Making Agroecology work in practice: a global perspective

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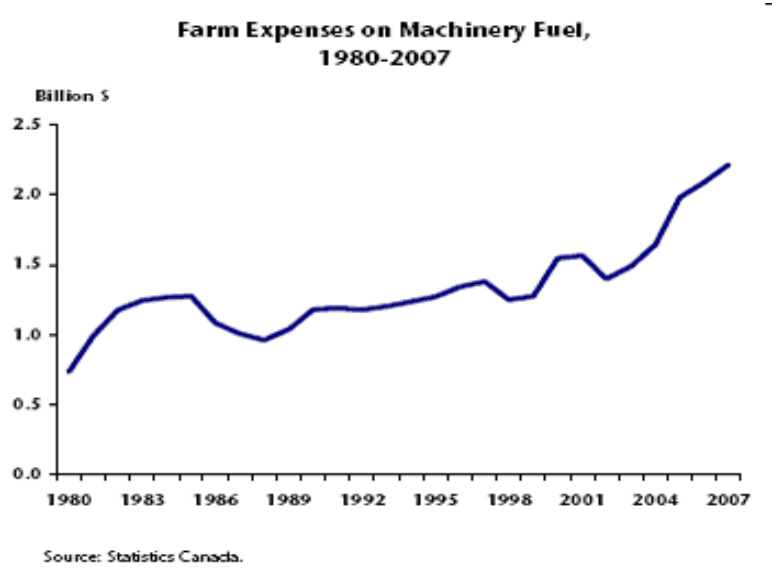
www.agroeco.org

Fertilizer and farm fuel prices- USA



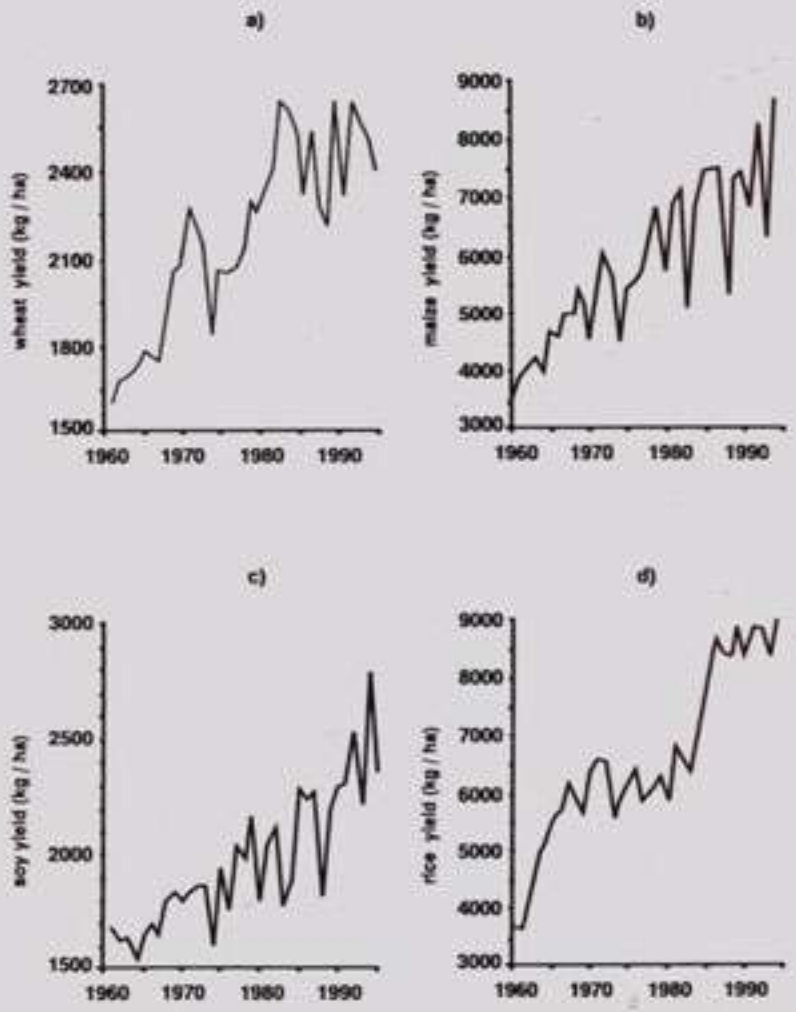
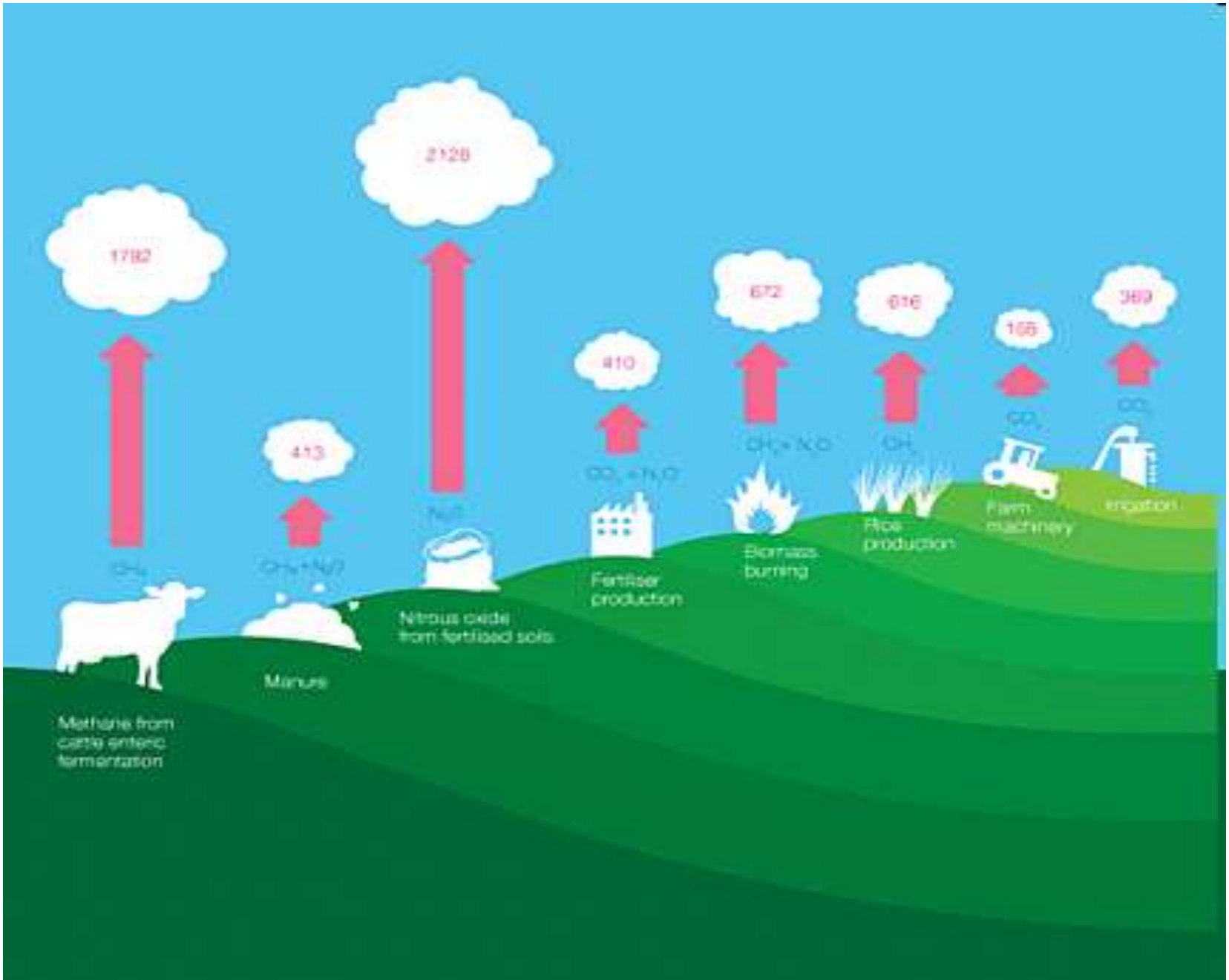
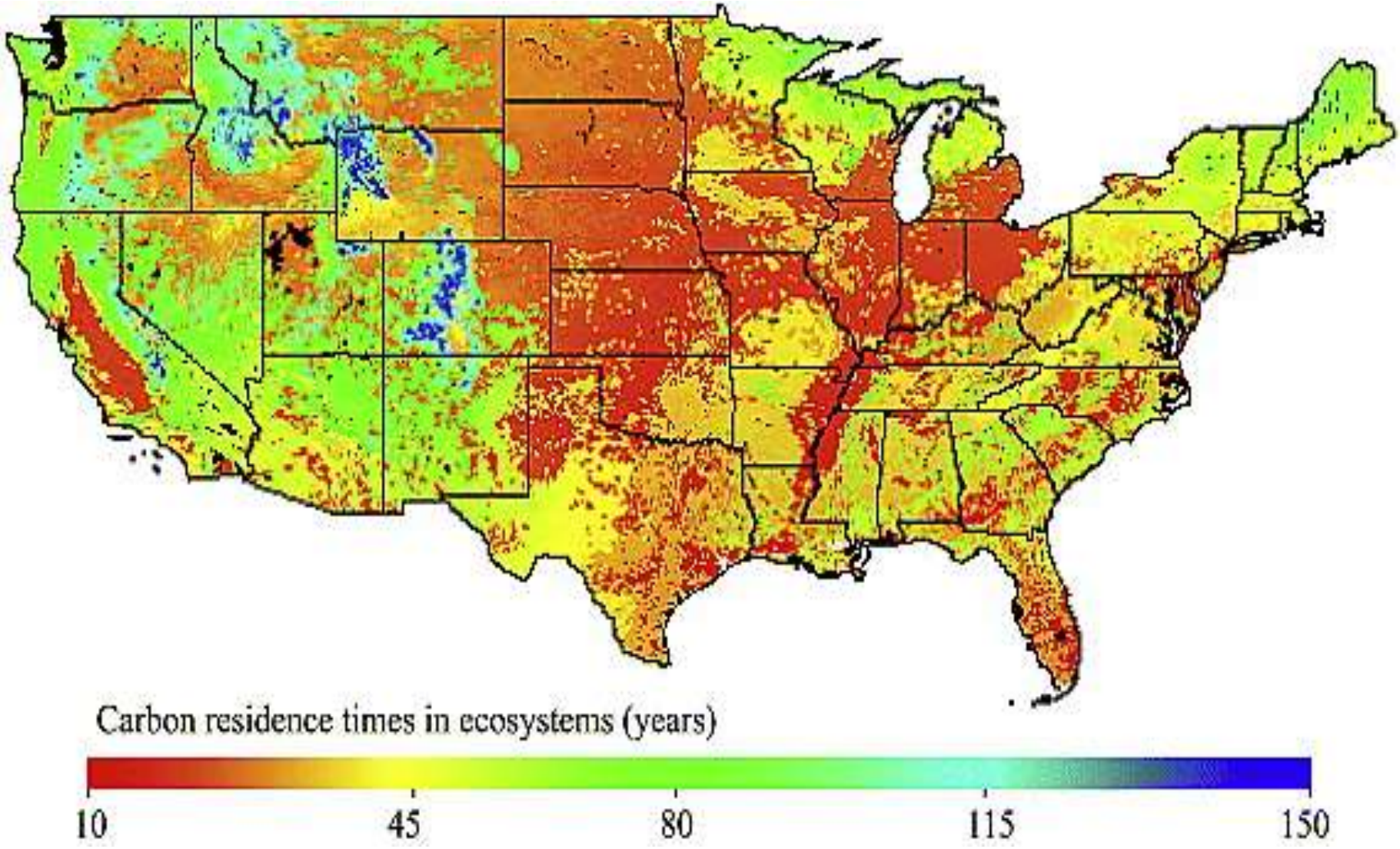


FIGURE 3. Yields of selected crops in the United States. (Source: McGuinness, 1993)


1782
413
2128
410
672
616
166
369
Methane from cattle enteric fermentation
Manure
Nitrous oxide from fertilised soils
Fertiliser production
Biomass burning
Rice production
Farm machinery
Irrigation

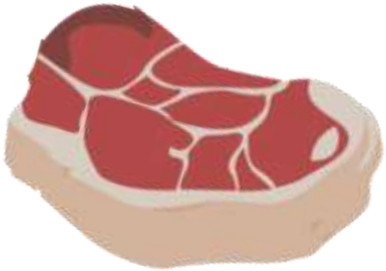
Soil Carbon Losses

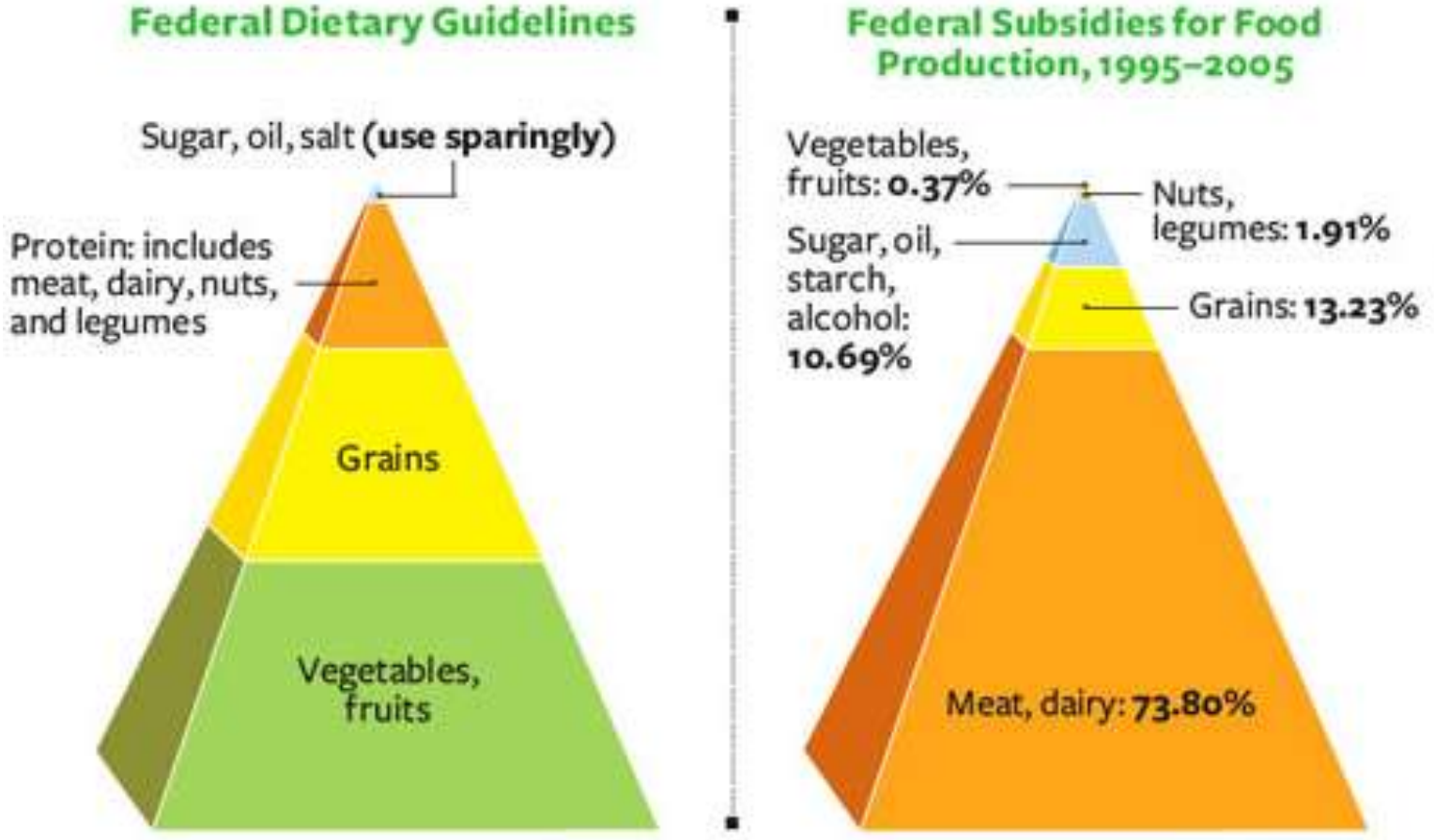


Grain for humans or livestock

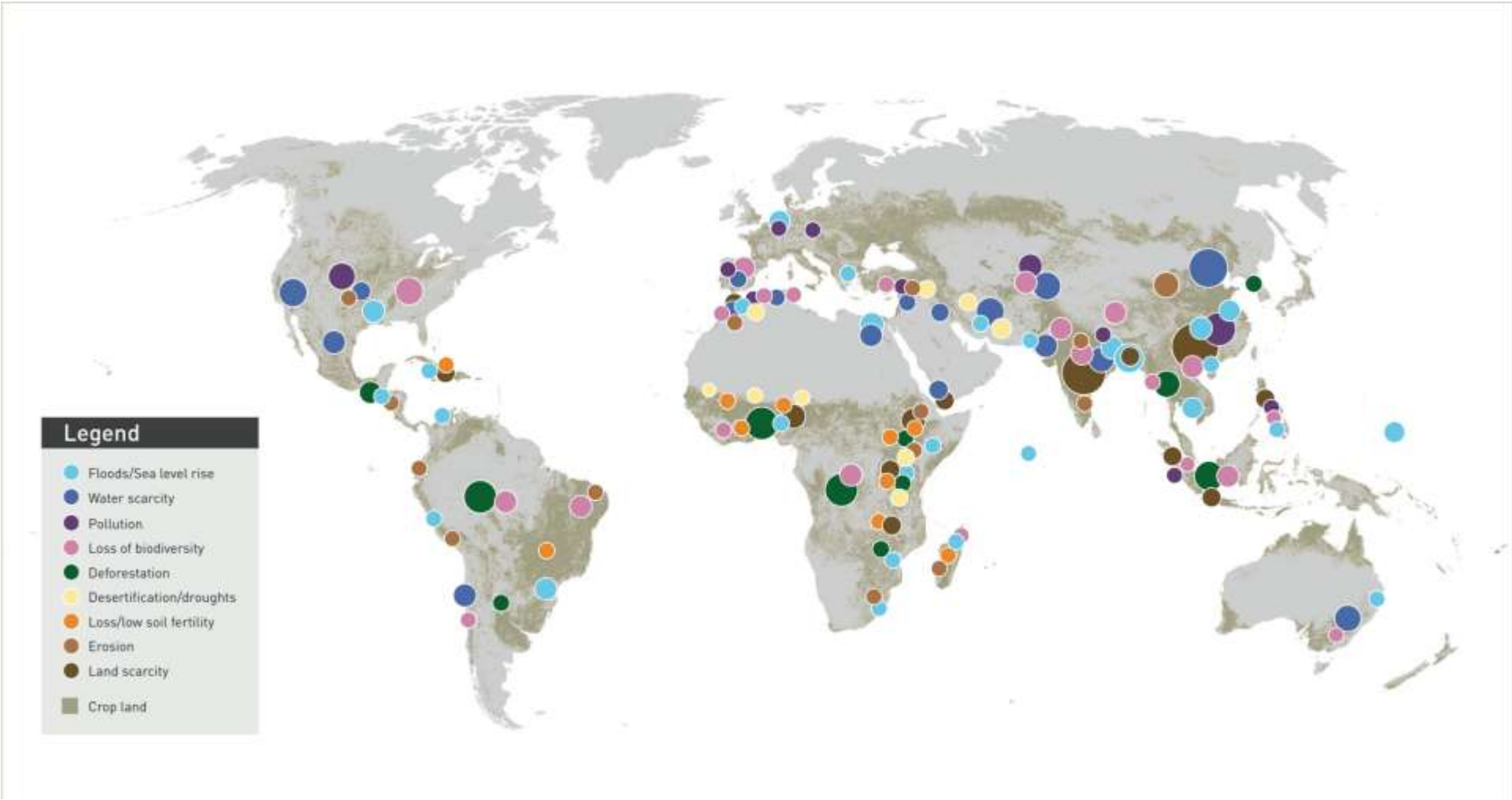
- **Nearly 40% of our global grain supply feeds animals. Some 650 million tonnes of grain – nearly 40% of global production – is fed to livestock.**
- **This amount of grain is equivalent to the annual calorie needs of more than 3.5 billion people.**

