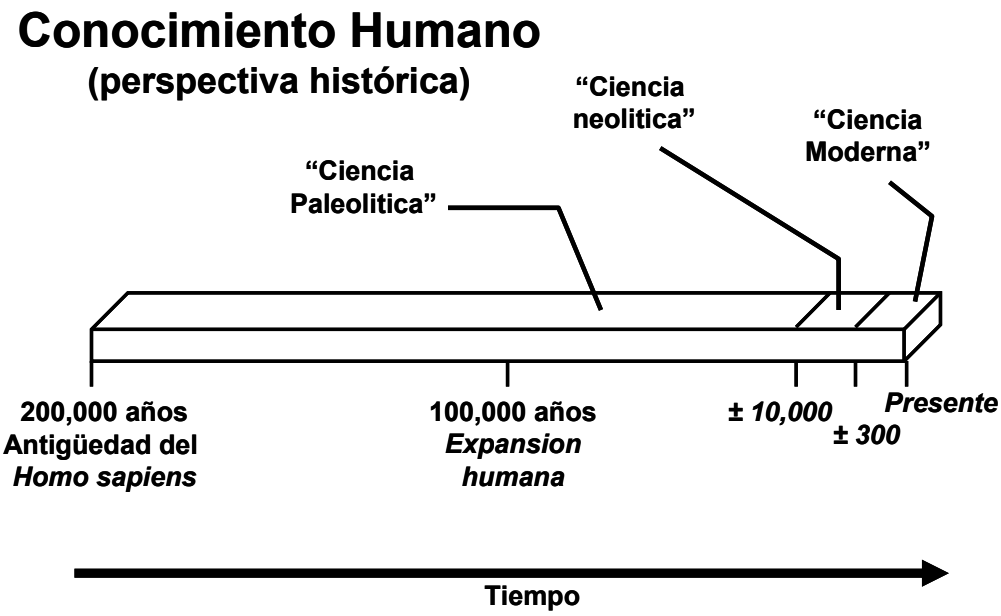
4. Rice-duke Co-culture System

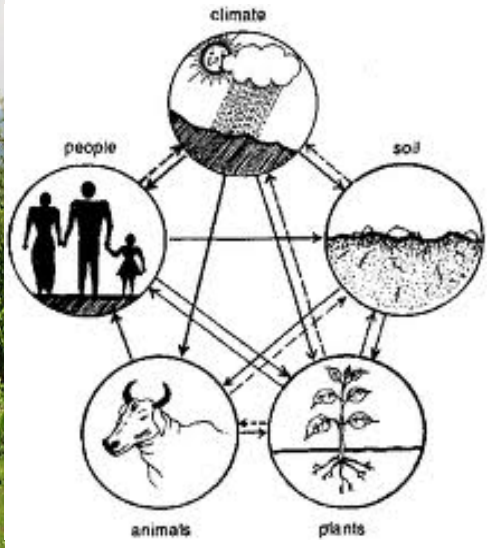


Features of an agriculture for the future

- De-coupled from fossil fuel dependence
- Agroecosystems of low environmental impact, nature friendly
- Resilient to climate change and other shocks
- Multifunctional (ecosystem, social, cultural and economic services)
- Foundation of local food systems


SOCIEDAD
NATURALEZA
TIEMPO


Conocimiento Humano
(perspectiva histórica)
"Ciencia neolitica"
"Ciencia Moderna"
"Ciencia Paleolitica"
200,000 años
Antigüedad del
Homo sapiens
100,000 años
Expansion
humana
± 10,000
± 300
Presente
Tiempo



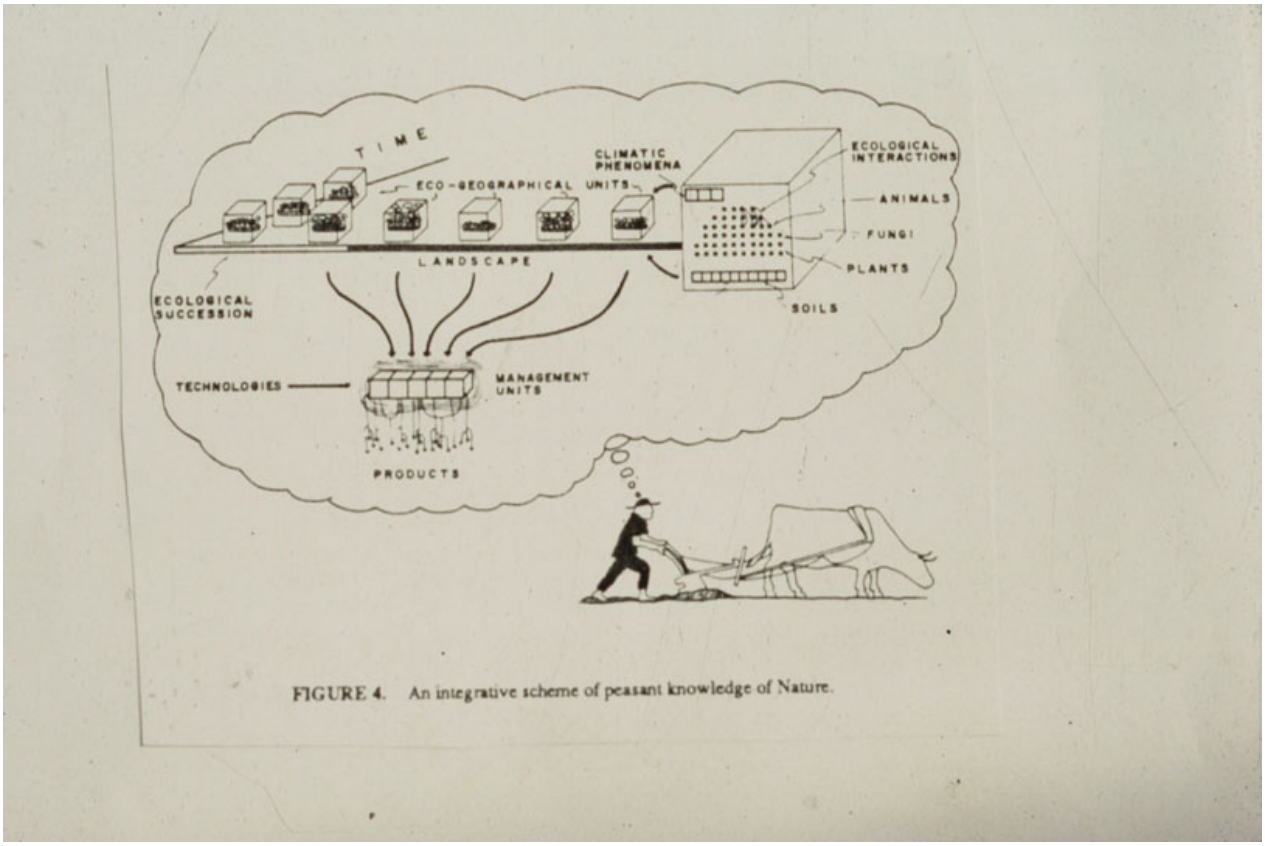


FIGURE 4. An integrative scheme of peasant knowledge of Nature.