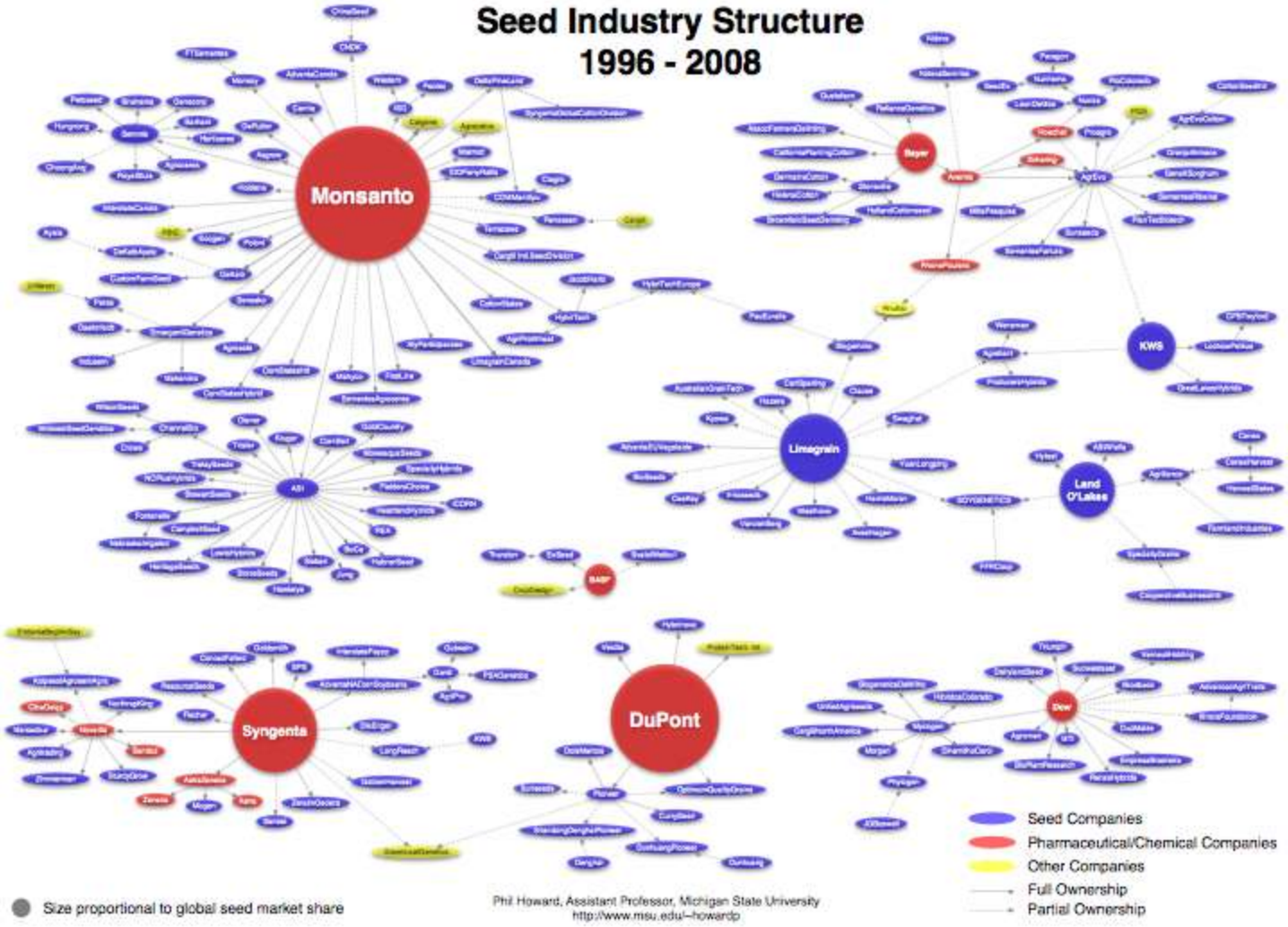
Water and changing diets

Product		liter/kg
beef		15 000
cereal		1 500
fruit		1 000

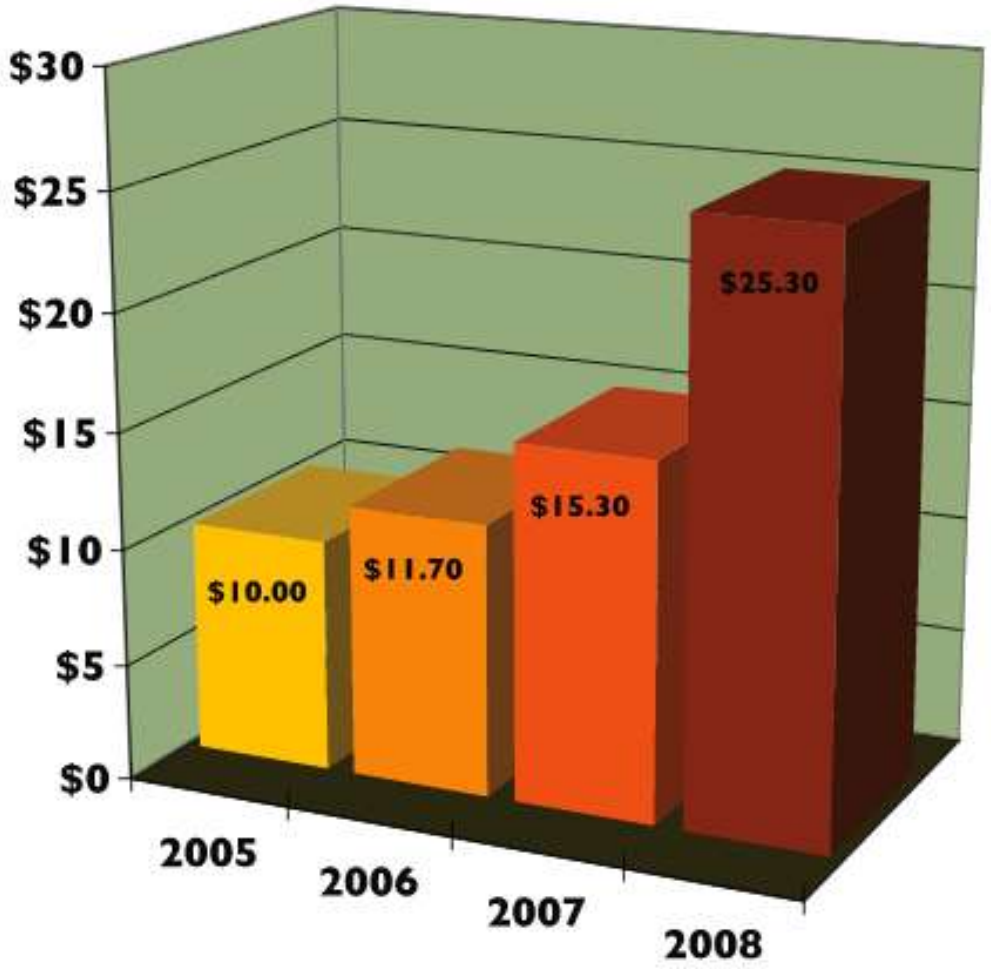

Federal Dietary Guidelines
Sugar, oil, salt (use sparingly)
Protein: includes meat, dairy, nuts, and legumes
Grains
Vegetables, fruits
Federal Subsidies for Food Production, 1995–2005
Vegetables, fruits: 0.37%
Nuts, legumes: 1.91%
Sugar, oil, starch, alcohol: 10.69%
Grains: 13.23%
Meat, dairy: 73.80%

Systems at Risk at a Glance

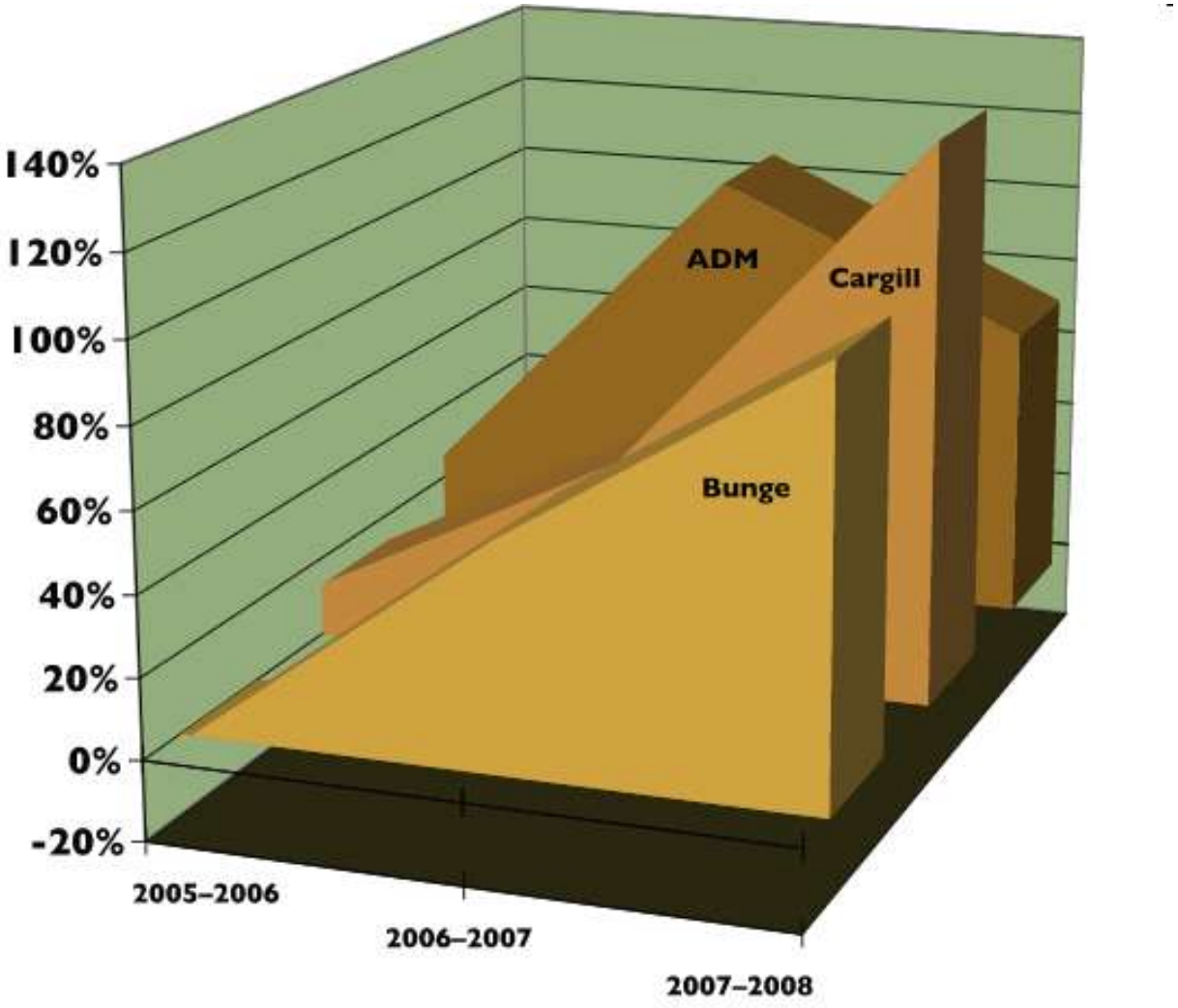


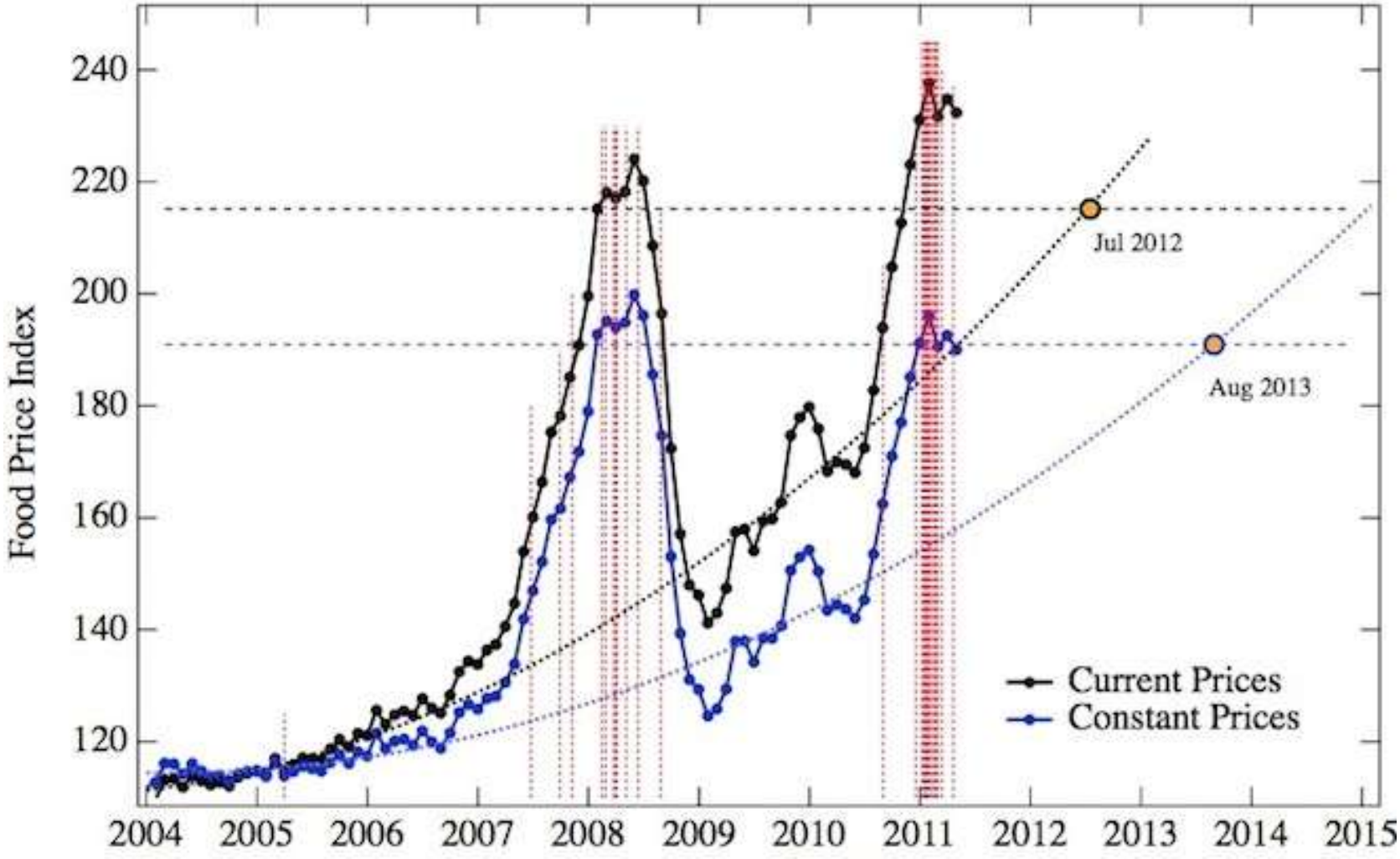

Seed Industry Structure
1996 - 2008
Monsanto
Bayer
Limagrain
KWS
Land O'Lakes
Syngenta
DuPont
Dow
Seed Companies
Pharmaceutical/Chemical Companies
Other Companies
Full Ownership
Partial Ownership
Size proportional to global seed market share
Phil Howard, Assistant Professor, Michigan State University
http://www.msu.edu/~howardp

Average food prices



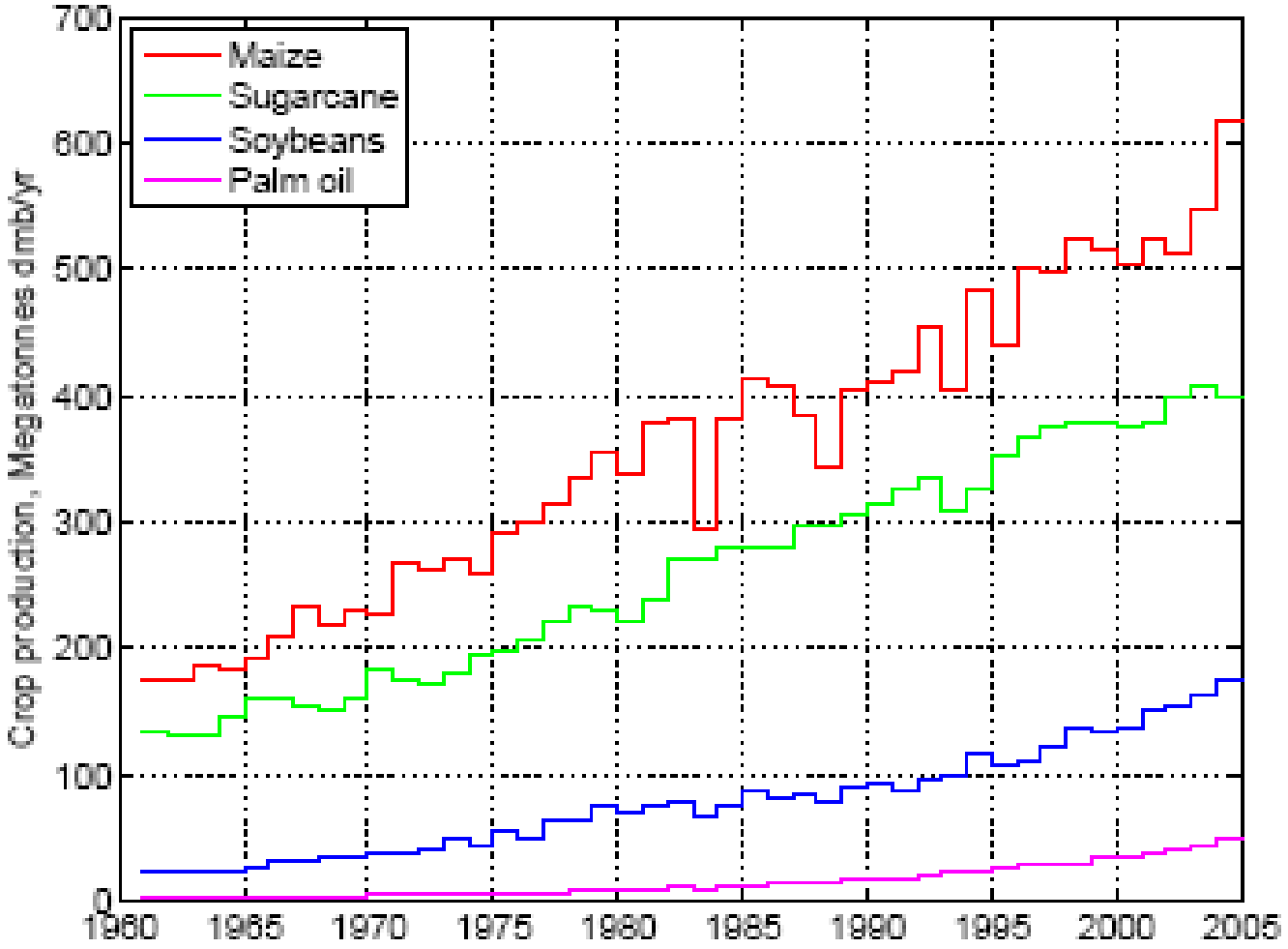
Profits of food multinationals





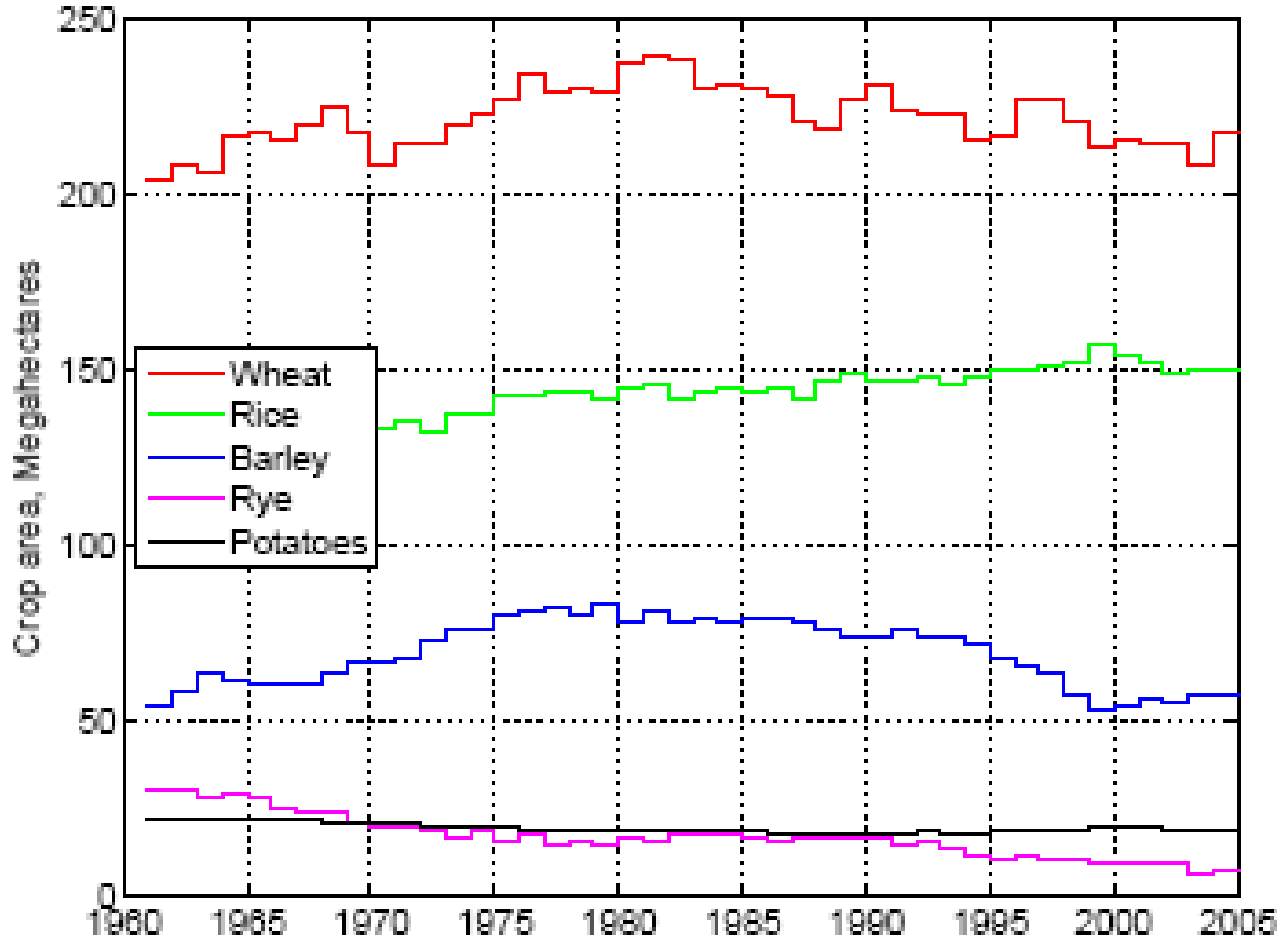
FAO Price Index at current prices (black curve) and corrected for inflation (blue curve) between January 2004 and May 2011. Red dashed lines signify the beginning dates of food riots and unrest in North Africa and the Middle East. Black and blue horizontal lines represent the current-price and inflation-adjusted food price thresholds for riots. *"The Food Crises and Political Instability in North Africa and the Middle East." By Marco Lagi, Karla Z. Bertrand and Yaneer Bar-Yam. arXiv, Aug. 11, 2011.*

World Energy Crops…



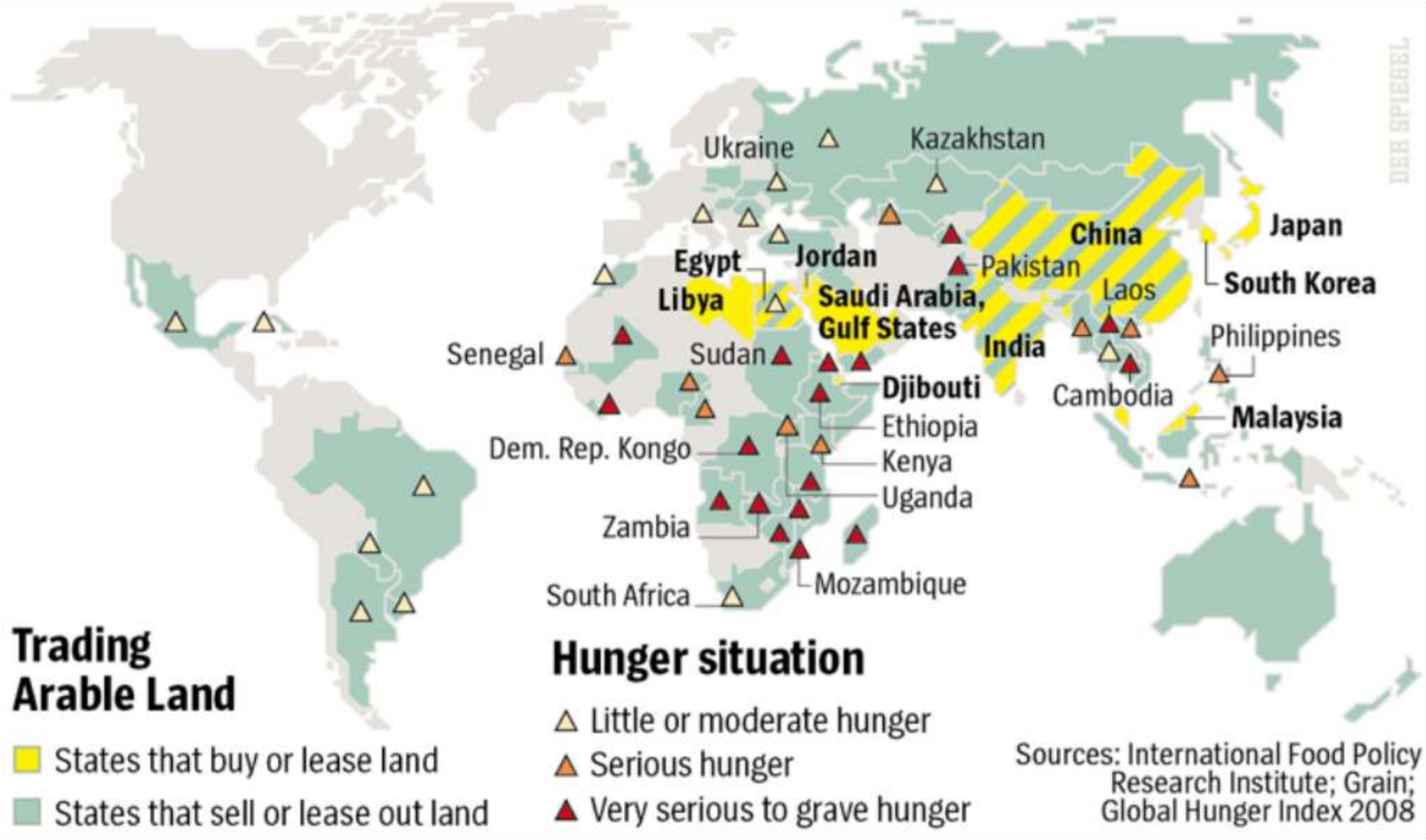
Source: FAOStat, accessed, Feb. 29, 2008

Areas of World Grains. . .



Source: FAOStat, accessed, Feb. 29, 2008

Who? Where? The big picture.

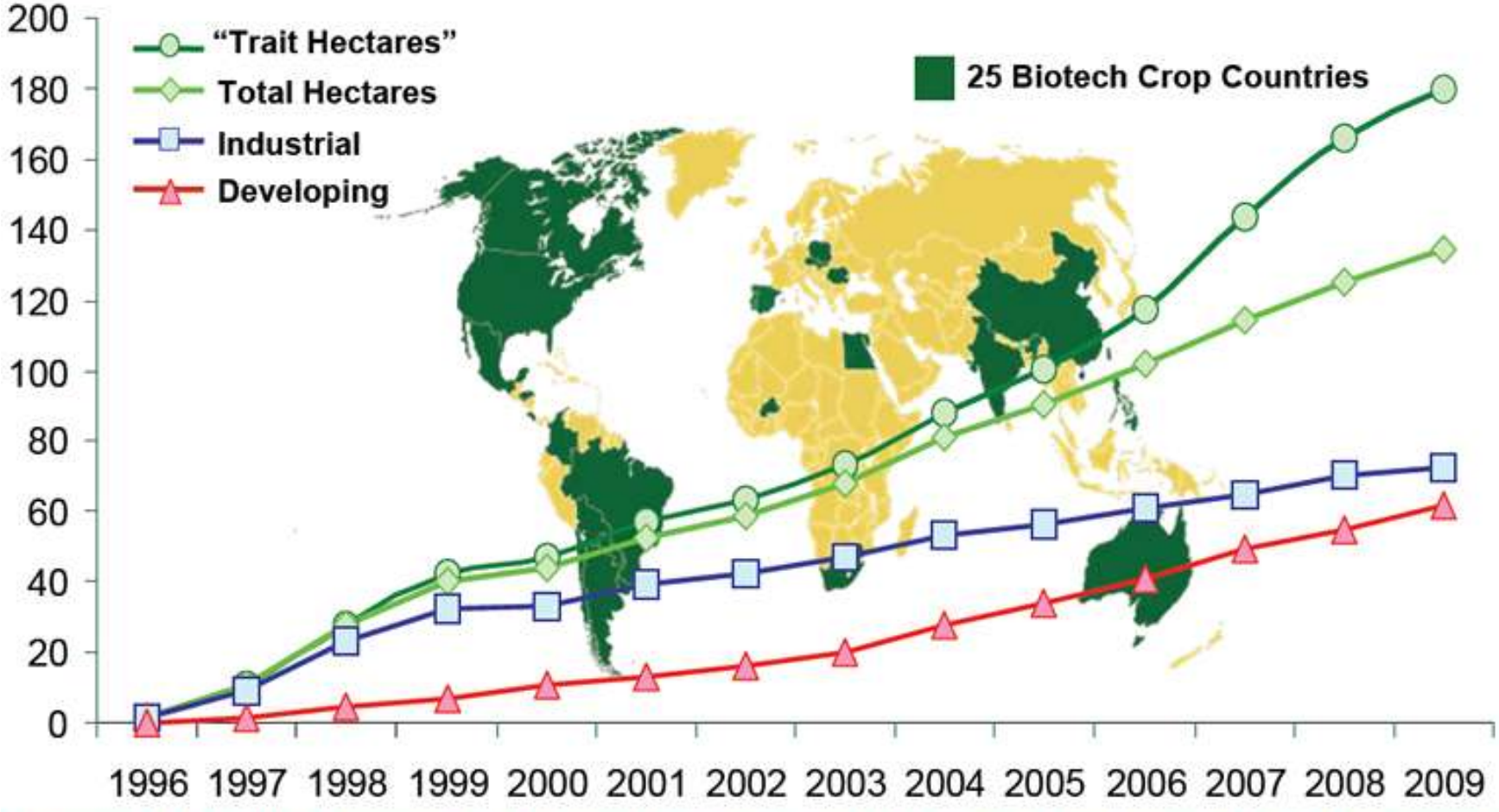


(NB: This map is quite incomplete, just serves to illustrate some of the players)

IFAD study on land grabs

- 50-80 million has transcated worldwide since 2001
- Total of 2,492,684 ha of approved land allocations since 2004 in the five study countries, excluding allocations below 1000 has
- Include a 452,500 ha biofuel project in Madagascar, a 150,000 ha livestock project in Ethiopia, and a 100,000 ha irrigation project in Mali
- Dominance of private sector and foreign investment (including government-owned investements)
- Goal of 405 deals: food production: 37%; cash crops: 21%; biofuels 21%; livestock, conservation & game reserves, plantation forestry: 21%

GLOBAL AREA OF BIOTECH CROPS
Million Hectares (1996 to 2009)



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.

Centro de Estudios Avanzados
Universidad de Buenos Aires
GEPAMA

Situación 3. Soja Roundup Ready de 1° sobre Rastrojo de Maiz.

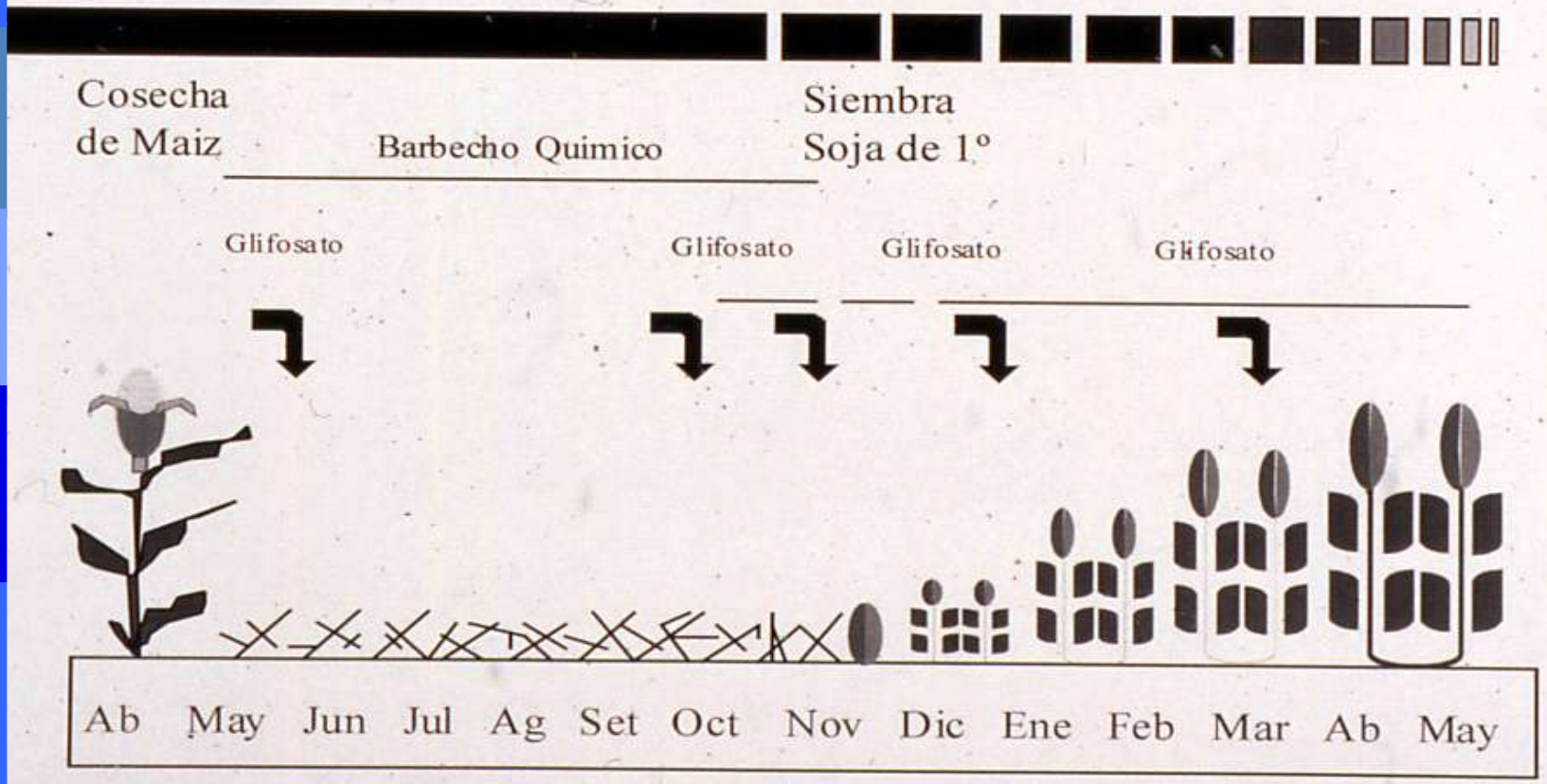


Diagrama N° 5

Fuente: Elaboración propia.

Figure 2. Evolution in glyphosate, atrazyn and 2,4-D consumption in Argentina, 1996-2006.

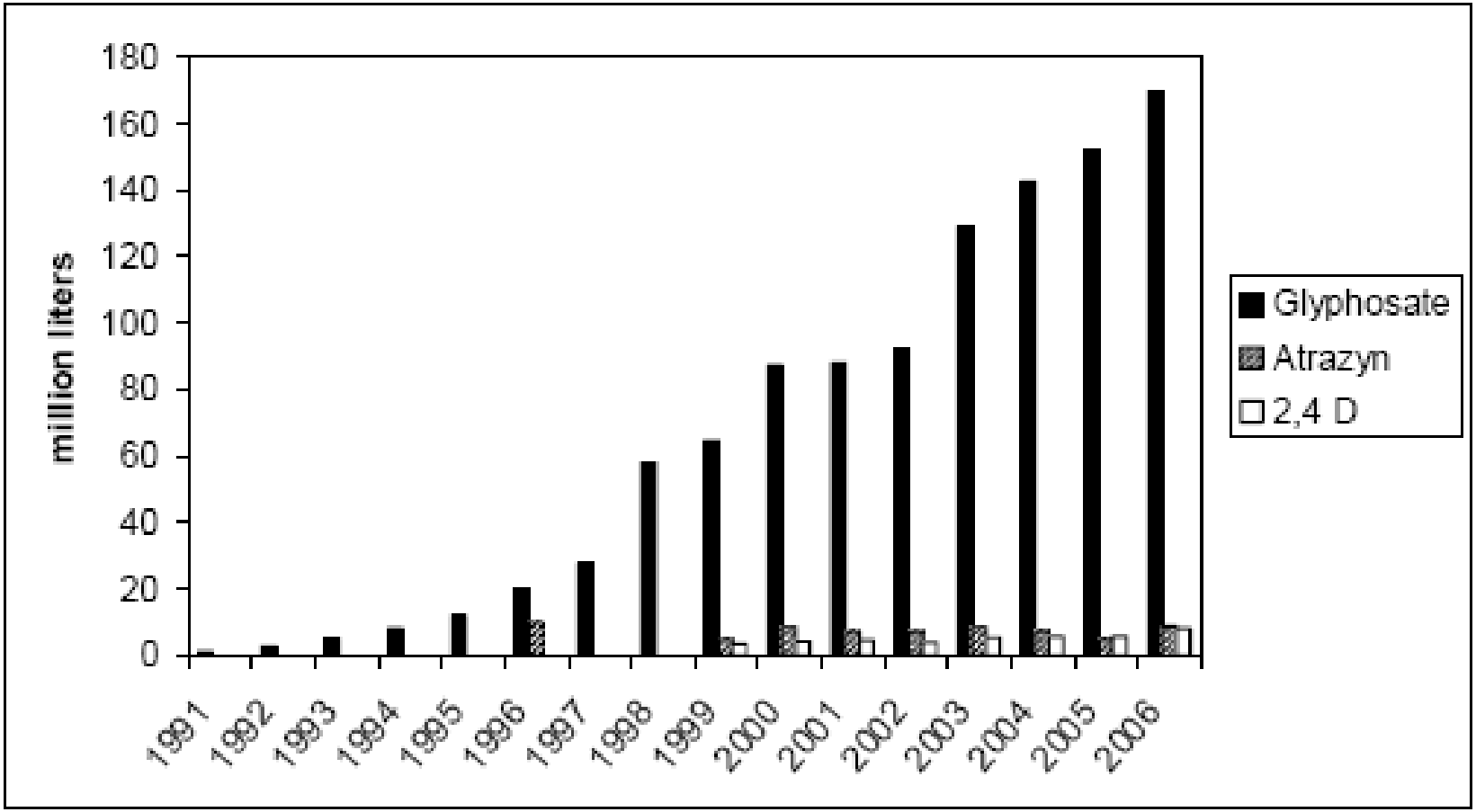


Foto: Robinson Osipe

Fotos: Robinson Osipe

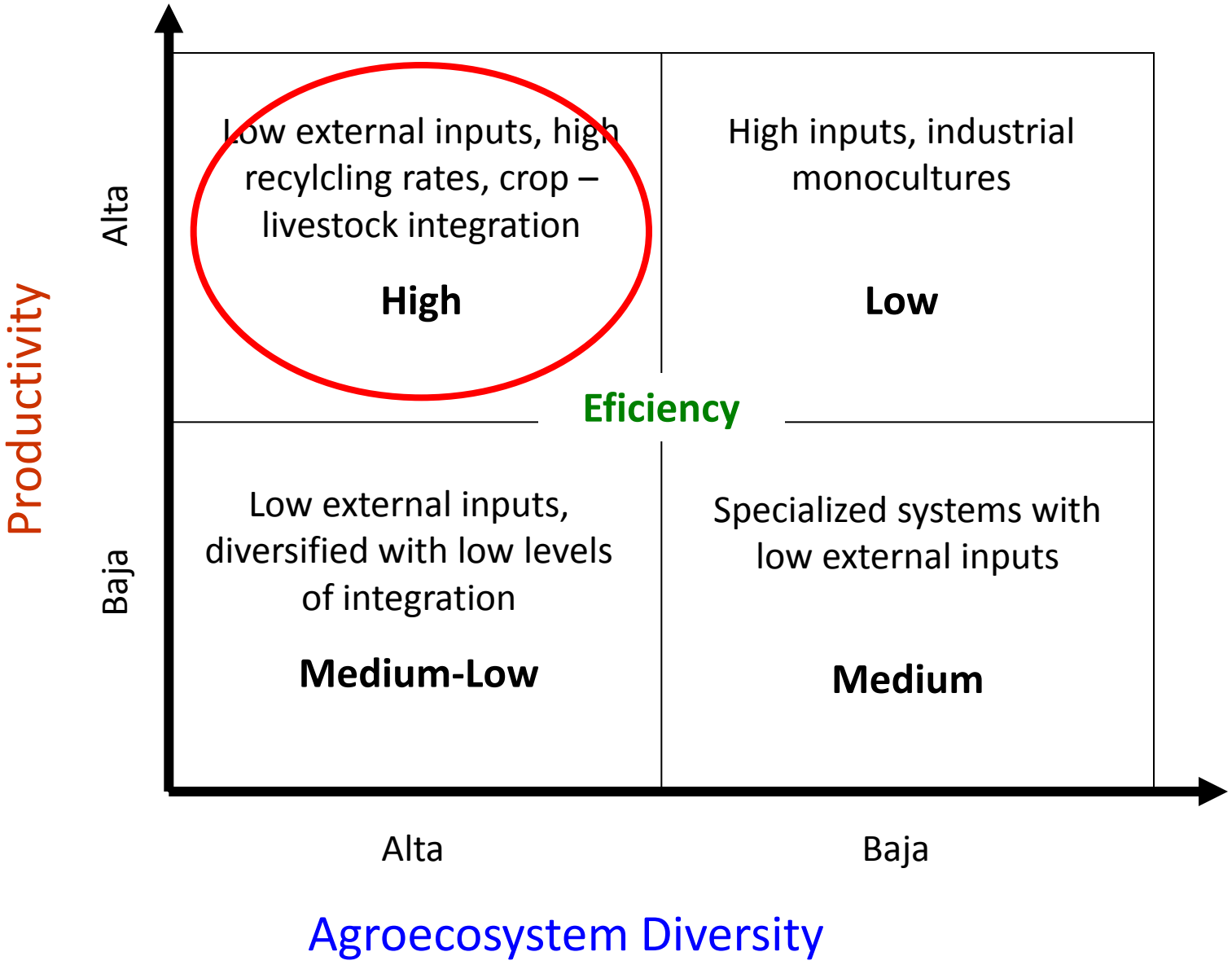
The agricultural challenge for the next decades

Food production must increase substantially and sustainably but using the same arable land base, with less petroleum, less water and nitrogen, within a scenario of climate change, social unrest and financial crisis.

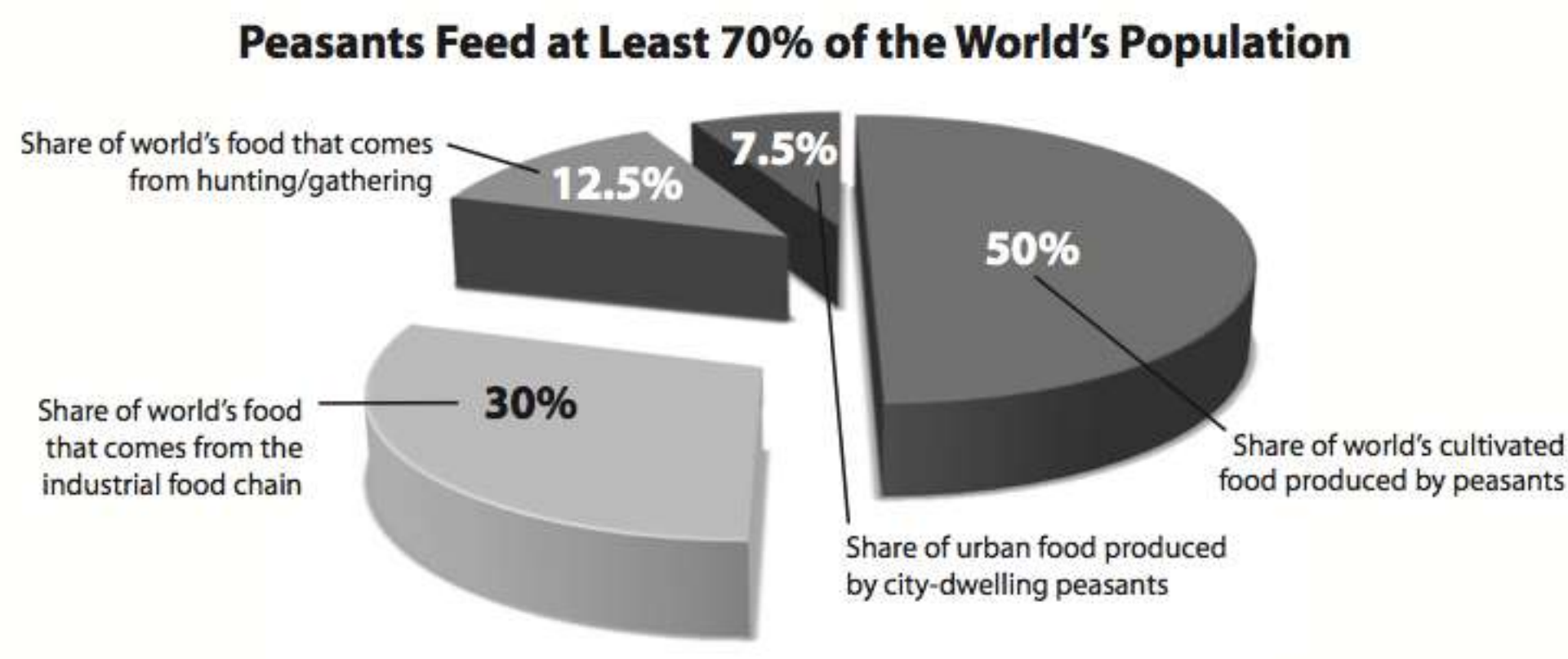
This challenge cannot be met with the existing industrial agricultural model and its biotechnological derivations

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


Productivity
Alta
Baja
Low external inputs, high recylcling rates, crop – livestock integration
High
High inputs, industrial monocultures
Low
Eficiency
Low external inputs, diversified with low levels of integration
Medium-Low
Specialized systems with low external inputs
Medium
Alta
Baja
Agroecosystem Diversity

Who feeds us today???