	CULTURA	NÚMERO DE TAXA
PLANTAS	Ifugao	2131
	Hanunoo	1879
	Subanuna	1400
	Jörai	1182
	Tobelorese	1162
	Maya	908
	Aguaruna	866
	Huasteco	861
	Mende	844
	Taubuid	825
ANIMALS	Aguaruna	800
	Wayapi	737
	Ifugao	597
	Nuaula	584
	Futuna	534
	Tzeltal	492
	Kyaka enga	466
	Hanunoo	461
	Tobelorese	443

How many peasant farmers? (ETC 2009)

- 1, 5 billion peasant farmers
- 380 million farms
- Globally: > 90% of the world's farms are small , < 2 ha.
- 1.9 million crop varieties

Peasants and world food

Produce 50-75% of food consumed by world population, but use :

- **25- 30% of the agricultural land**
- **30% water used in agriculture**
- **20 % fossil fuels used in agriculture.**

a.

b.

F

Rotacion en la chinampa : flor de muerto y milpa

Milpa: polyculture of maize, beans and squash

LER > 1,5 …… 1,5 hectares of monoculture needed to equal productivity of one hectare of polyculture

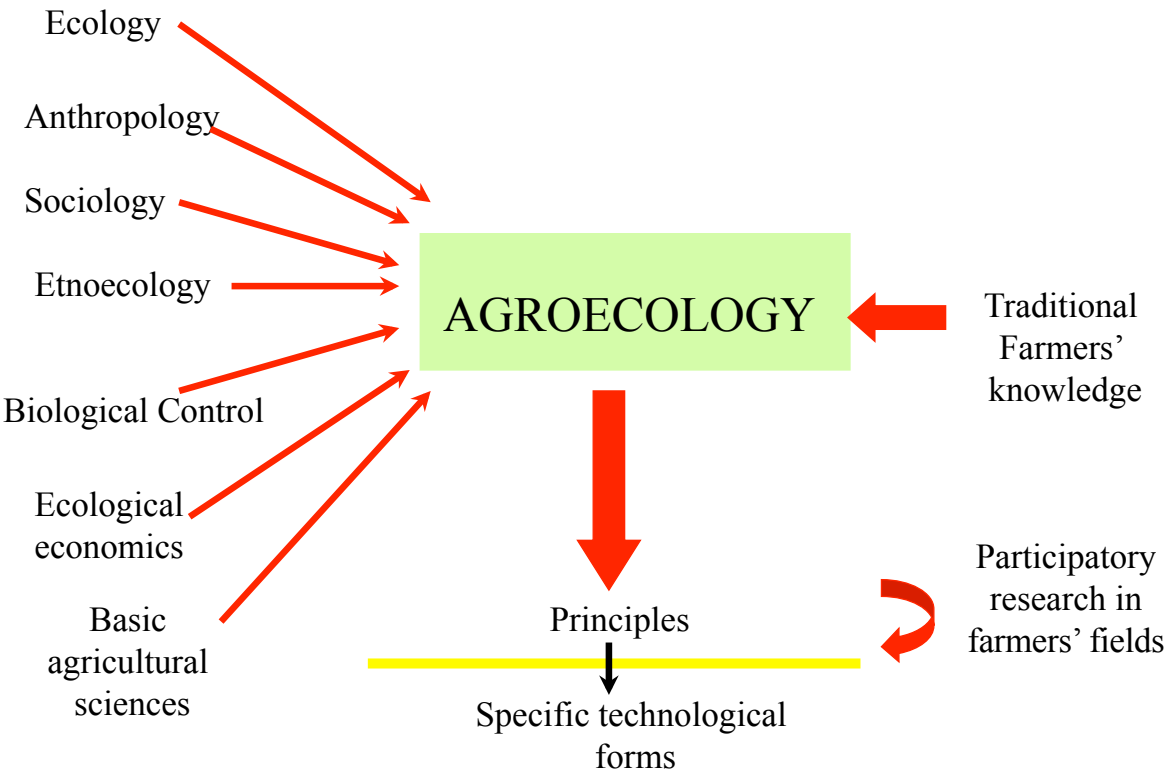
Productivity of Chinampas

- Maize yields in 1950: 3,5-6,3 t/ha (average US yields in 1955~2,3t/ha and went up >4 t/ha after 1965).
- One hectare could produce enough food for 15-20 persons
- One chinampero can successfully farm 0,75 ha, producing food for 12-15 people

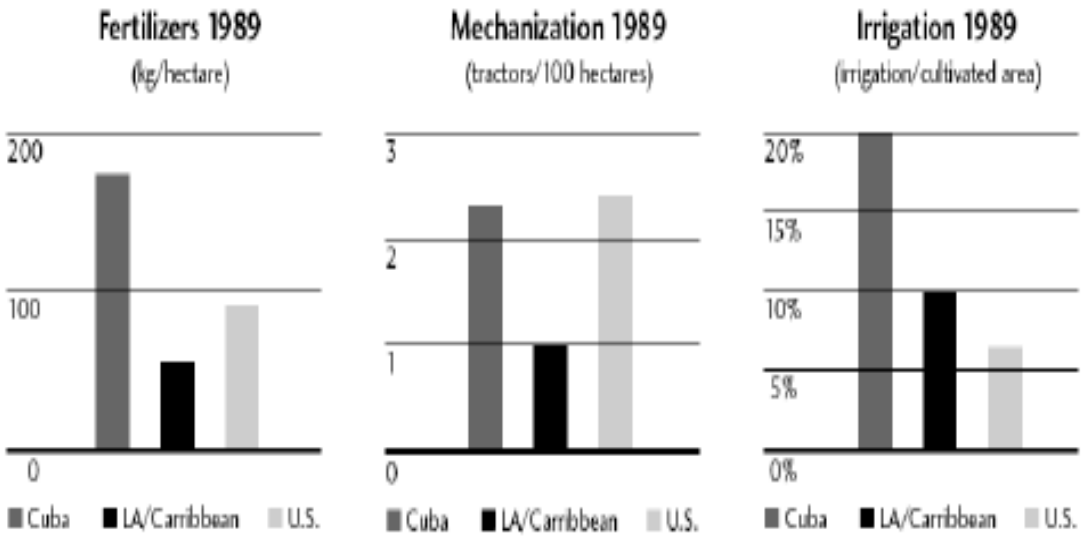
Weeds (quelites) as food crop

.

- San Bartolo del Llano, Ixtlahuaca, México.
- Quelites.
  - 74 quelite species all useful.
  - Used as food, fodder, medicinals, etc.
  - 4.5 kg quelite/family/month.
  - One hectare of milpa produces 1,5 t/ha of quelite and represents 25% of the total value of maize (approx 200 dollars).