How many peasants there are in the world? (ETC 2009)

- 1, 5 billion peasants in 380 million small farms
- At least 370 million of these are also indigenous peoples occupying *92 million farms*
- 17 million peasant farms in Latin America grow between a half to two-thirds of staple foods
- Africa's 33 million peasant farms (mostly female-led) account for 80% of farms and most of the domestic food consumption
- Asia's 200 million peasant rice farms produce most of its harvest

Peasants, industrial agriculture and Agrobiodiversity

- 40 species of domestic animals
- 7,6l6 animal breeds
- 1,9 million crop varieties since 1960 freely available to humankind

- 5 species of domestic animals
- < 500 animal breeds
- Green Revolution: 8,000 new crop varieties since 1970
- Indusrial breeders: 72,500 varieties (under IPR protection)

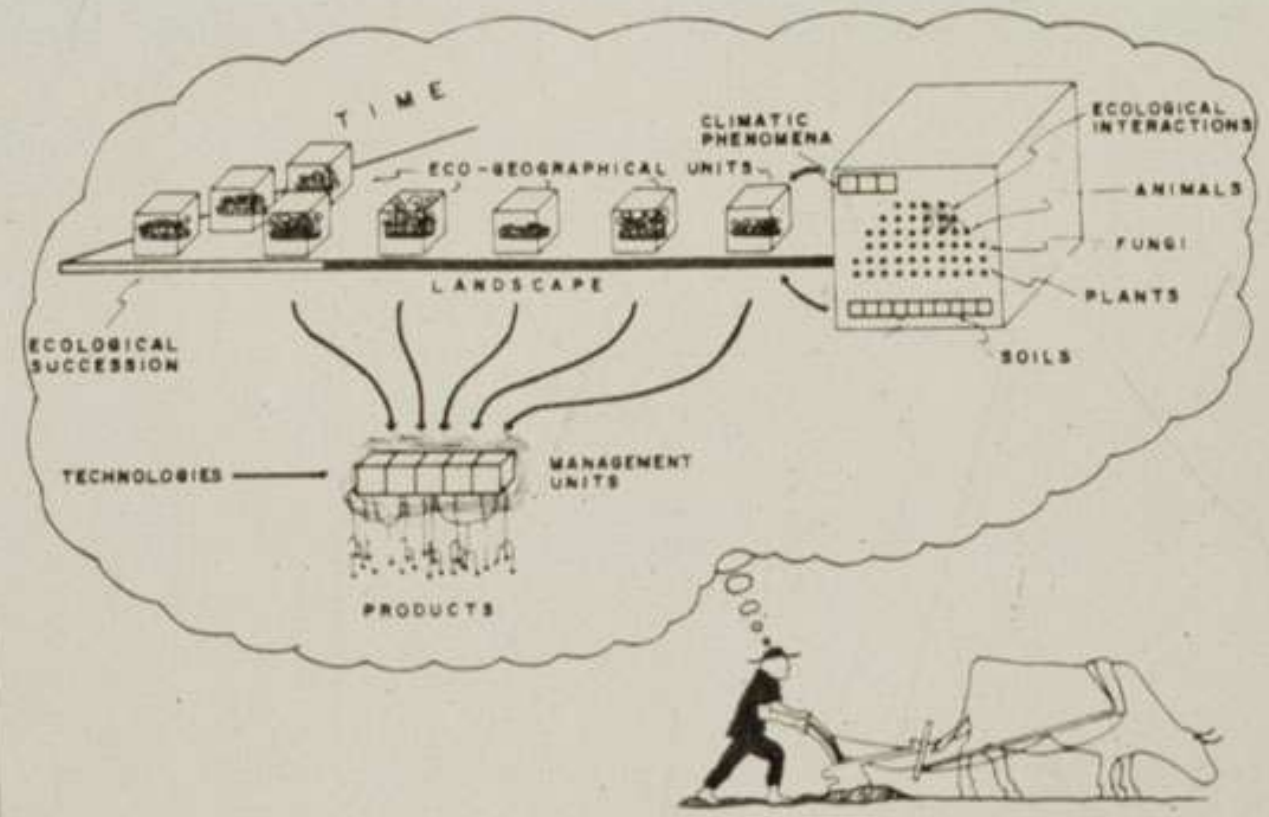
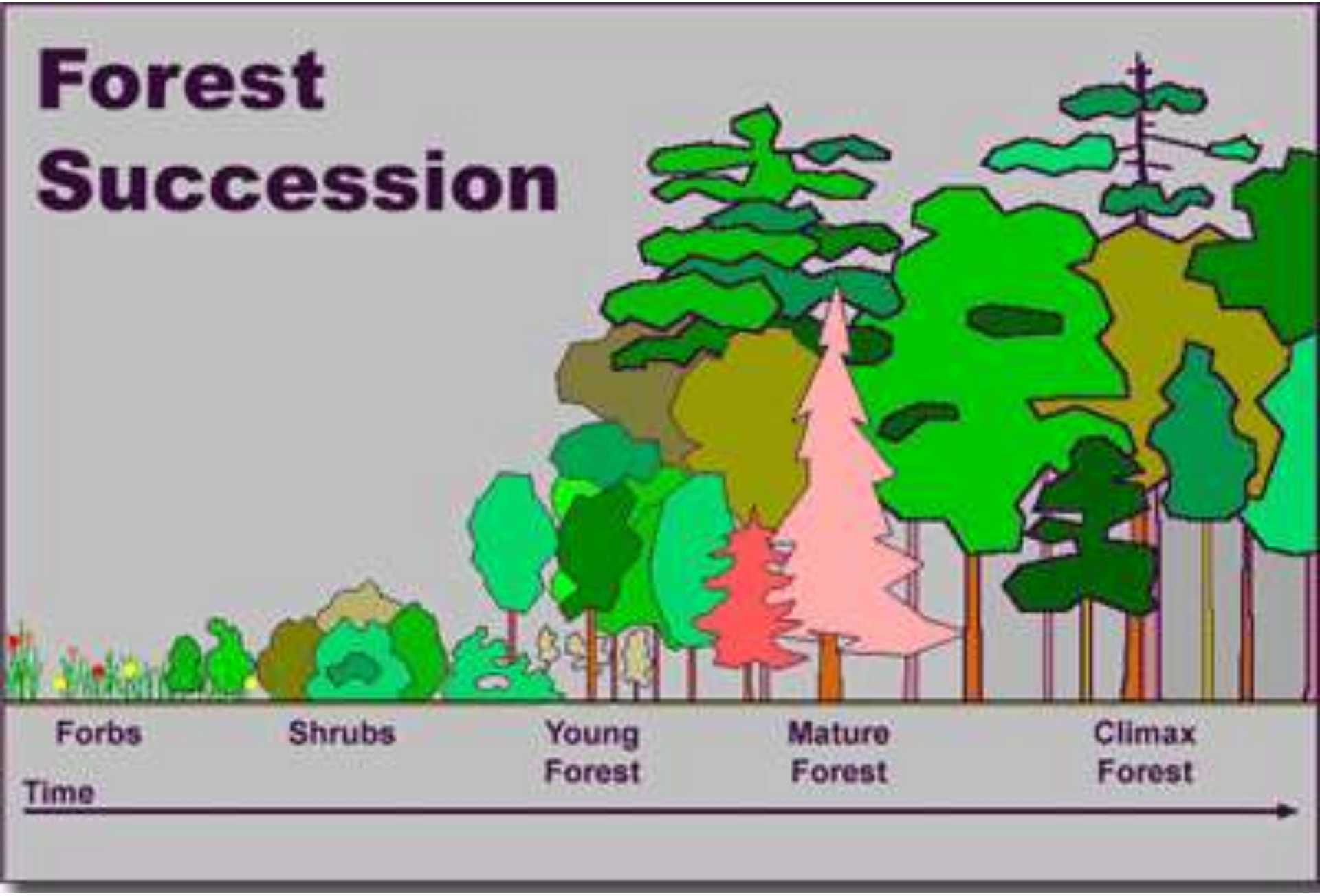


FIGURE 4. An integrative scheme of peasant knowledge of Nature.


Forest Succession
Forbs
Shrubs
Young Forest
Mature Forest
Climax Forest
Time

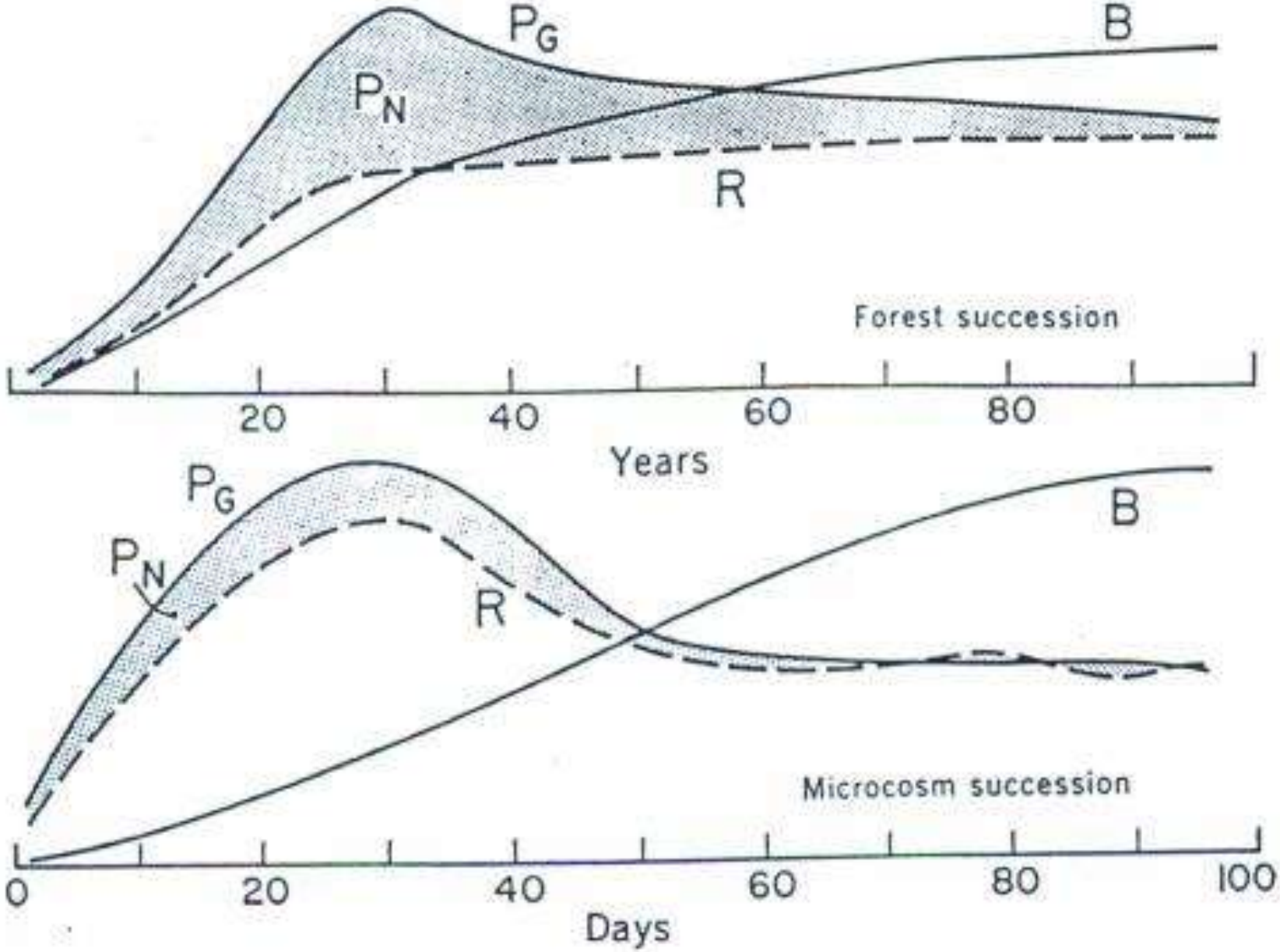
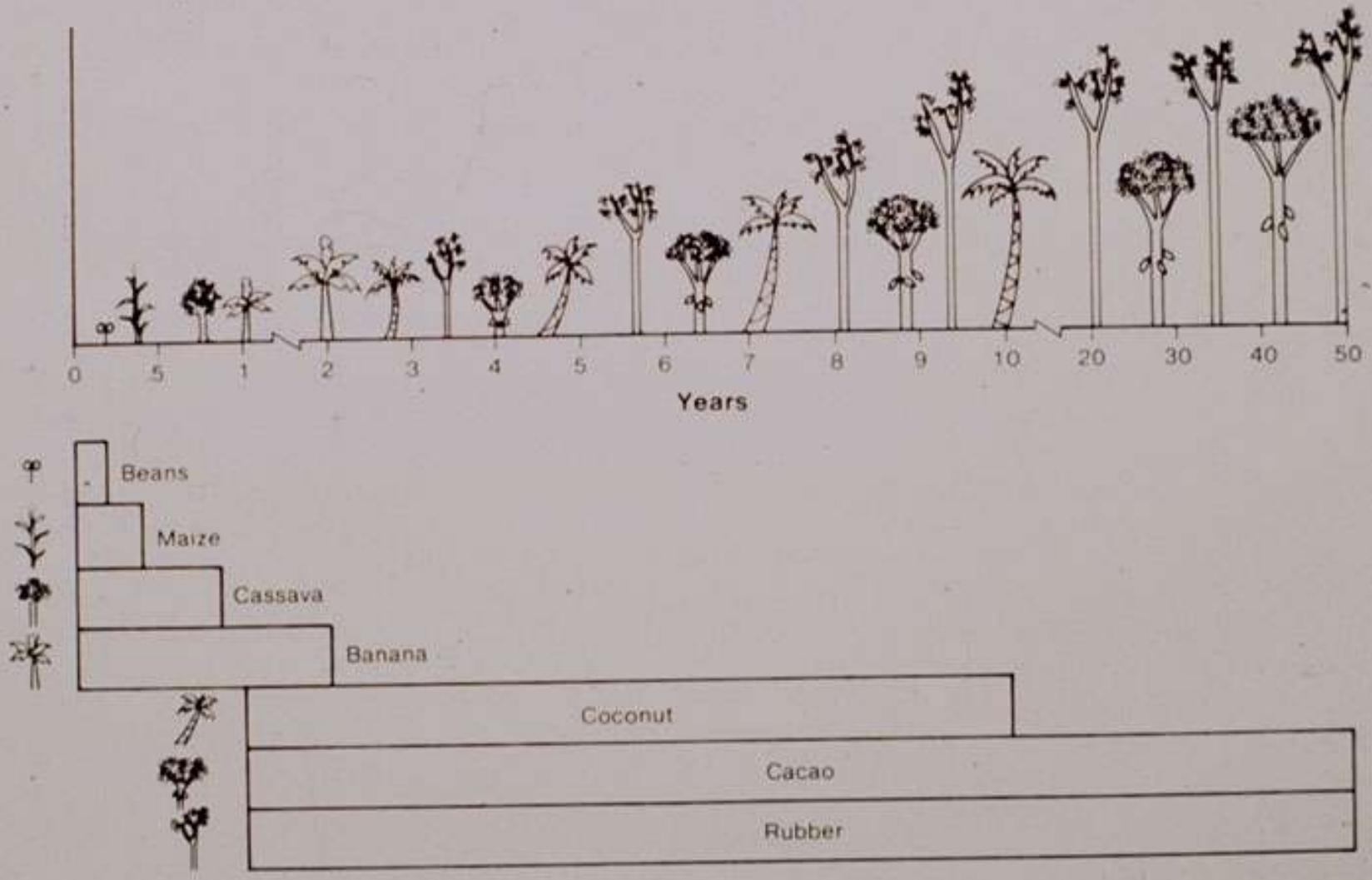
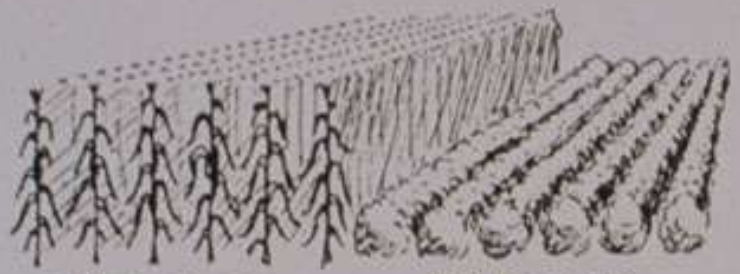

P_G
B
P_N
R
Forest succession
20
40
60
80
Years
P_G
B
P_N
R
Microcosm succession
0
20
40
60
80
100
Days

Figure 15.1. The Chronological Arrangement of Interplanted Crop Components in a Successional Mixed Cropping System



Source: Hart 1980.

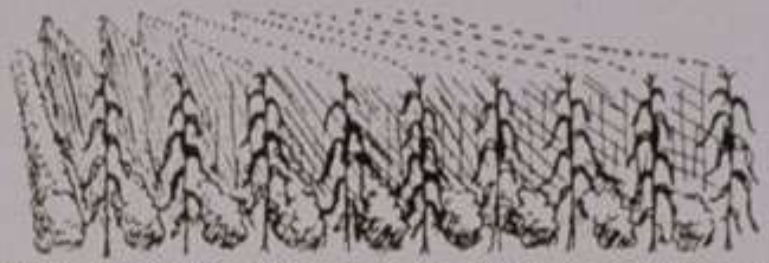
1 acre each yields



150 bushels corn

40 bushels soybeans

2 intercropped acres yield



270 bushels corn and 24 bushels soybeans

thus, the land equivalent for intercropping is:

270 bushels corn	@	150 bushels per acre	1.8 acres
24 bushels soybeans	@	40 bushels per acre	0.6 acres
		Total	2.4 acres

Under normal cropping you would need 2.4 acres to obtain the same yield produced from 2 intercropped acres. This means intercropping (in this case) made 20 percent better use of the available land. Below are actual examples of land use with intercropping around the world.

Crops	Land Use	Country
Corn & Rice	1.6	Phillipines
Corn & Peanuts	1.5	Taiwan
Sorghum & Cotton	1.5	U.S.A.
Corn & Dry Beans	1.4	Colombia
Corn & Soybeans	1.4	India
Corn & Sugarbeets	1.4	Canada
Sorghum & Cowpeas	1.3	Nigeria

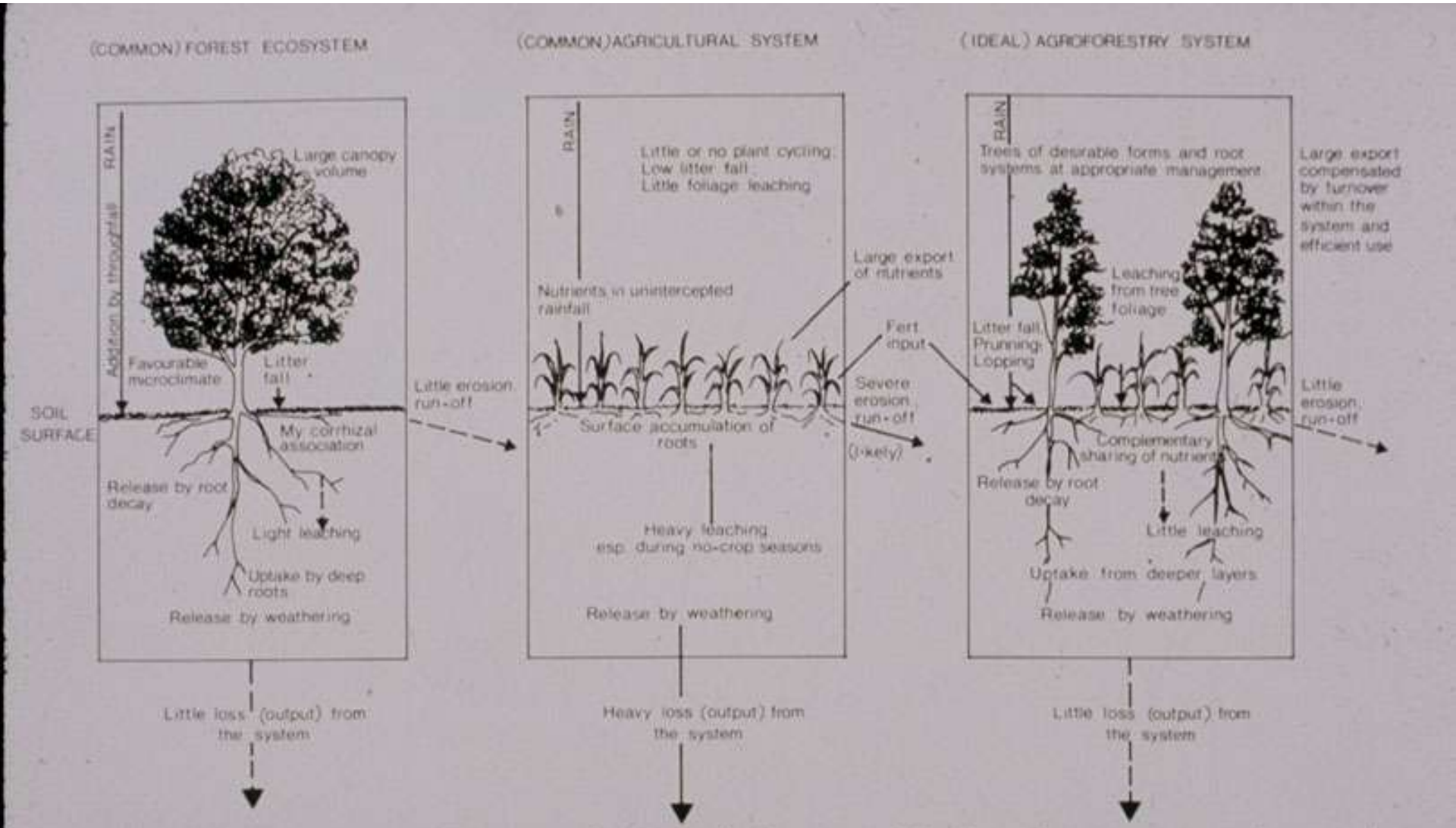
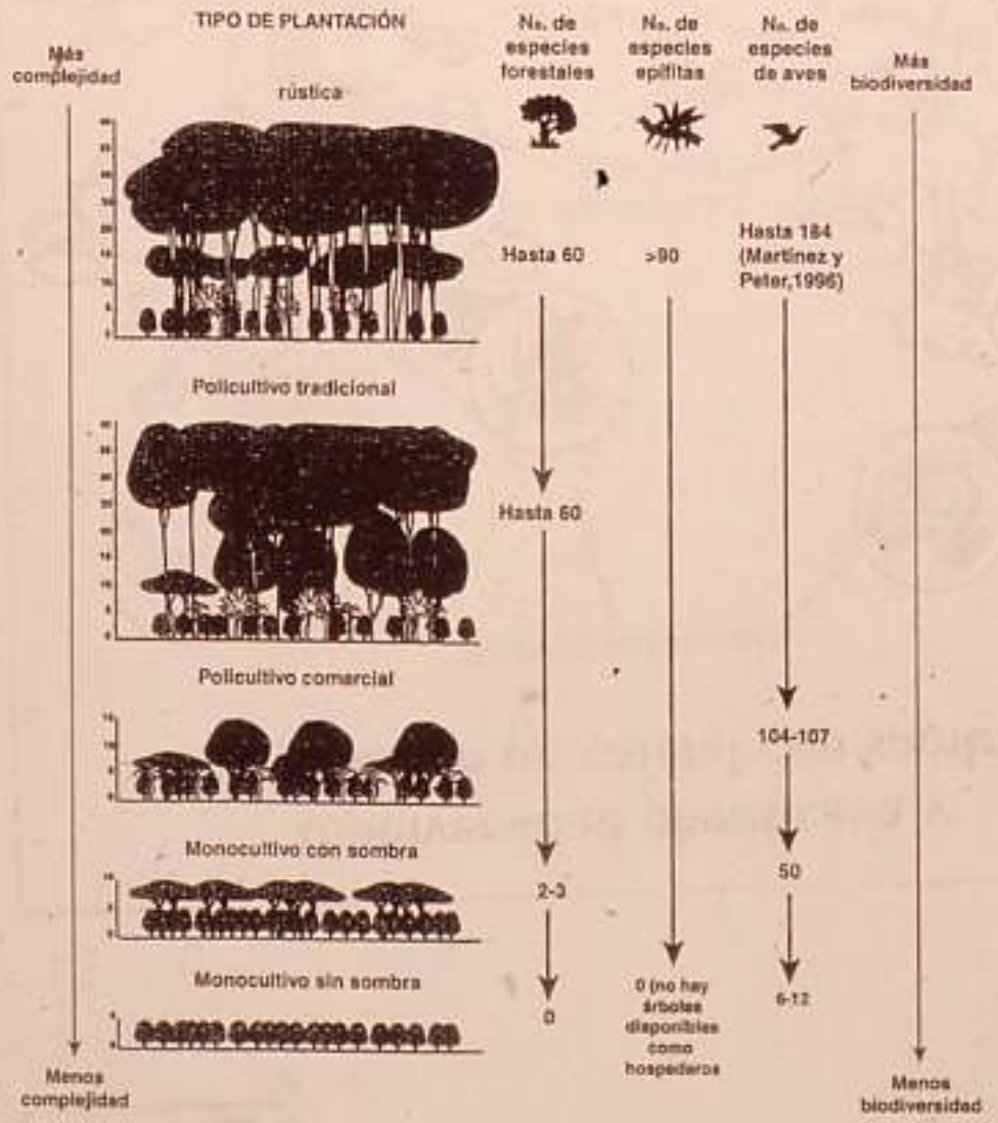
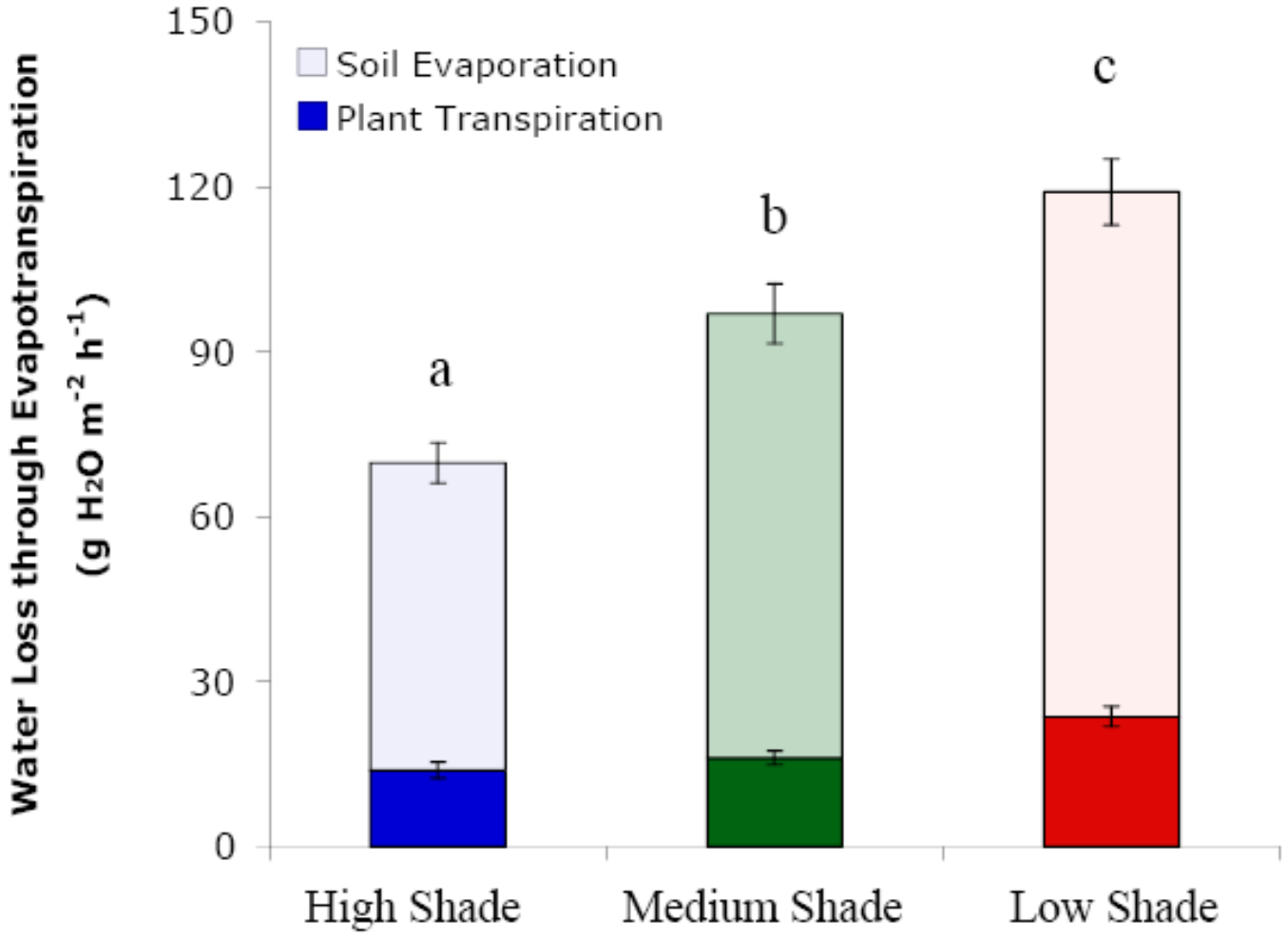


Fig. 21.2. Schematic presentation of nutrient relations and advantages of ideal agroforestry systems in comparison with common agricultural and forestry systems.

La biodiversidad en plantaciones de café depende de su estructura y densidad de la sombra



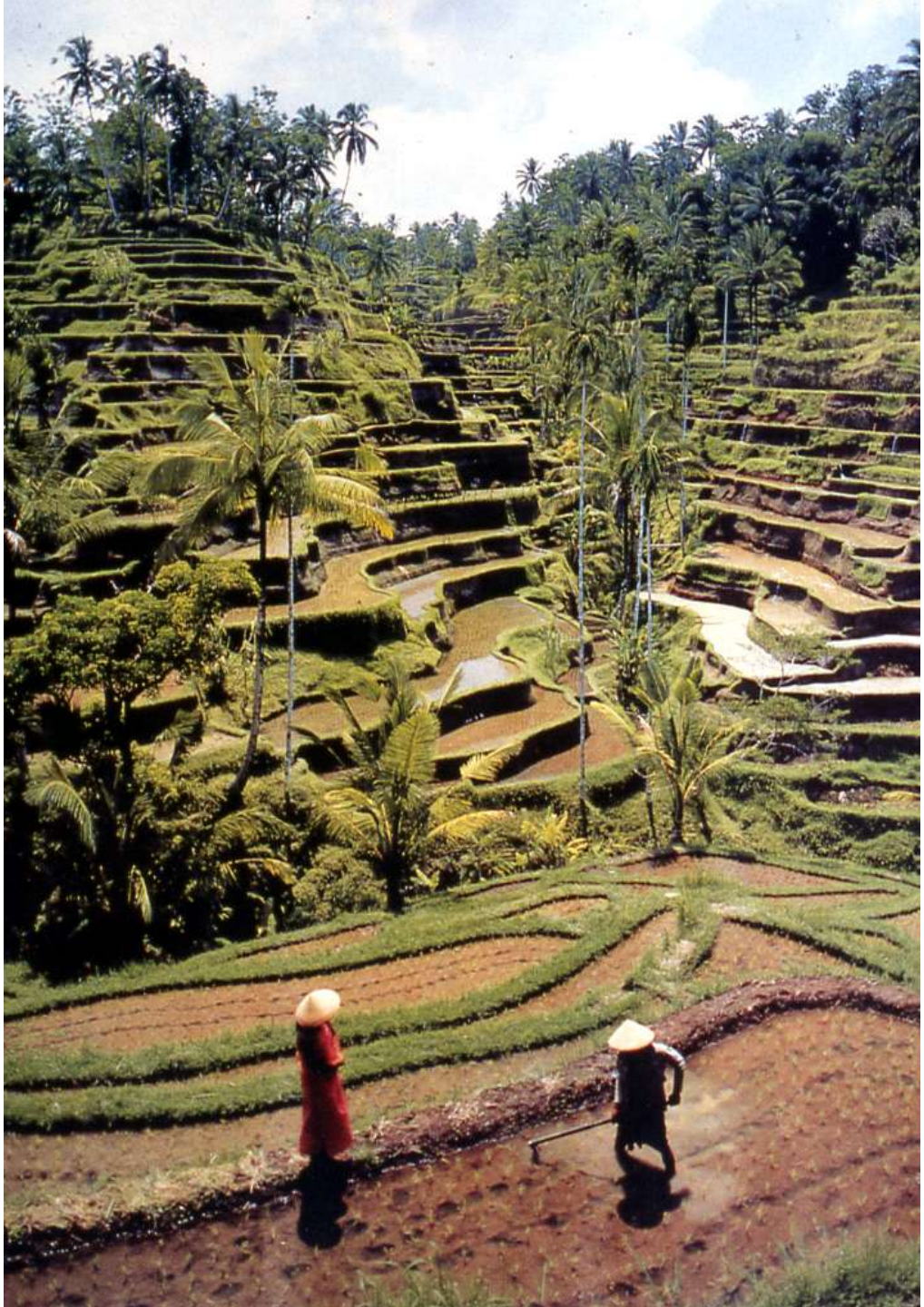
Microclimate variability: Evaporative loss



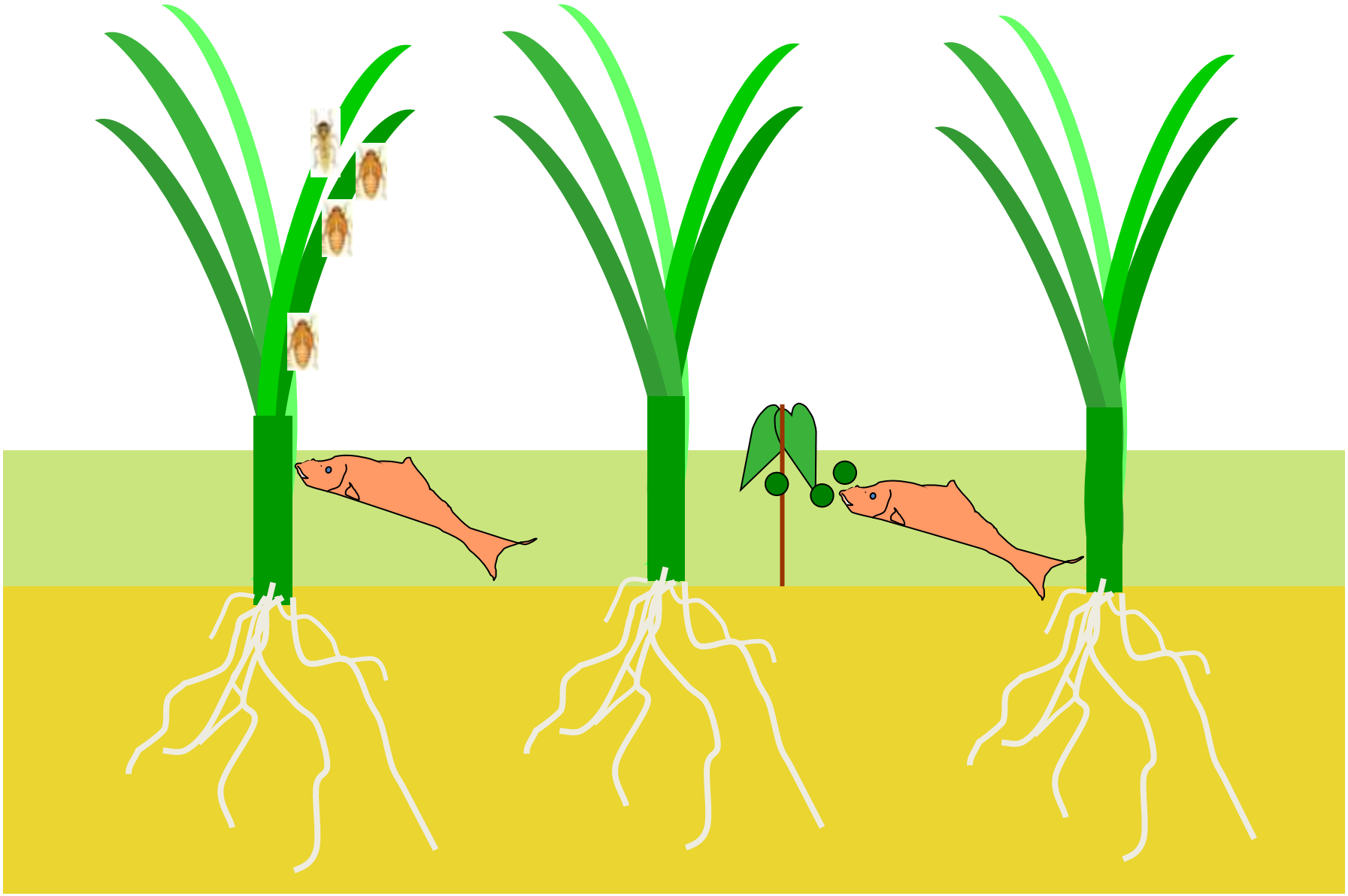
(Lin, *In revision*, Agriculture and Forest Meteorology)


Improved grasses are vulnerable to droughts.

Sucesión vegetal manejada




2006 7 28



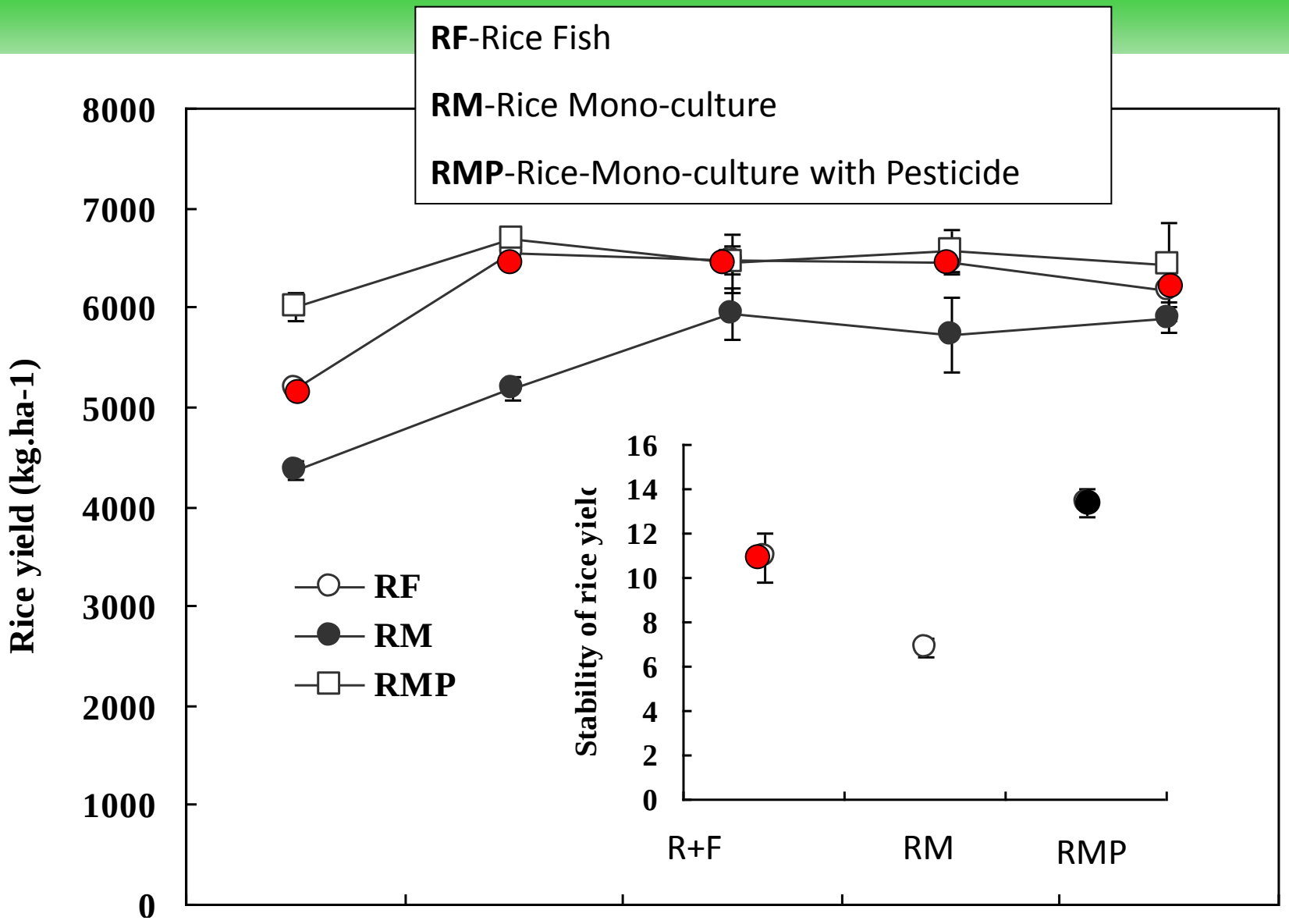


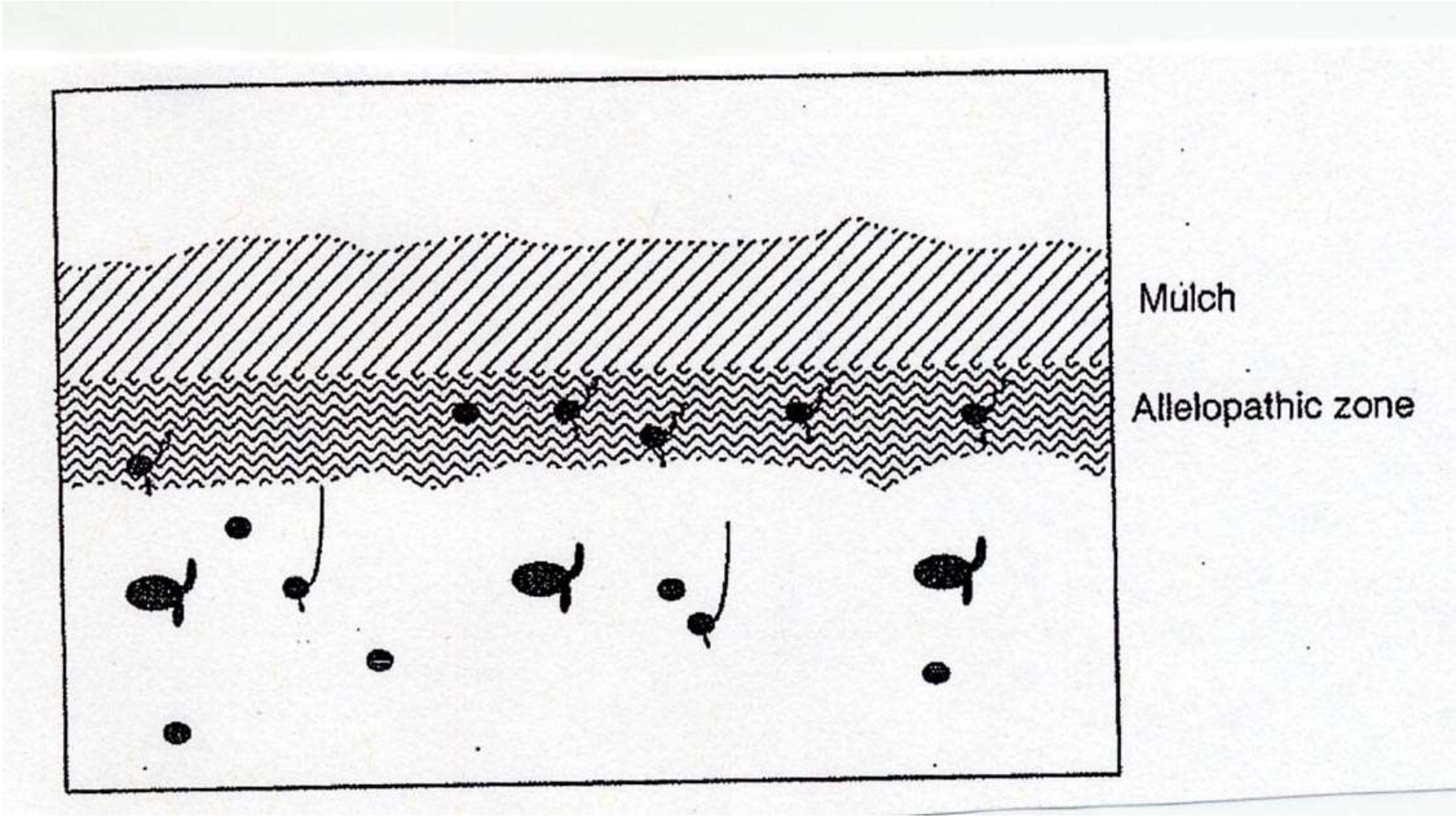
Fig. 2 Rice yields and temporal stability of rice yield (a), and fish yield and temporal stability of rice yield (b) over the 5 experimental years. RF: rice-fish co-culture; RM: rice monoculture; RMP: rice monoculture with pesticides; FM: fish monoculture.

Maiz de cajete

Cover crop mixture

- Centeno (*Secale cereale*) - 80 kg.ha^{-1}
- Veza (*Vicia sativa*) - 60 kg.ha^{-1}
- Rabano forrajero (*Raphanus sativus*) - 15 kg.ha^{-1}




Mulch
Allelopathic zone

The Campesino a Campesino Movement

- The Campesino a Campesino movement is an extensive grassroots movement in Central America and Mexico.
- It is a cultural phenomenon, a broad-based movement with campesinos as the main actors
- The Campesino a Campesino movement is an excellent example of how alternative technologies and practices can be disseminated bypassing "official channels".
- It is a bottom up, horizontal mechanism for knowledge sharing and technology transfer

Extensionismo Clásico

Investigadores desarrollan un tecnología

↓

Hacen pruebas en campo

↓

Hacen más pruebas en unas fincas campesinas

↓

Extensionistas montan parcelas demostrativas, días de campo y hacen visitas de asistencia técnica

↓

La familia campesina adopta o rechaza la tecnología

Campesino a Campesino

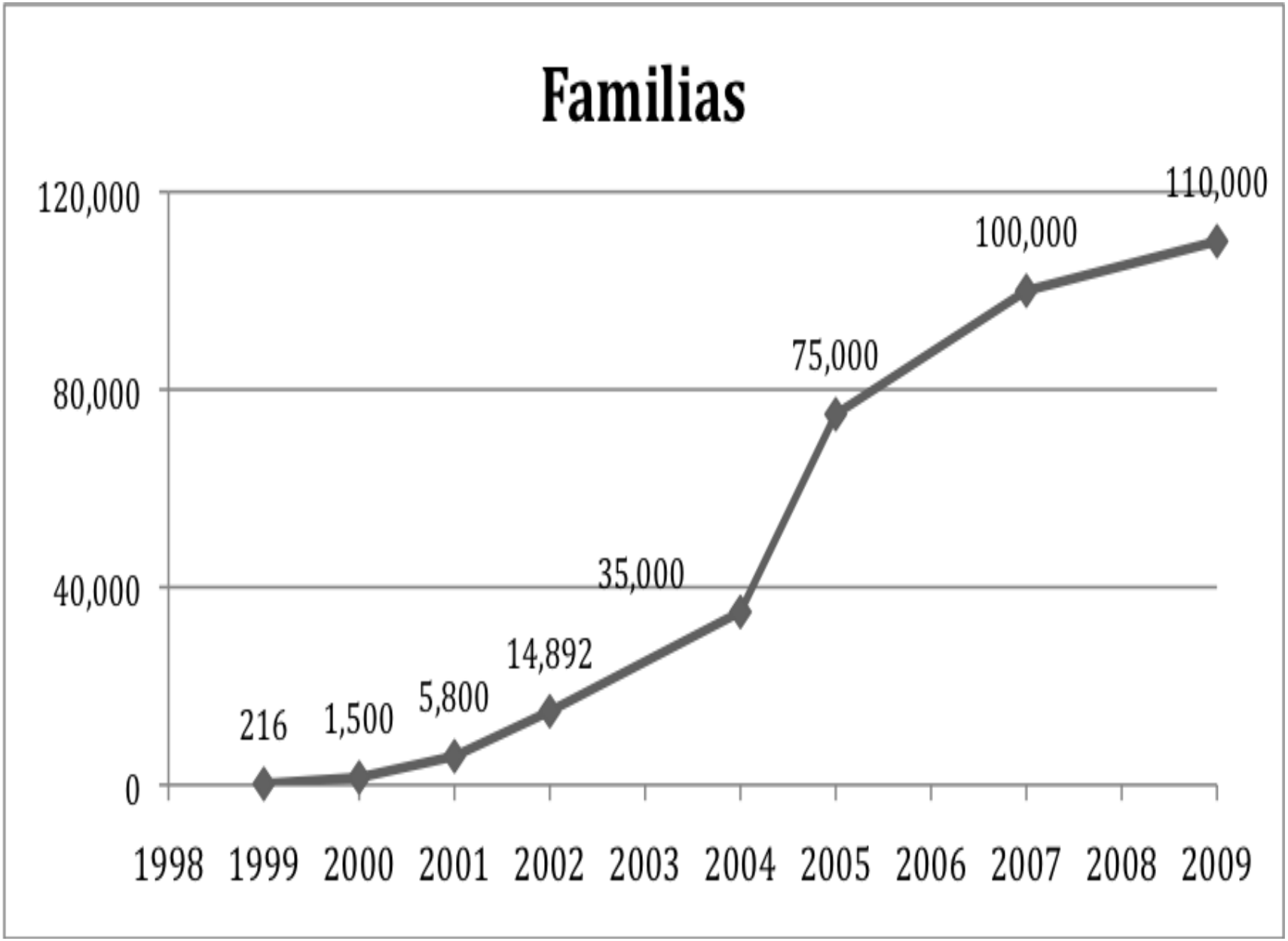
Un campesino ya tiene una solución, o innova una solución, a un problema que es común entre otros campesinos