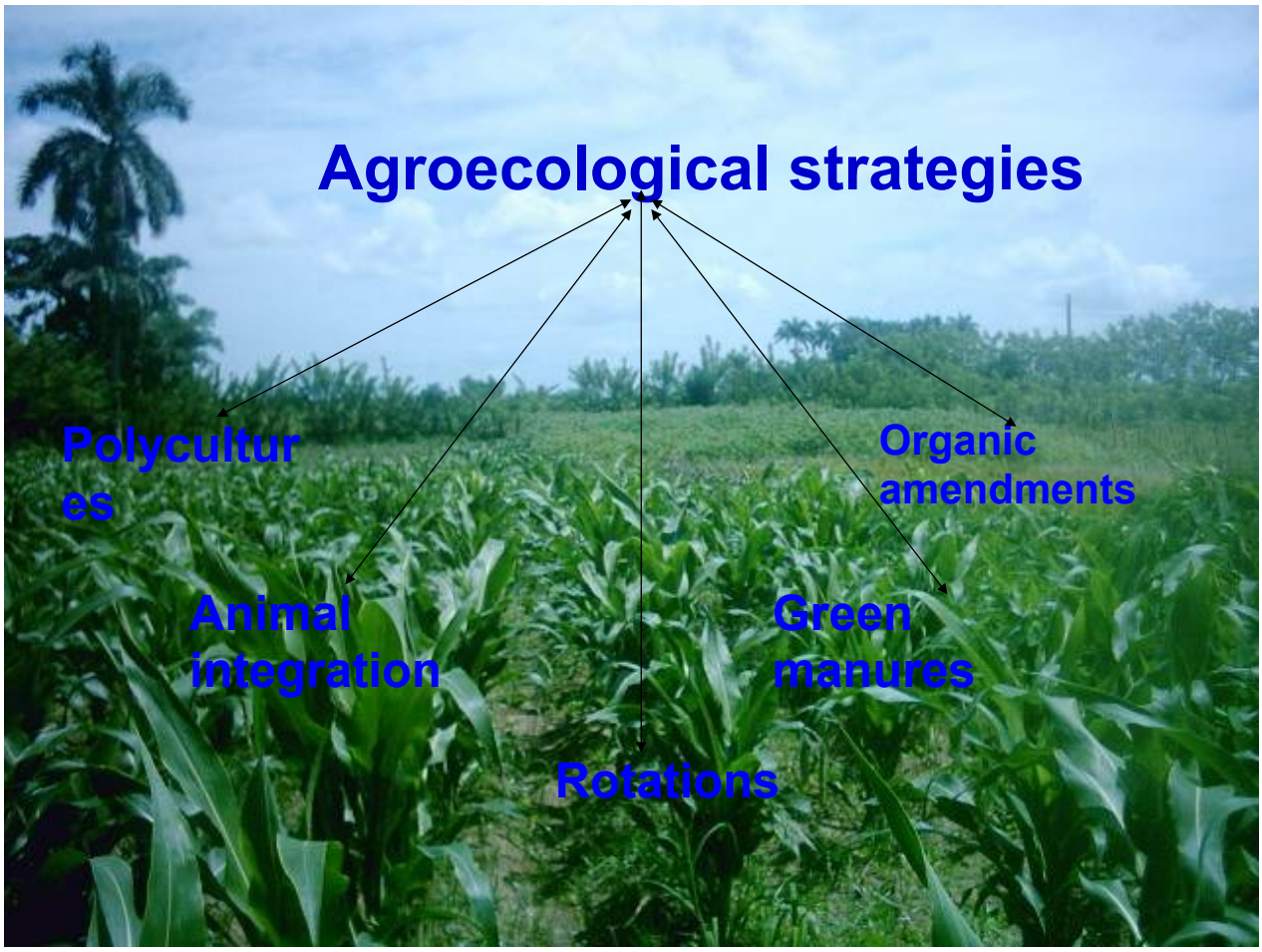
Comparison of fertilizer use, mechanization and irrigation between Cuba, the USA and other Latin American countries



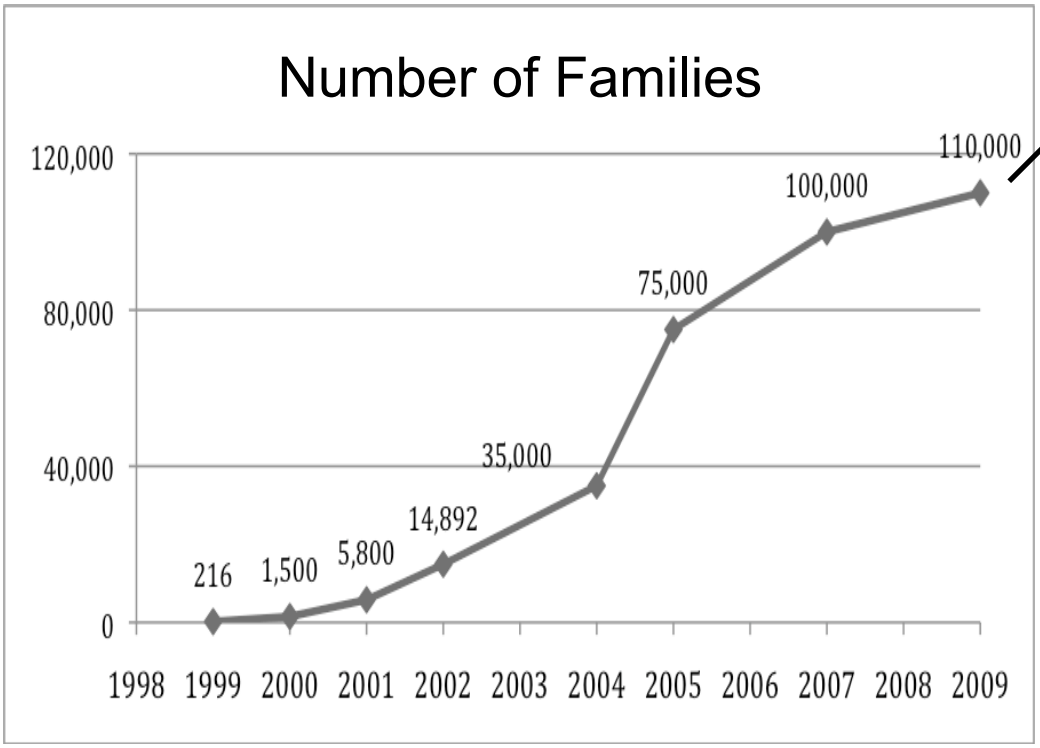
Losses of major agricultural inputs after the dissolution of the Soviet Union

Input	1989 imports	1992 imports	Reduction %
Petroleum (Mt)	13.0	6.1	53
Fertilisers (Mt)	1.3	0.3	77
Pesticides (US$)	80.0	30.0	63
Animal feeds (Mt)	1.6	0.5	72

Source: Rosset & Benjamin, 1993



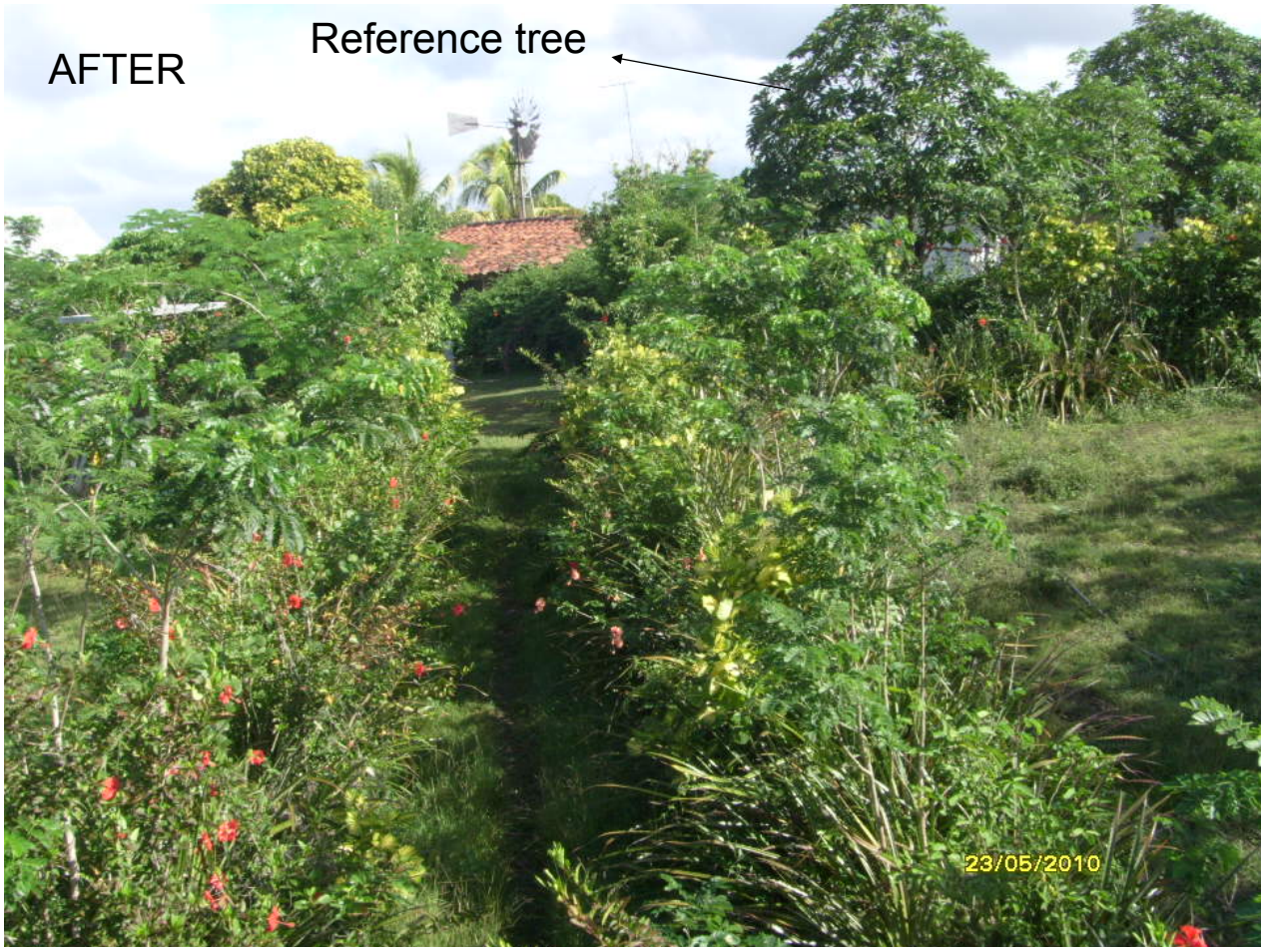
Growth in Cuba

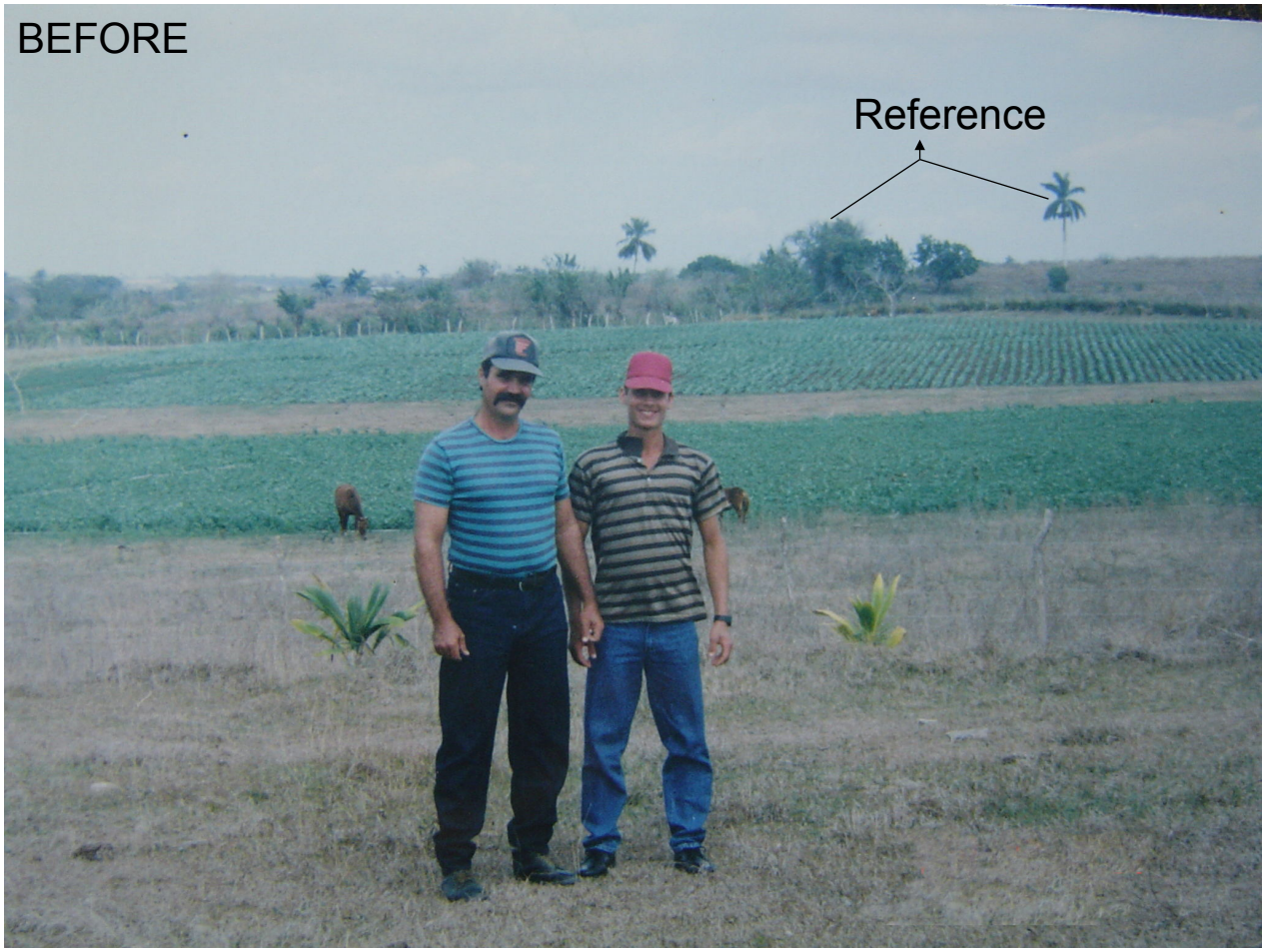


Finca “Del Medio” – José A. Casimiro

Sancti Spíritus

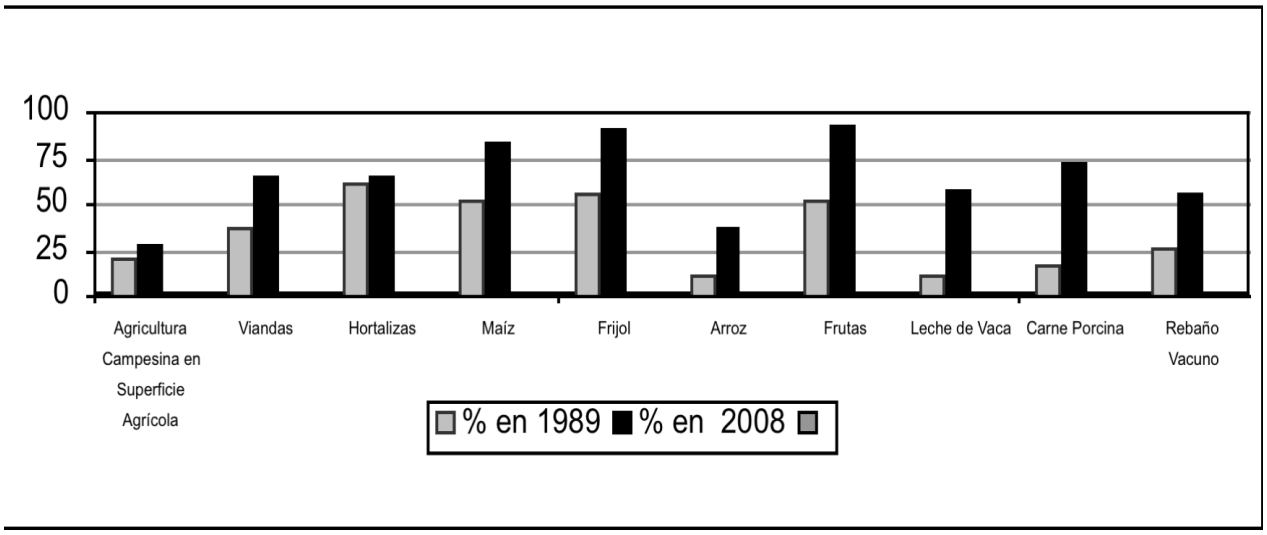

BEFORE
Reference: mamey tree
MAY 3 2004


AFTER
Reference tree
23/05/2010



Area (ha)	10
Energy (GJ/ha/año)	50.6