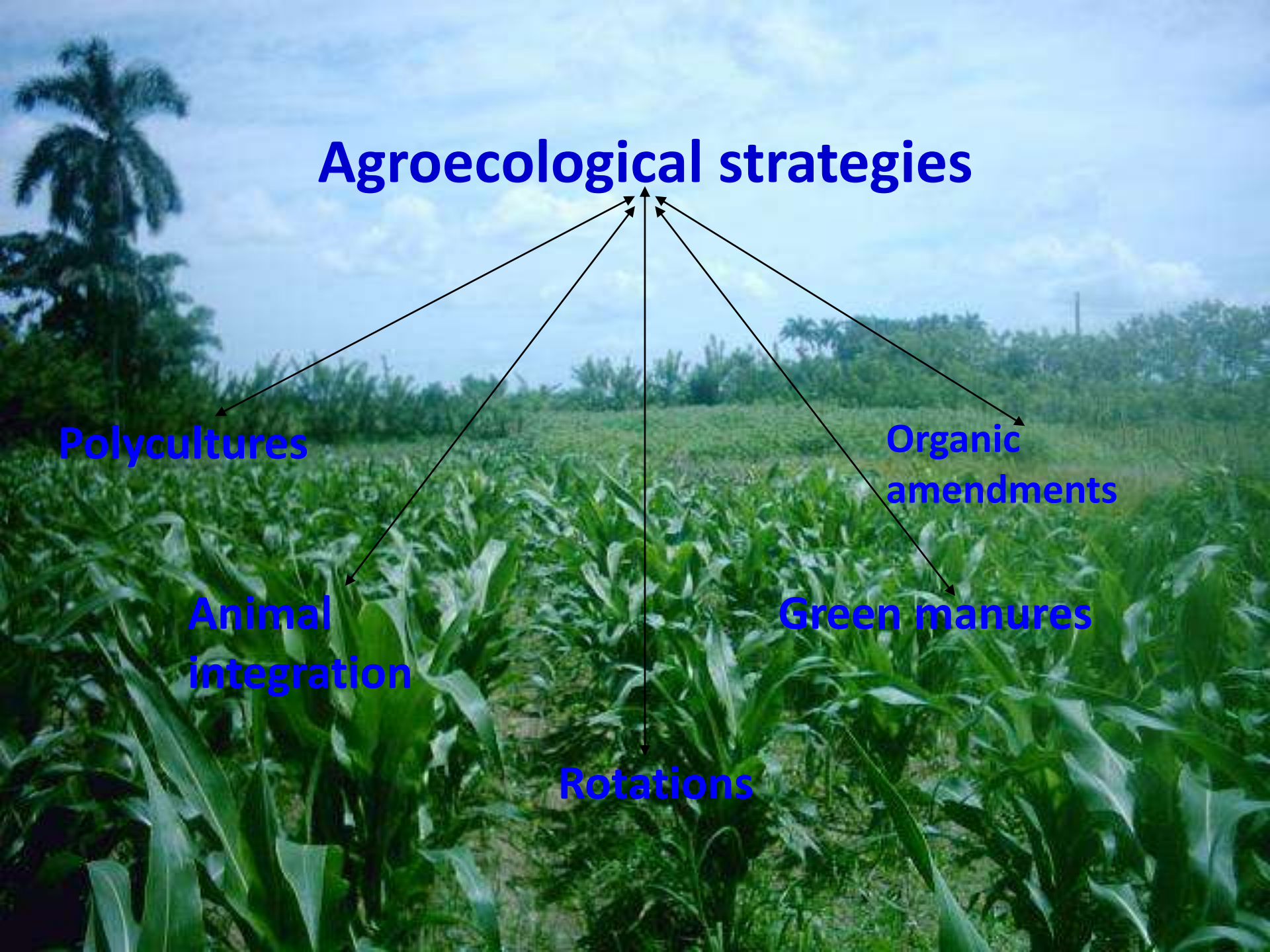
↓

Se convierte en promotor de esta nueva o recuperada práctica

↓

Se realicen intercambios en donde otros(as) visitan su finca para aprender, o en donde el visita a otros para enseñar


Familias
120,000
80,000
40,000
0
216
1,500
5,800
14,892
35,000
75,000
100,000
110,000
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009

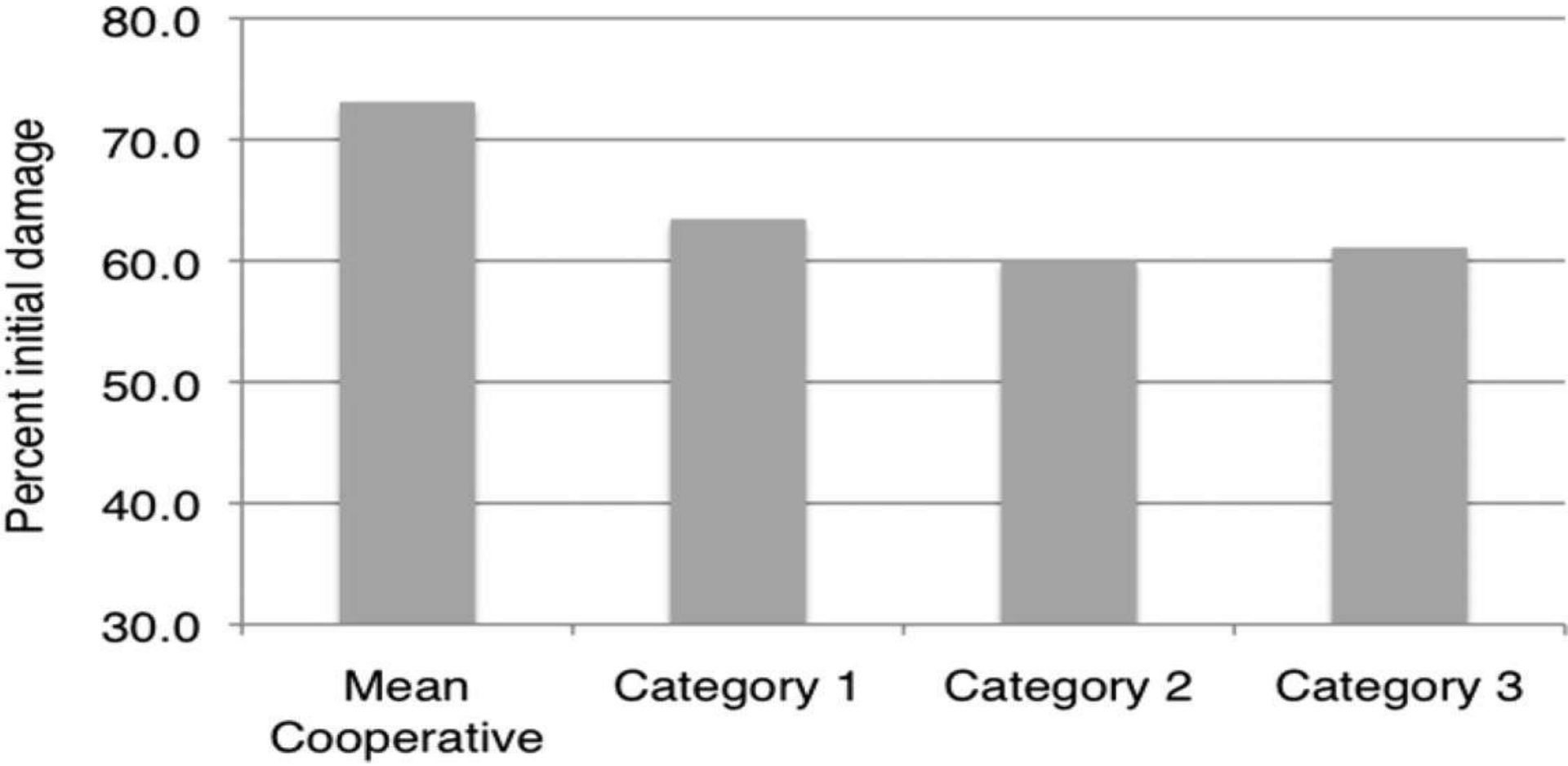

Agroecological strategies
Polycultures
Organic amendments
Animal integration
Green manures
Rotations

Finca “Del Medio” – José A. Casimiro

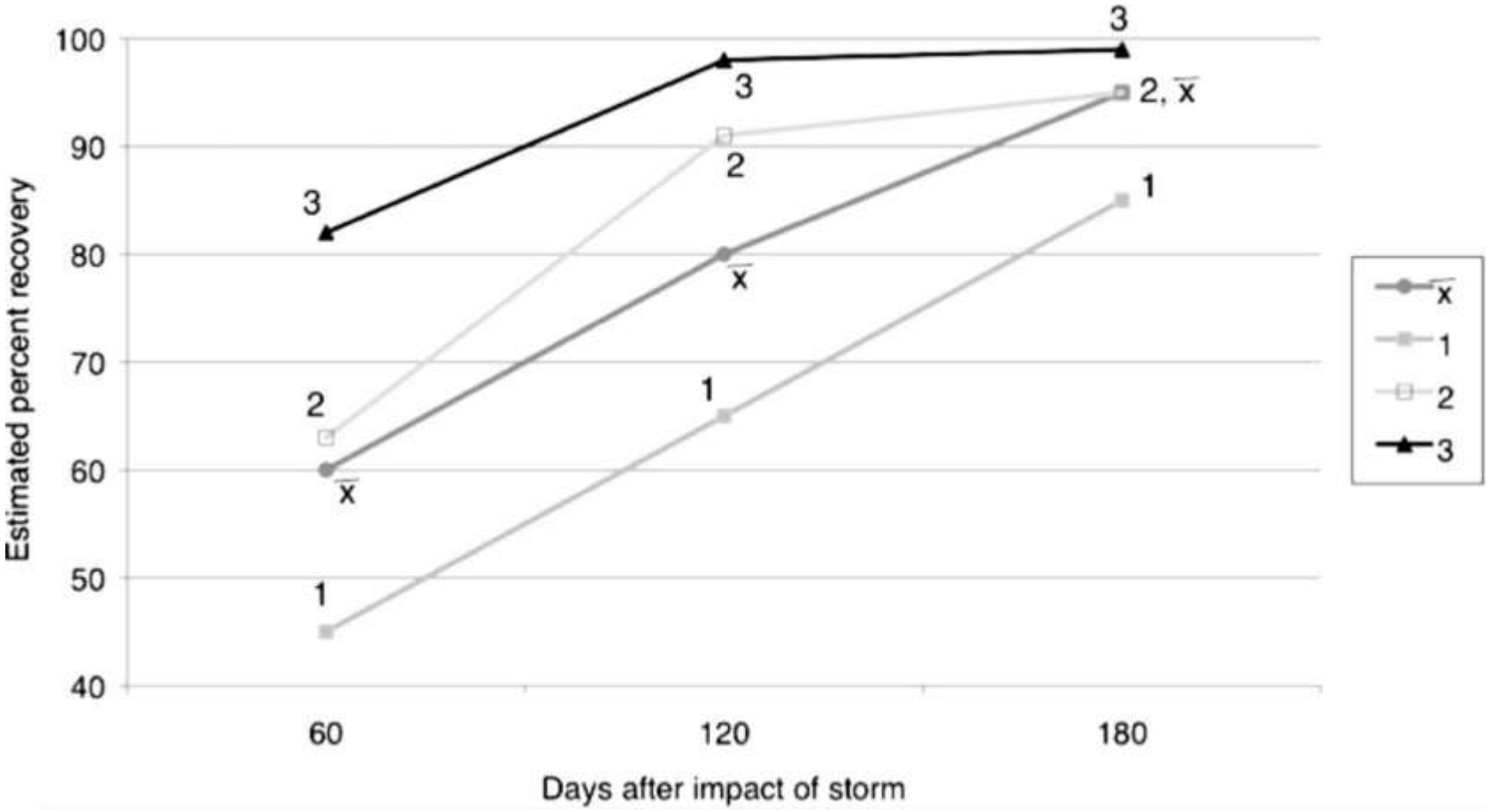
Sancti Spíritus

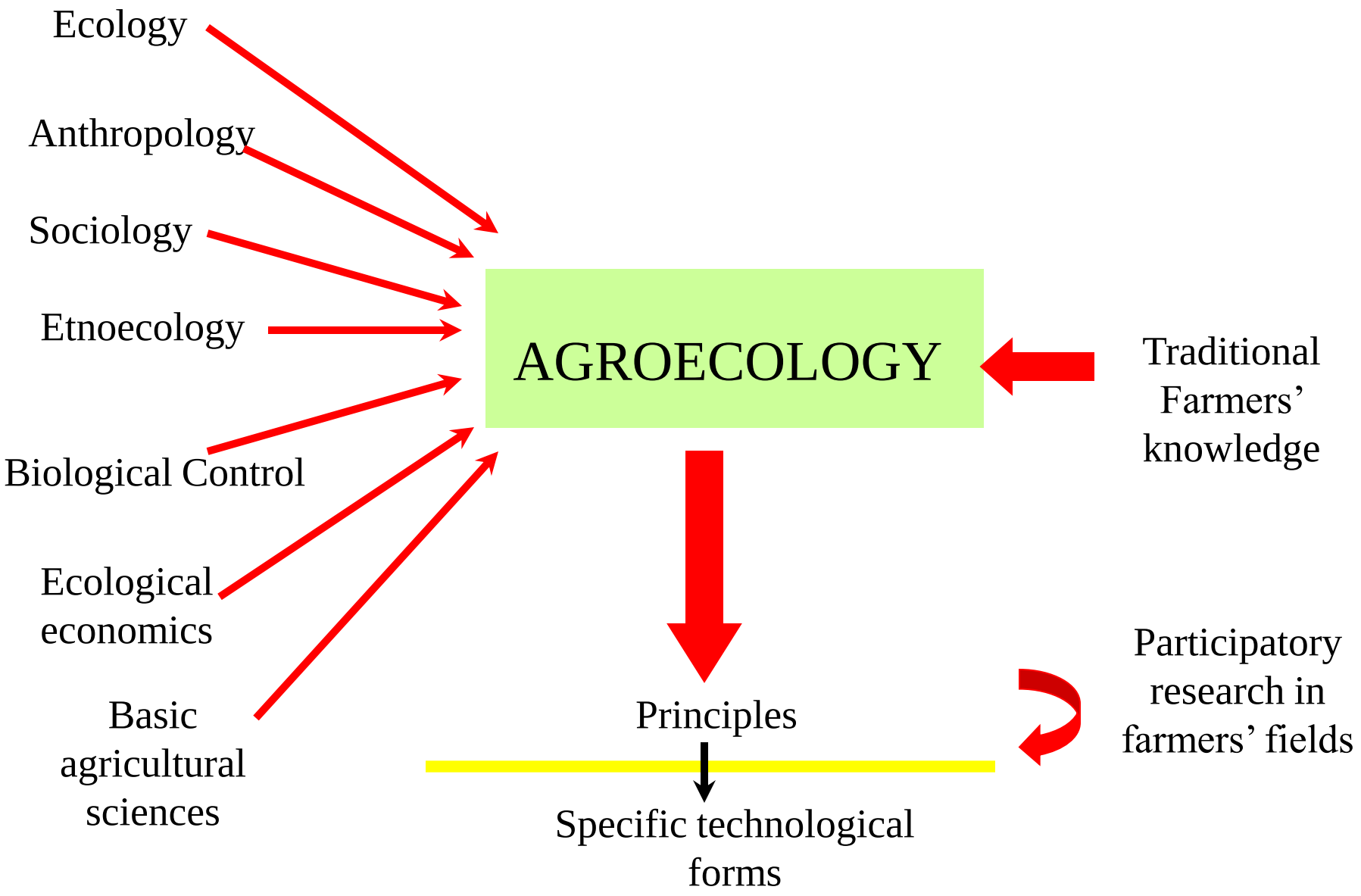
Area (ha)	**10**
Energy (GJ/ha/año)	**50.6**
Proteín (kg/ha)/año	**867**
People fed by produced energy (Pers/ha/año)	**11**
People fed by produced protein (Pers/ha/año)	**34**
Energy efficiency	**30**

% de dano incial a fincas por el Huracan Ike (2008) la coopertaiva Rafael Zaroza' en Sancti Spıritus,Cuba, escala 1¼ bajo, 3¼ alto,) segun grado de integracion agroecologica (1 baja, 3 alta).



% 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.




Ecology
Anthropology
Sociology
Etnoecology
Biological Control
Ecological economics
Basic agricultural sciences
AGROECOLOGY
Traditional Farmers' knowledge
Principles
Specific technological forms
Participatory research in farmers' fields

Agroecological principles underlying productivity, sustainablity and viability of agroecoystems

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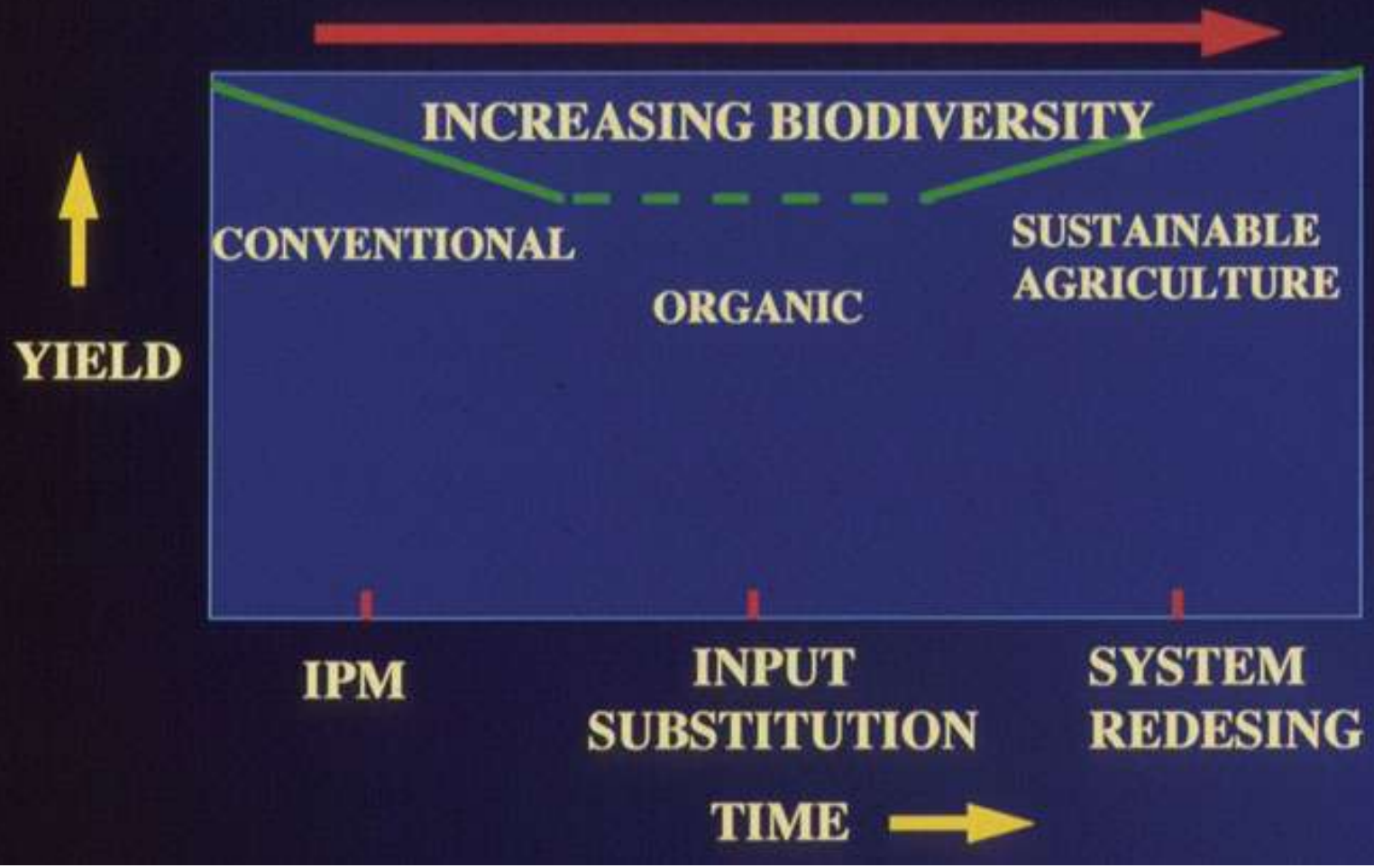
1. Spatial and temporal genetic and species diversity at farm and landcape level

2.Crop and animal integration

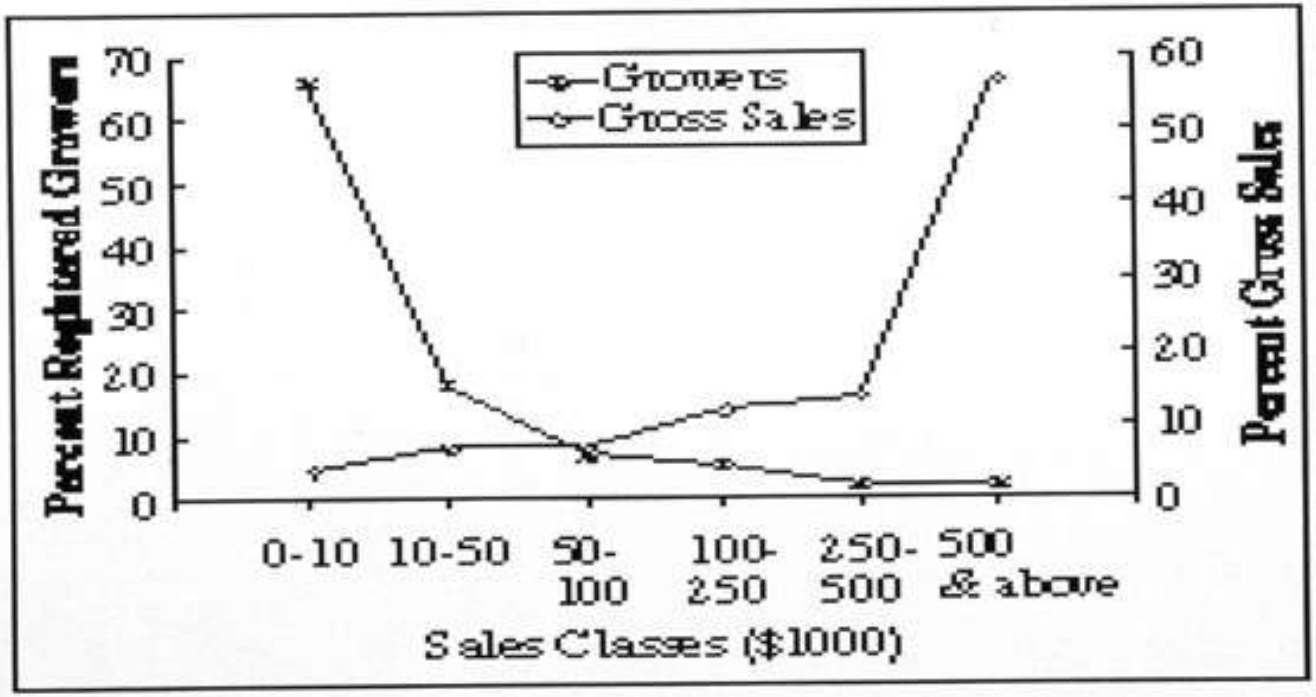
3. Biologically active soils and high biomass recyling rates