Proteín (kg/ha)/año	867
People fed by produced energy (Pers/ha/año)	11
People fed by produced protein (Pers/ha/año)	34
Energy efficiency	30

Contribución porcentual de la agricultura campesina a la producción nacional total en diversos rubros

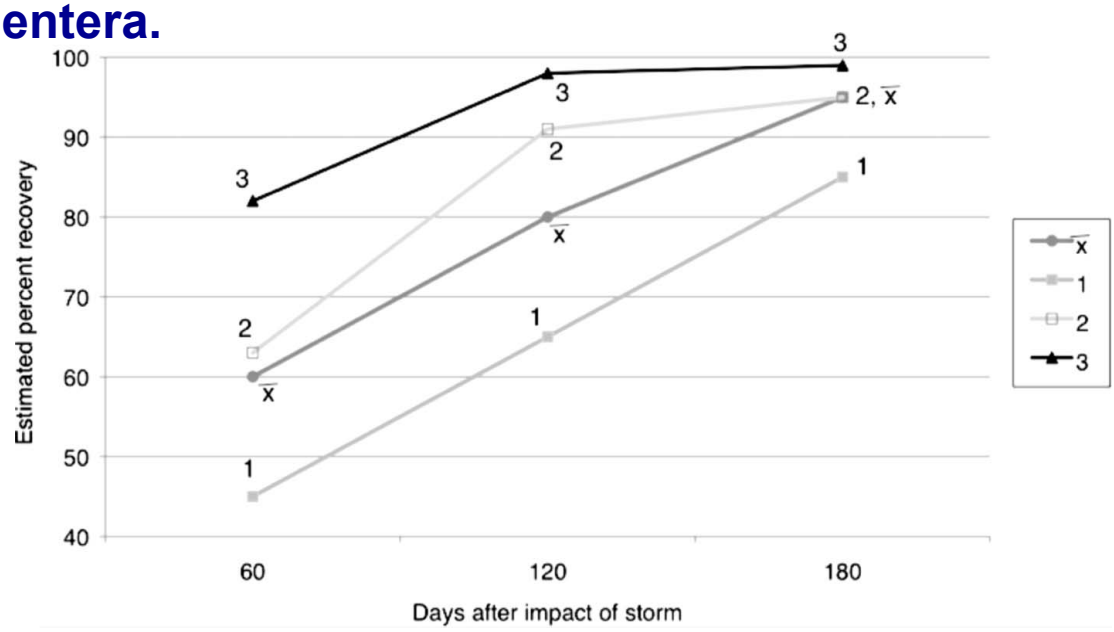


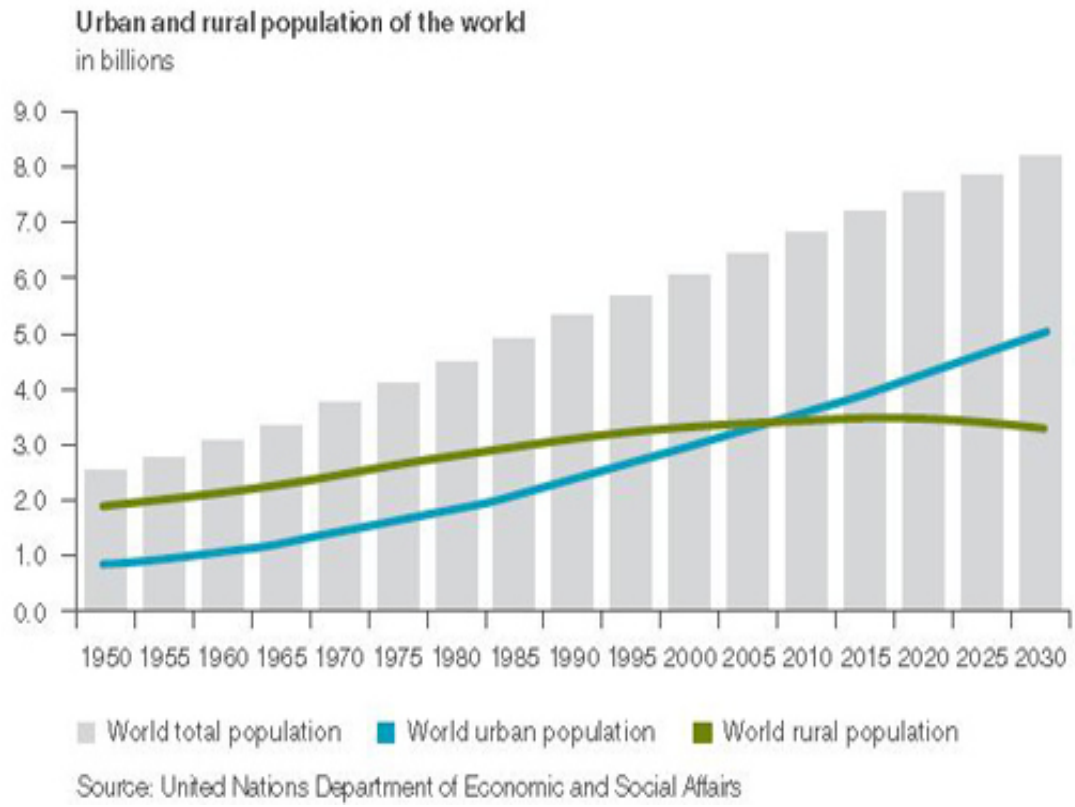
Evidencia II (Huracan Ike-Cuba)