4. Optimization of the use of space (Agroecological design)

Stages in the Agroecological Conversion



Income concentration for organic growers during 1994-1995



Consolidation of organic farms in California

- Earthbound Farms: 25,000 under contract with 135 different farms
- Greenways Organic- 2,000 acres outside Fresno
- Cascadian Farm- General Mills, Grimmway Farms which owns Cal-Organic brand

Organic for export

- **Chile:** Certified organic crops took up a total of 151,097 hectares in 2009-2010 .
- 8961 tons of apples, kiwifruit, avocados, berries and asparragus were exported
- **Colombia:** 37000 has organically certified devoted to coffee, palm oil, sugar cane, coconut, cocoa, organic fruits (mango, bananas, raspberries), flowers and ornamental plants
- Value of organic exports > 20 million/year

The pillars of agroecosystem health

Agroecological Principles

Agroecosystem Design

"Below ground" Habitat Management, Biota Activation and Diversification(Soil Organic Matter, Nutrient Management)

"Above ground" Habitat Management, Plant Diversification and enhancement of beneficial fauna

Crop Health

Agroecosystem Health

Soil fertility and pests

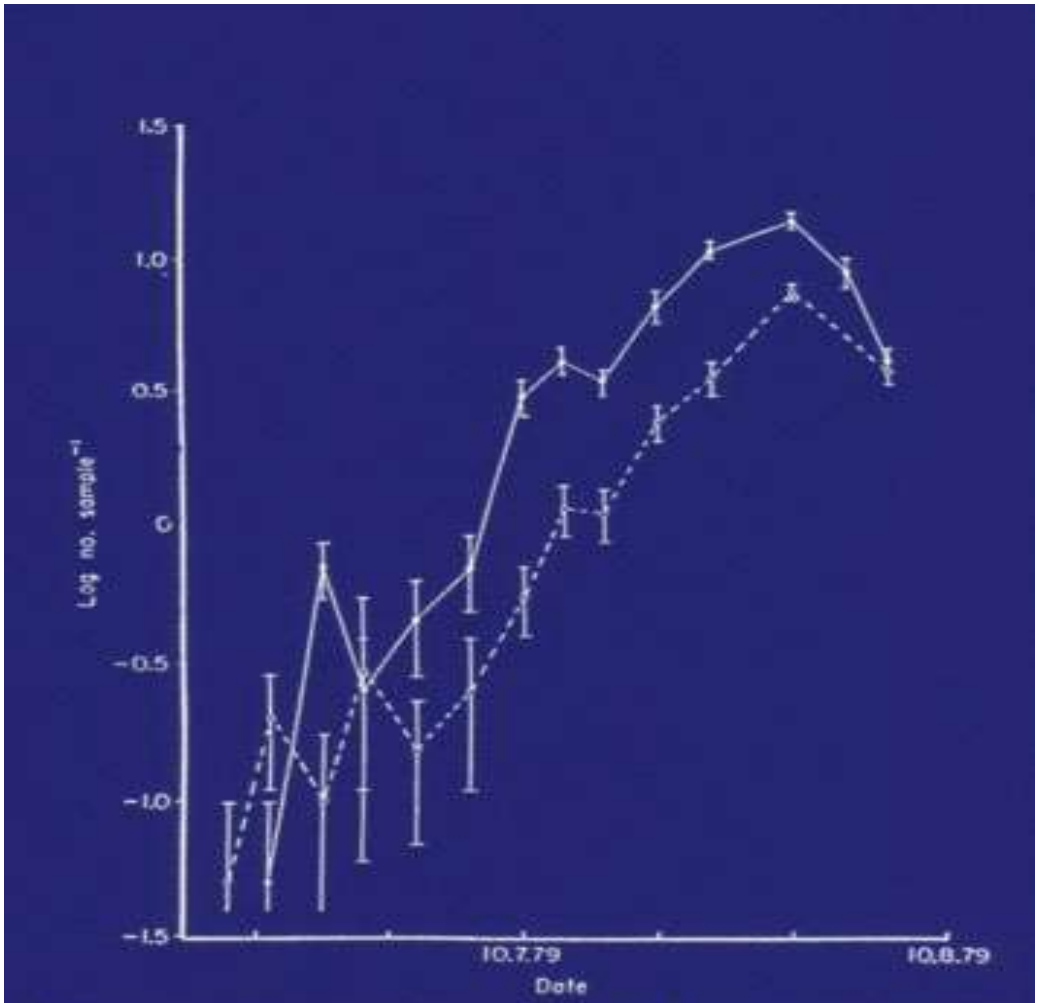
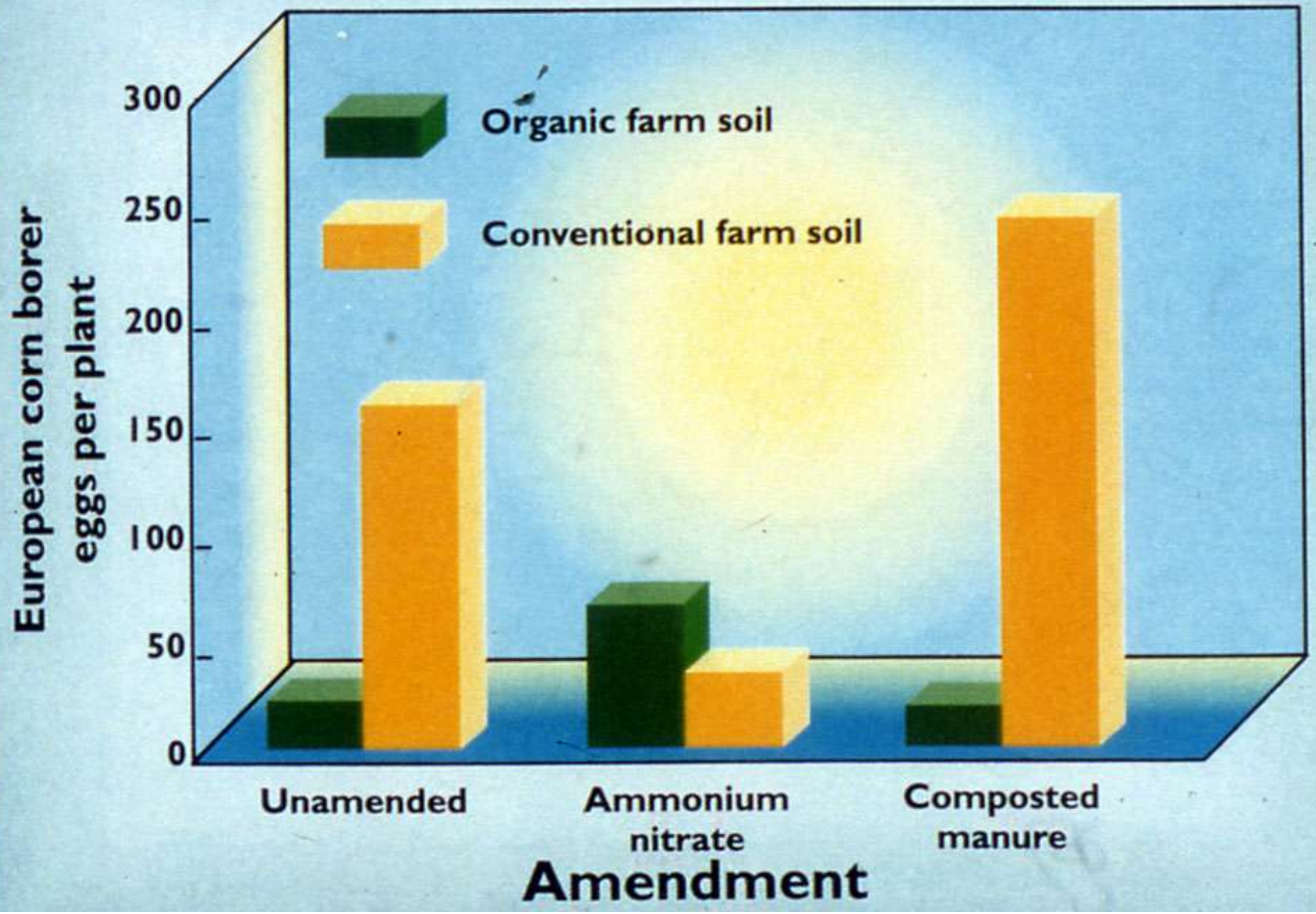
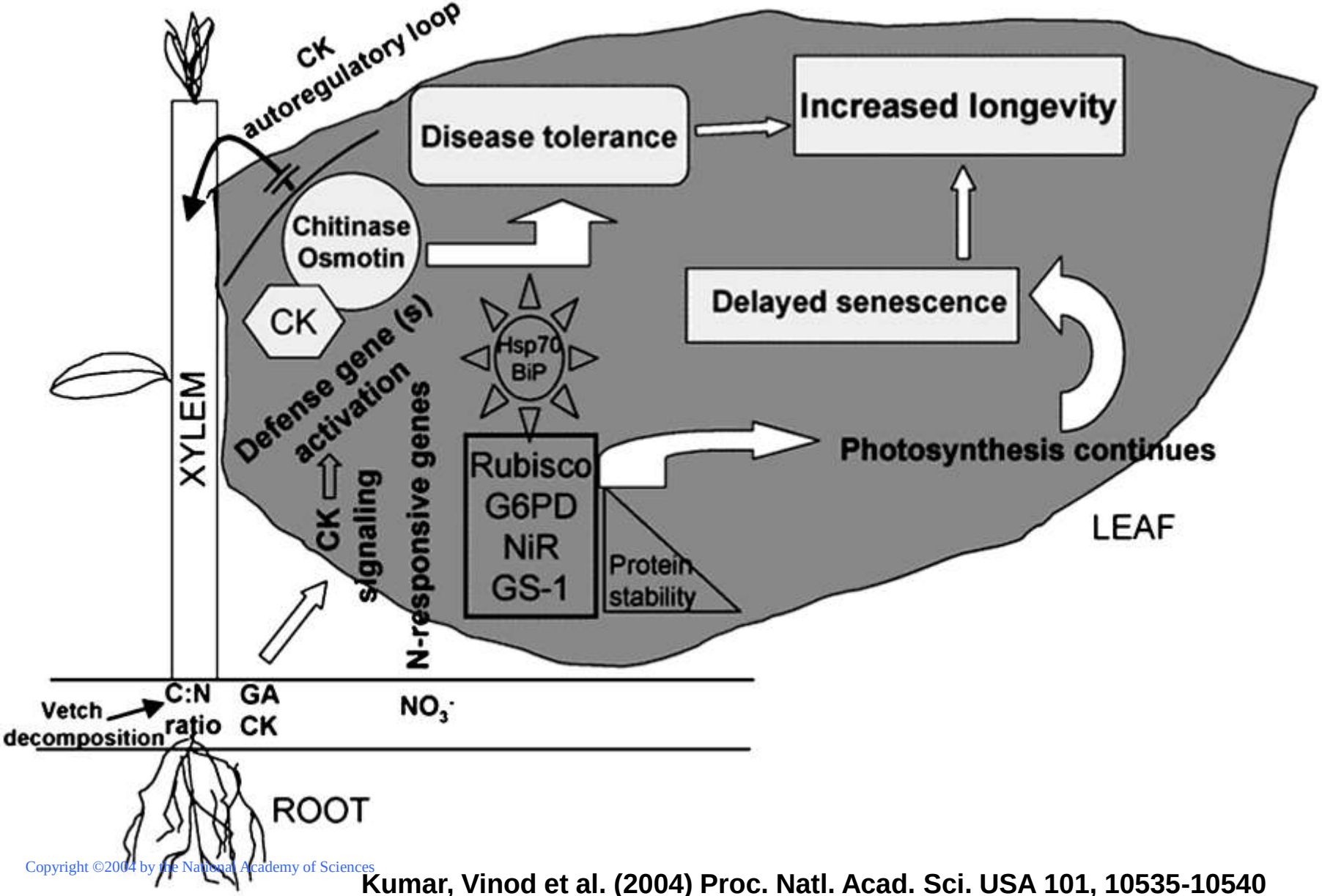


FIG. 13.2. *Sitobion avenae* population development on ●——● conventional and ○ - - - - ○ organic winter wheat. Bars represent ± one standard error.

European corn borer egg laying influenced by soil management

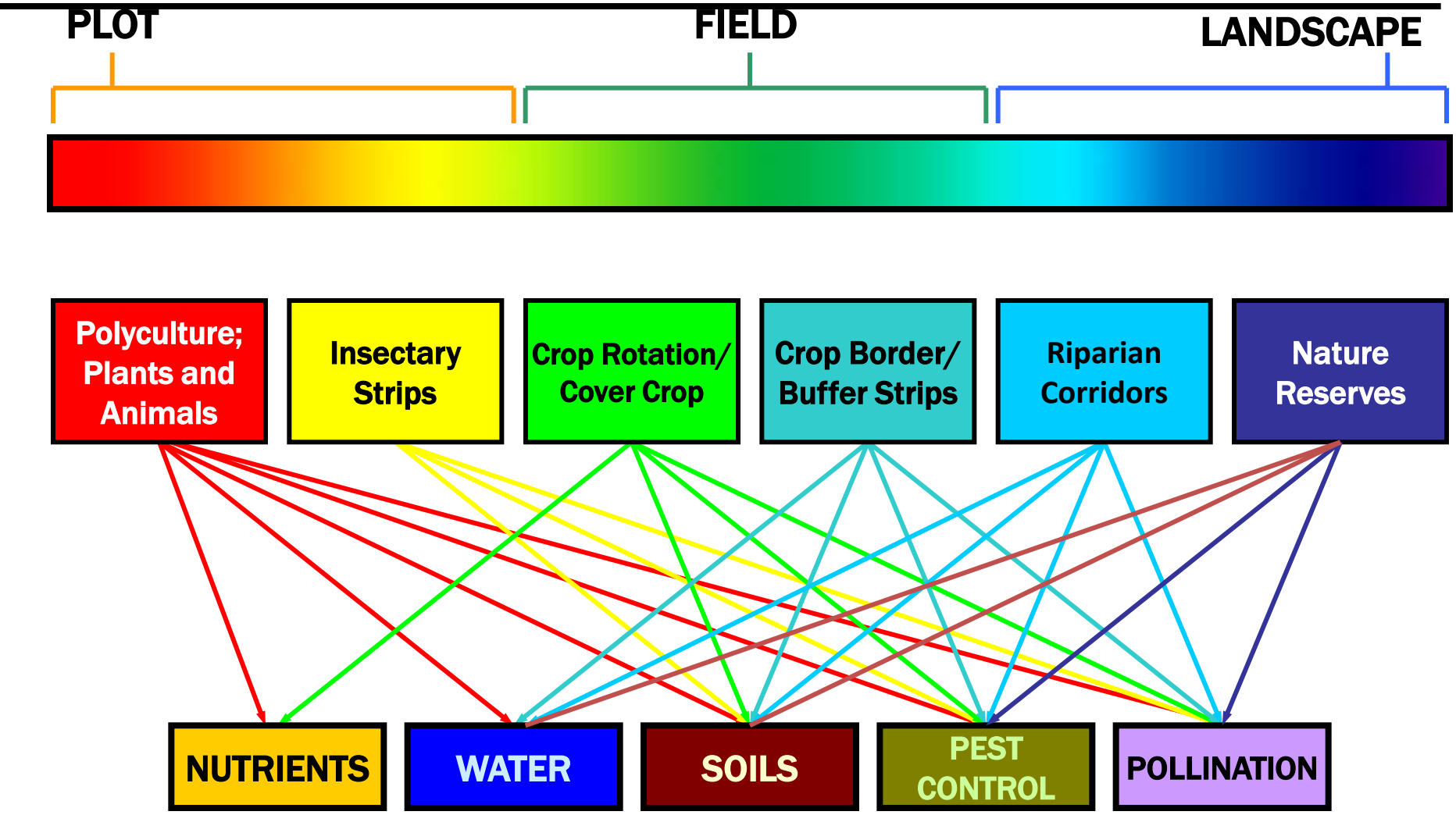


A schematic model showing factors that may be responsible for increased disease tolerance and delayed senescence in tomatoes grown under HV-based alternative agriculture system



Kumar, Vinod et al. (2004) Proc. Natl. Acad. Sci. USA 101, 10535-10540

DFS: restoring ecological services in farms



Modern intercropping?

- **Maize and flax seed**

- **Wheat and soybeans**


07-06-06

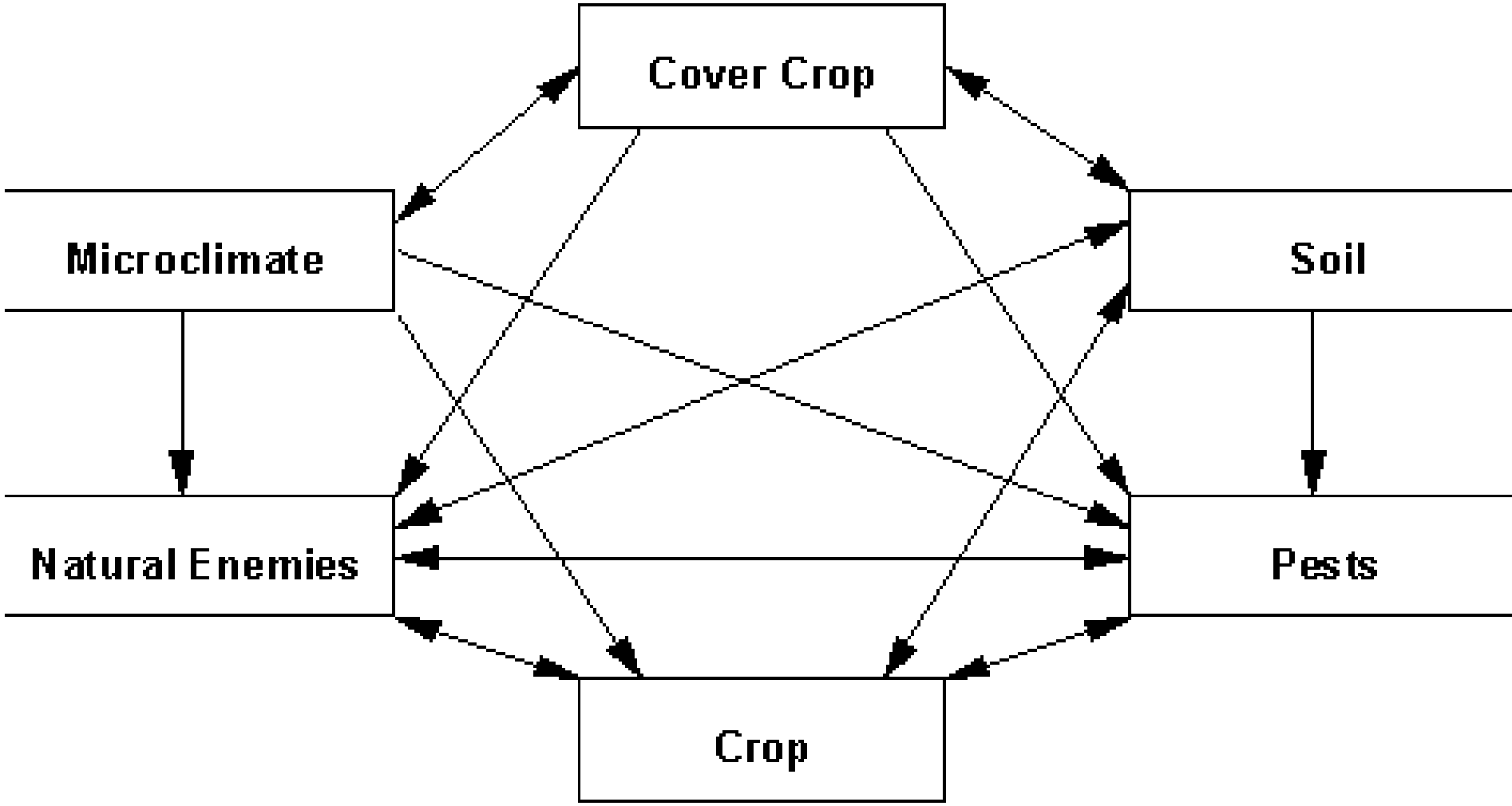
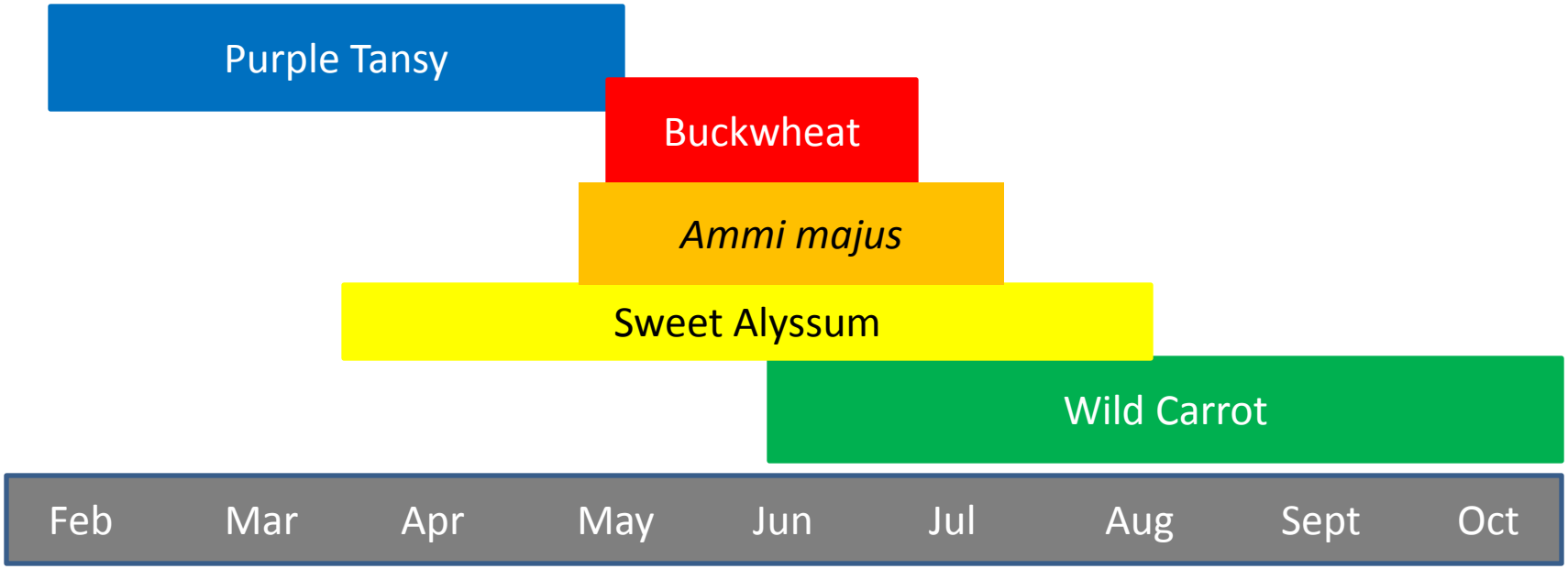


Figure 1. Diagram showing effects of cover crops on agroecosystems.