- Areas under industrial monoculture suffered more damage and exhibited less recovery than diversified farms.
- After the hurricane average loss in diversified farms was about 50% compared to 90-100% in monocultures
- Productive recovery was about 80 - 90%,and was noticeable 40 days after the hurricane

EVIDENCIA II (HURACAN IKE-CUBA)

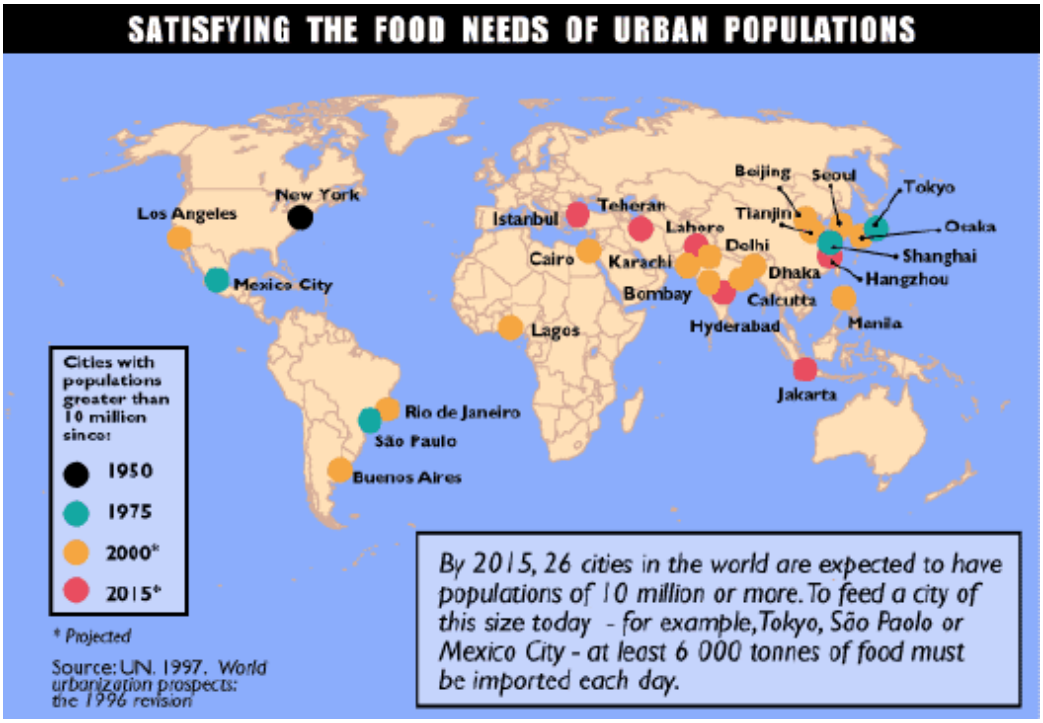
% estimado de recuperacion de fincas a los 60, 120 y 180 dias despues de Huracan Ike (2008) en CCS ‘Rafael Zaroza’ Sancti Spı´ritus segun nivel de integracion agroecologica (1 bajo, 3 alto) comparada con el promedio de la cooperativa entera.

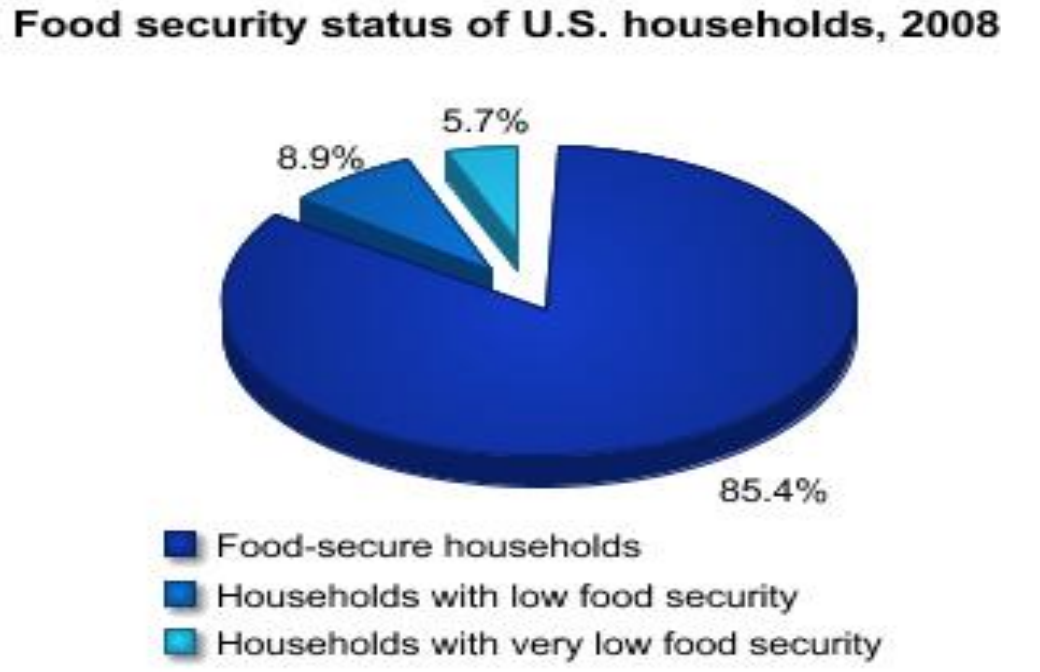




Urbanization of the world

- In one century urban population expanded from 15% of the total to 50% of the >7 billion world population
- In 1800s only London was city with 1 million people
- 1990s 100 largest cities accommodated 540 million, 220 million live in 20 world's largest cities
- By 2030, some two thirds of the world's people will be living in cities, the world's population will rise to nine billion by 2050.

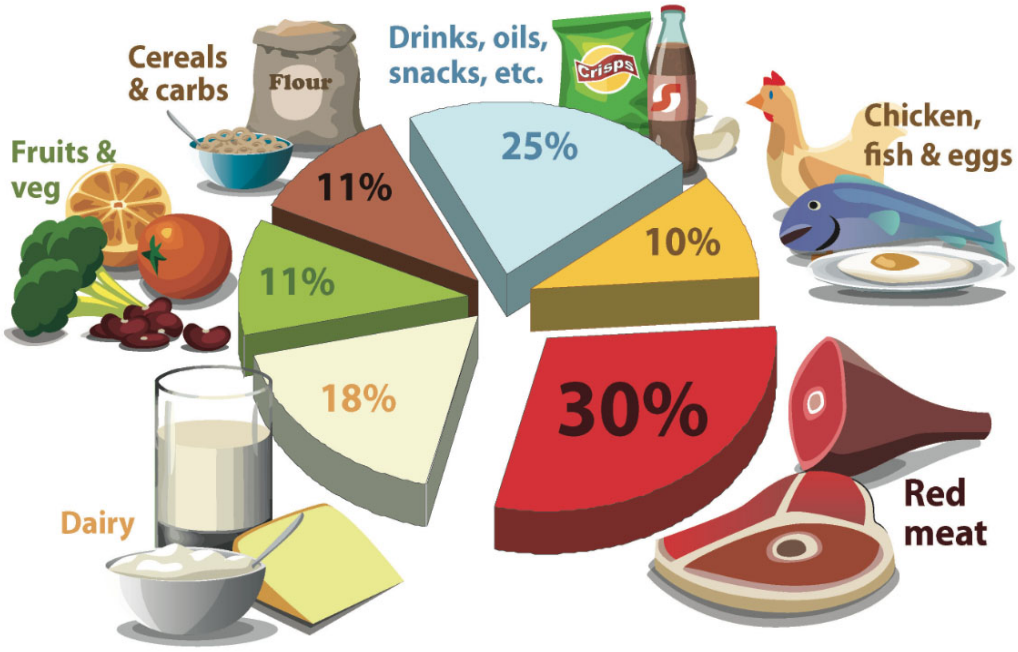




Note: Food-insecure households include those with low food security and very low food security.

Source: Calculated by ERS using data from the December 2008 Current Population Survey Food Security Supplement.

Sources of greenhouse gas emissions from U.S. food choices

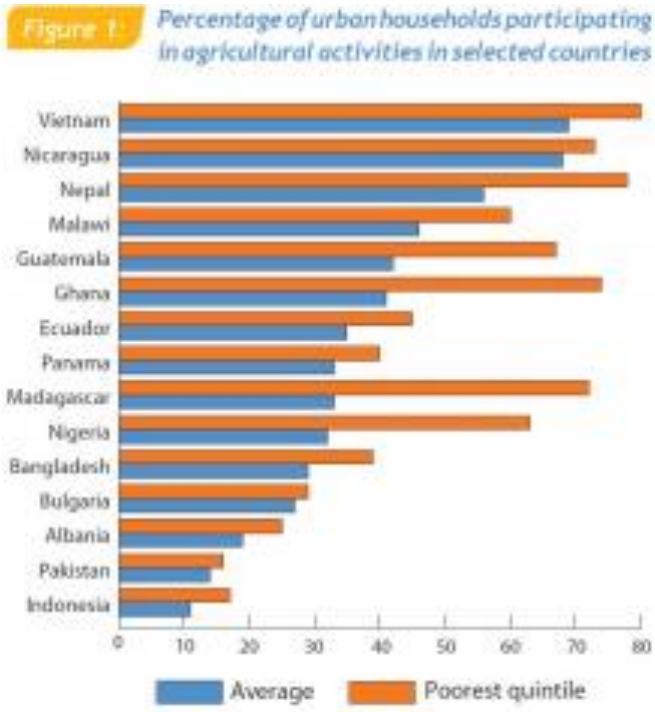


Adapted from: Weber and Matthews (2008) *Food-Miles and the Relative Climate Impacts of Food Choices in the United States.* Environmental Science & Technology, 42 (10), 3508-3513.

JOHNS HOPKINS Center for a Livable Future
B. Kim

Urban agriculture worldwide

- 800 million people involved in UA
- 200 million produce for the market, predicted to double in next decade
- 150 million employed full time in UA
- In 2005 UA increased its share of total food production to 33%
- 50% of vegetables, meat, dairy consumed is produced in many cities

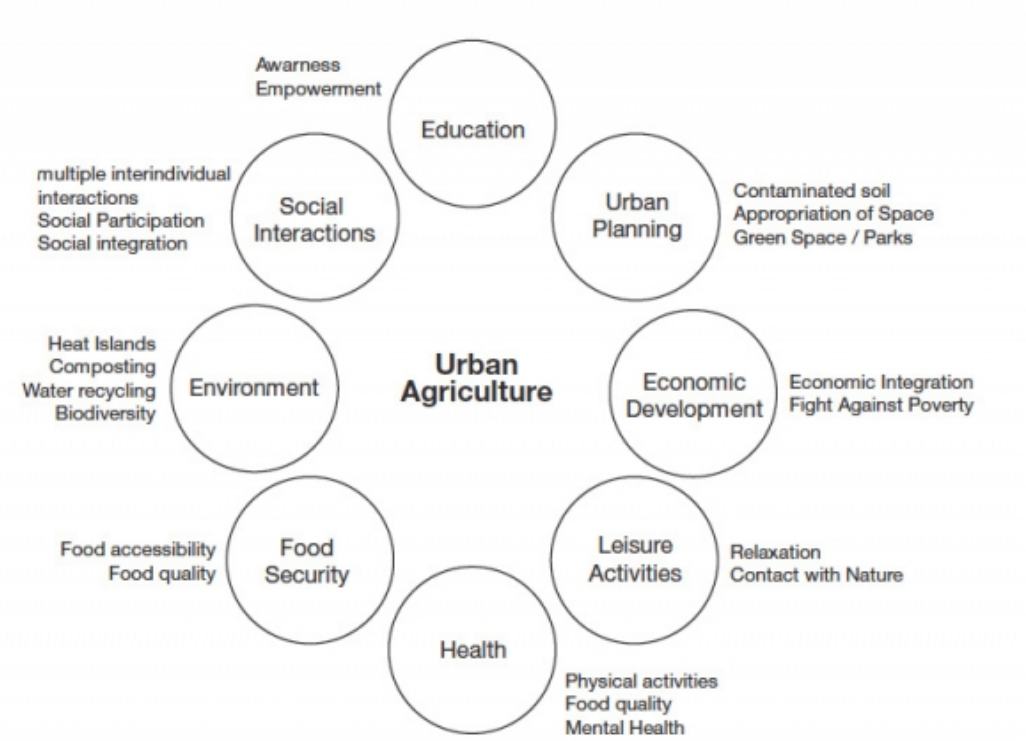


Increased public awareness about UA

- Recent volatility in global food and fuel costs
- detrimental effects of the industrialized food system on ecological sustainability.
- epidemic increases in levels of obesity and chronic disease in USA due to the overconsumption of cheap but unhealthy and calorie-dense foods.
- These trends have contributed to growing public interest in establishing food production in urban and suburban areas.

Potential of UA

- Developing agricultural capacity within or close to urban areas has the potential to reduce food transportation costs and environmental impacts
- provide economic development opportunities, and reduce disparities in healthful food access that have led to epidemic rates of obesity and diabetes among low-income populations.



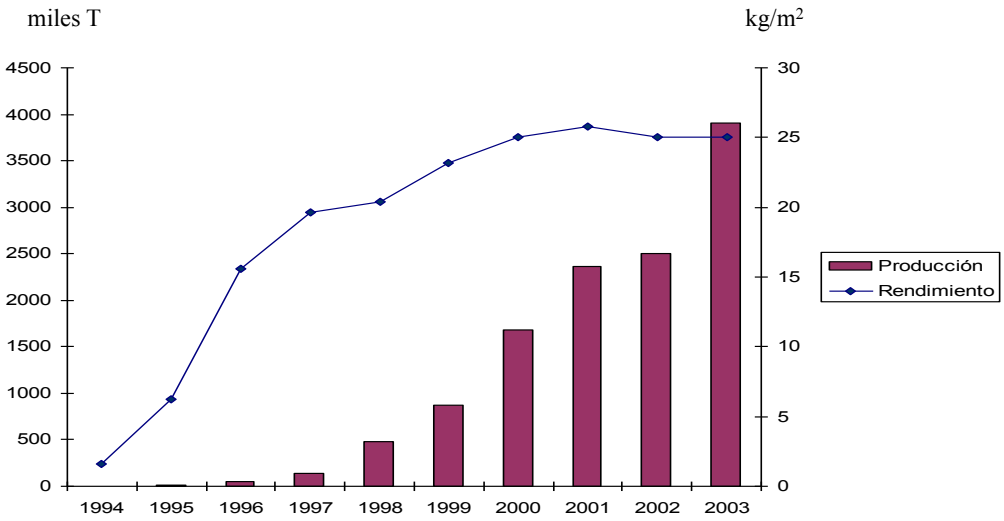
Rosario Argentina

- Thousands of families in the city of Rosario, Argentina, were able to feed themselves during the country's 2002 economic crisis by growing their own food.
- Now more than 800 community gardens in the city feed some 40,000 people and produce surplus for sale.

Rosario cont…

- 35 % of the territory of Rosario was occupied by empty or virtually empty tracts of land which was divided into districts.
- A technical coordinator and two local support workers were appointed for each district, each with many years of market-gardening behind him or her, to help the other inhabitants put what they had learned at their courses into practice.
- In the community market-gardens, an allotment of between 500 and 1000 m2 was allocated to each of the small farmers . The land belongs to the municipality or private owners, who lend it temporarily in exchange for tax benefits.

Urban agriculture evolution in Cuba



Productivity of organoponicos

Urban Agriculture

Urban Agriculture-2009

- Emergence of about 383,000 gardens nationwide
- 1,460,000 tons of vegetables in 5O thousand hectares
- Urban gardens produce about 60% of all vegetables consumed in Cuban major cities (215 grams of vegetables per day/person)
- Productivity ranges between 10-20 kg/$m^{2/year}$ in intensive gardens systems

Innovation of the production of urban agriculture

California

- In 10 years California's population will grow from 36 to 46 million people, with 80% concentrated in cities.

Oakland UA potential

- 1,200 acres of vacant and underutilized public land in Oakland, California, that could potentially be used for food production.
- more than 800 acres of public land with slopes under 30% were identified, a potential contribution of up to 5% of Oakland's vegetable needs if only half of this land were used
- an additional 3,008 privately owned vacant lots totaling more than 800 acres, a potential contribution of another 10% of the city's produce requirements.

Agroecological yield estimates

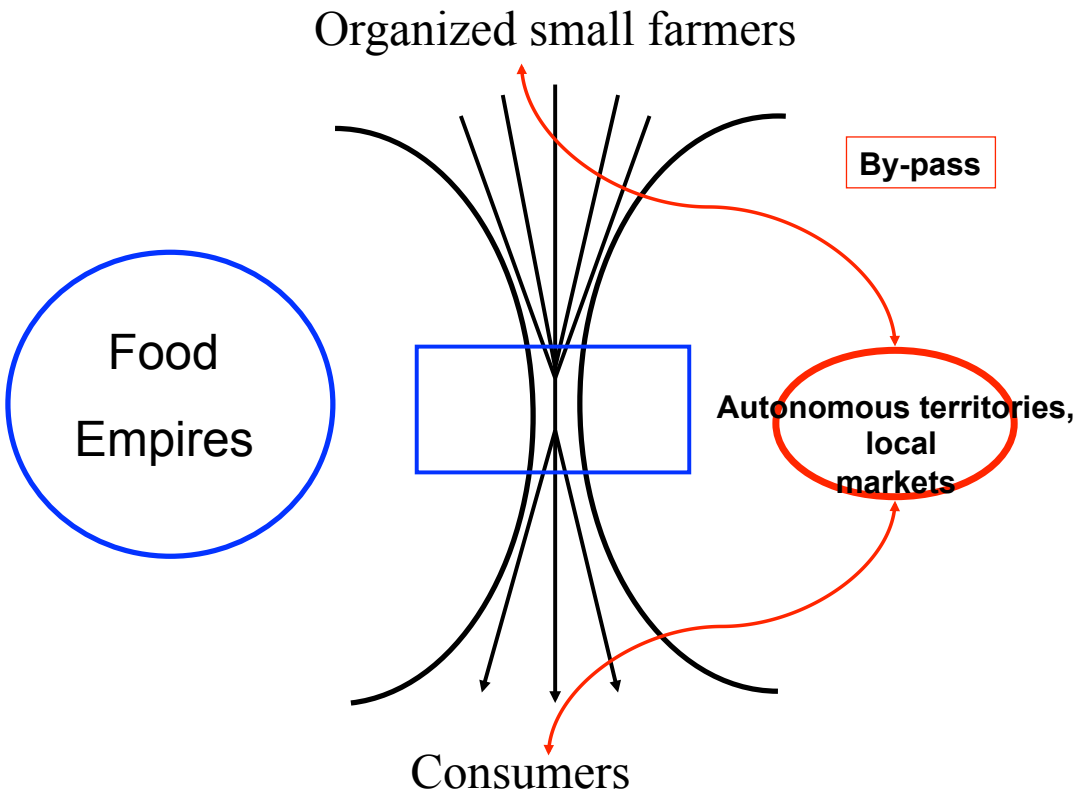
- UA yields could reach 10 kg of fresh biomass per sq.meter/ year (that is 50% of what Cuban urban farmers-best in the world- reach under optimal management).
- Assuming that well defined agroecological management systems are scaled up in Oakland in 1000 acres (400 hectares), reaching a yield of 10 kg per sqm/year (1 ha= 2.47 acres, 1 ha=10000 sq m) we estimate that UA yields in Oakland would reach 100000 kg /ha/yr or 40 million kgs in the whole 400 hectares (or 1000 acres).
- If each person consumes 45 Kg per year of fresh vegetables, the total UA production in 400 hectares could feed 800 thousand people/year. Let's assume that the levels of production would only reach 5kg/sq.m/year, still fresh vegetable needs of 400,000 people would be met.

Agroecology and social movements

• Social movements are key to achieving supportive policy environment (movements of farmers, workers, indigenous people, urban poor, consumers, environmentalists, human rights, etc.)

• The combination of peasant and family farm agriculture with agroecology can feed families, cities, countries and the world, with higher productivity, efficiency, and autonomy, lower costs, be more environmentally sound, produce healthier food, reduce migration, and be more resilient to climate change.

• Up-scaling really requires social movements at the center, who can build alliances with government institutions, NGOs, researchers, students, etc., but on new terms.



The pillars of food sovereignity