Full Season Bloom Sequence

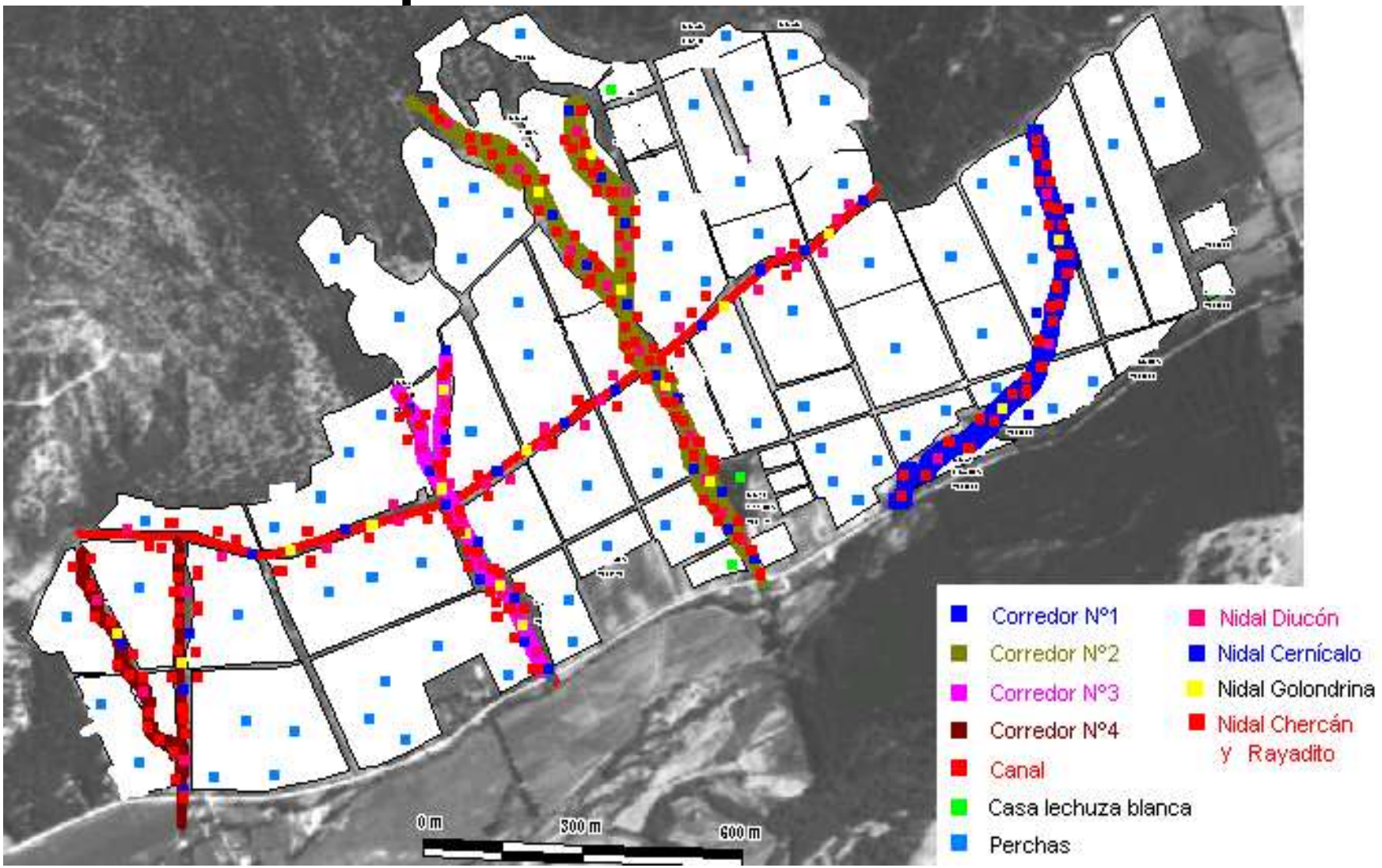


Biodiversity at the landscape level: hedgerows, corridors

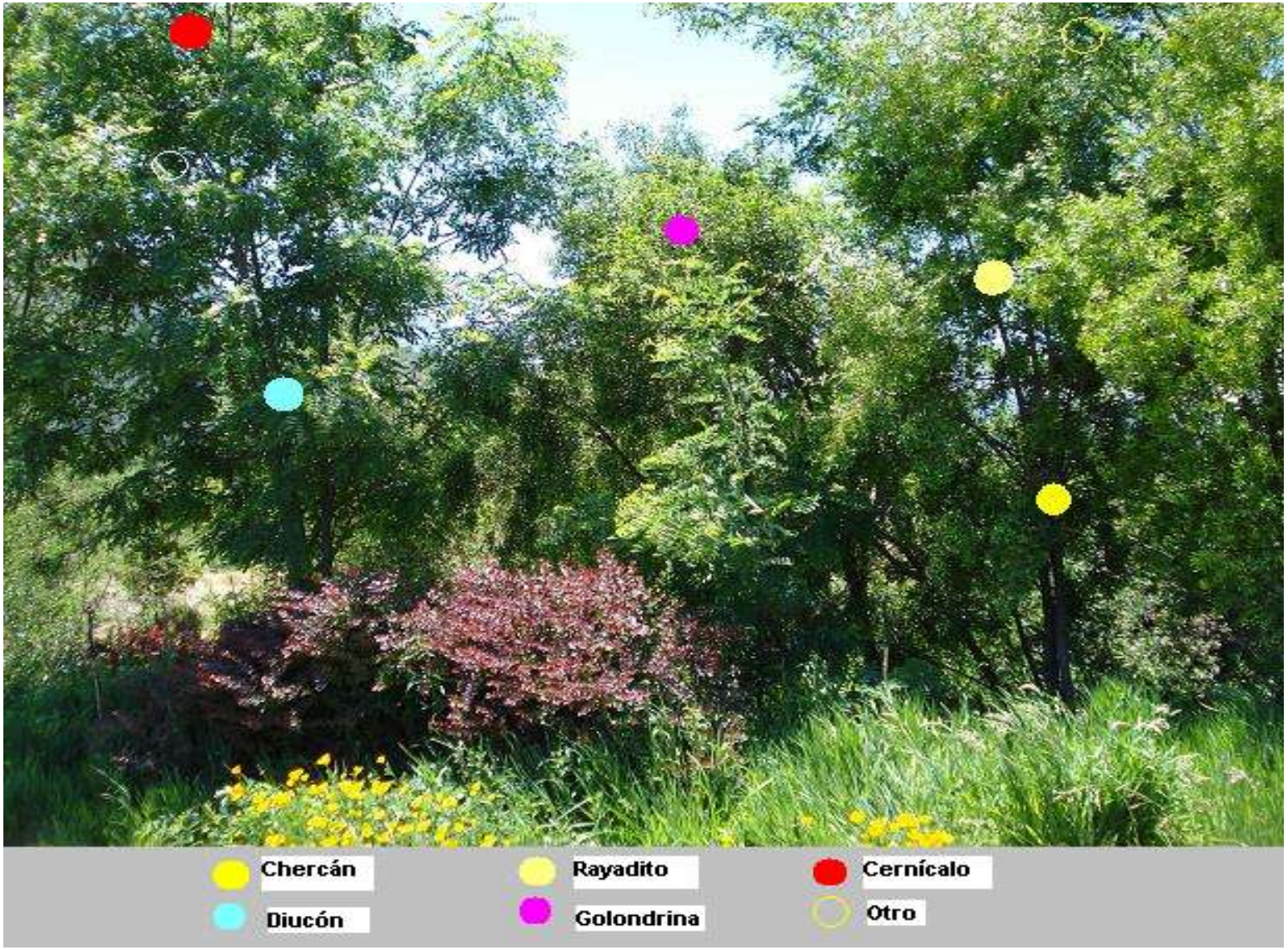
Biodiversity corridor in Fetzer Vineyard

Bonterra Vineyards – Habitat Corridor – 104 plant species

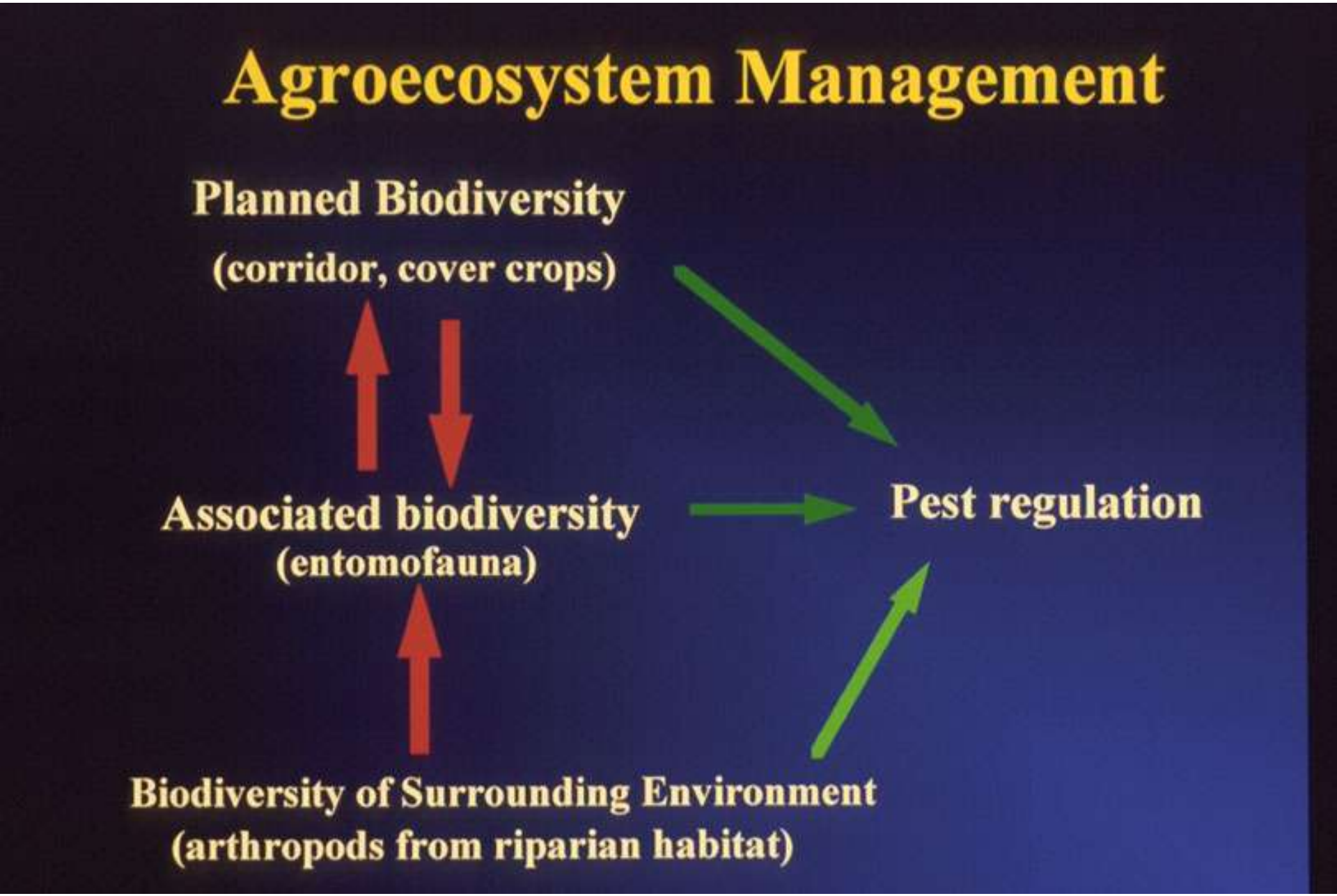
Distribución de nidales y perchas dentro del predio ”Los Robles”

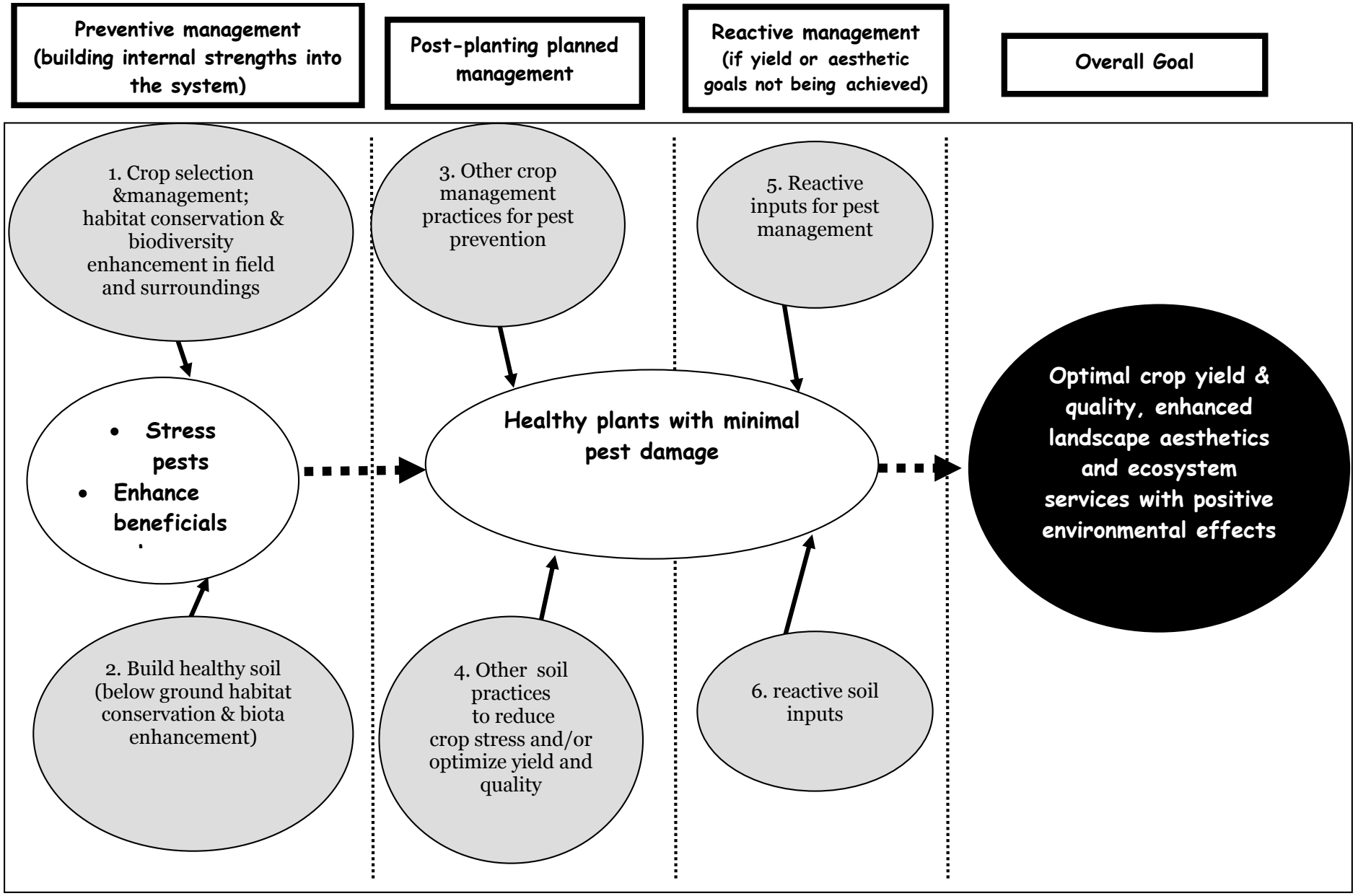


Posible ubicación de las casitas para nidificación, de acuerdo al micro hábitat de las distintas especies de aves insectívoras



Agroecosystem Management



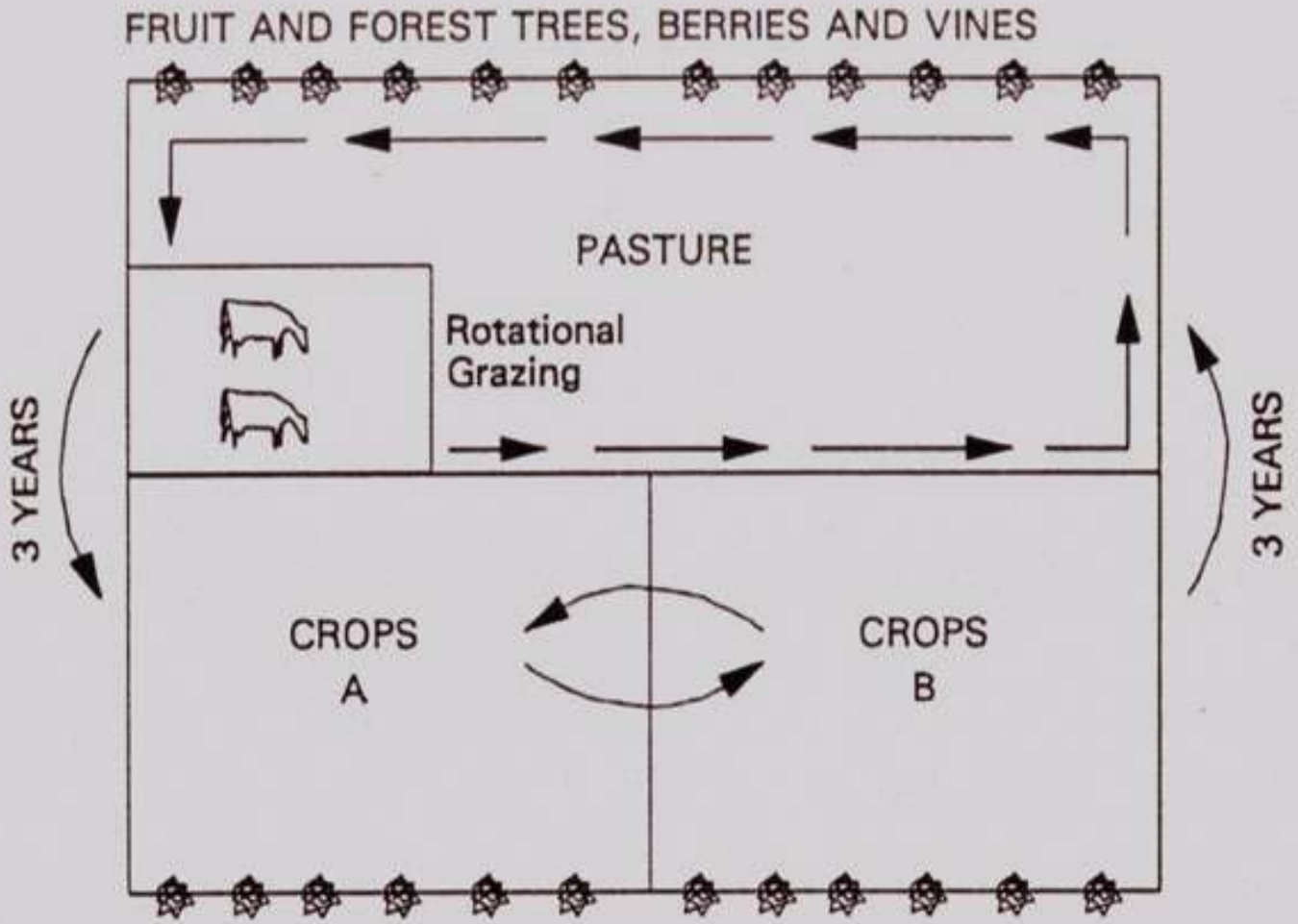


A Framework for ecological crop management (4/19/03)

Producción vegetal

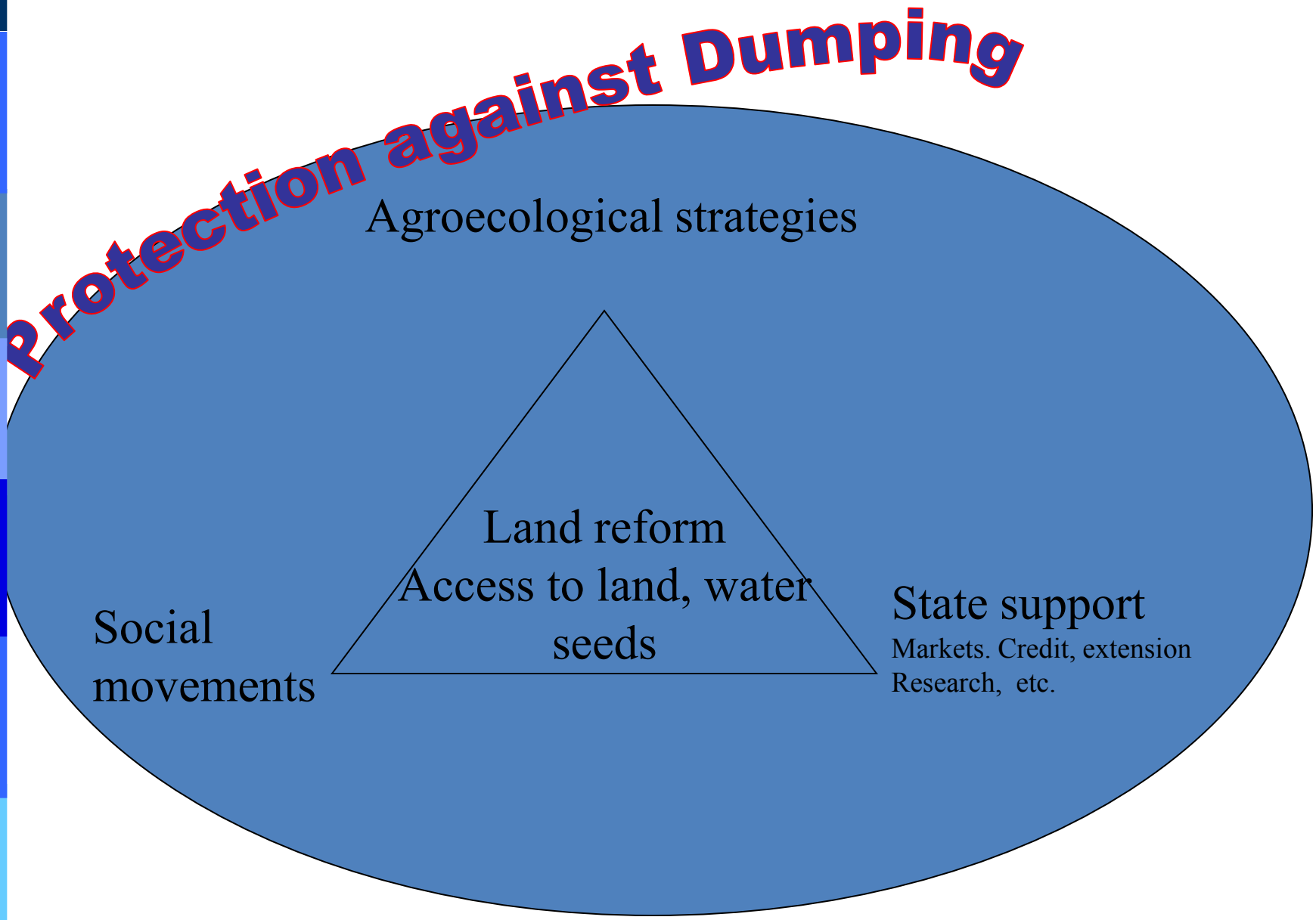
Sistema integrado

Producción animal



Note: This model shows an integrated farm with spatial and temporal designs of crops, pasture, animals and trees. The pasture constitutes the "charging phase" of the rotation while the crops constitute the "extractive phase". Animals are managed with rotational grazing.

The pillars of food sovereignity



Badgley et al. 2007 (estudio de la Universidad de Michigan)

1: org.=conven. < l: conven. mayor que org. >1: org. mayor que conven.

	(A) World			(B) Developed countries			(C) Developing countries		
Food category	***N***	**Av.**	**S.E.**	***N***	**Av.**	**S.E.**	***N***	**Av.**	**S.E.**
Grain products	171	1.312	0.06	69	0.928	0.02	102	1.573	0.09
Starchy roots	25	1.686	0.27	14	0.891	0.04	11	2.697	0.46
Sugars and sweeteners	2	1.005	0.02	2	1.005	0.02			
Legumes (pulses)	9	1.522	0.55	7	0.816	0.07	2	3.995	1.68
Oil crops and veg. oils	15	1.078	0.07	13	0.991	0.05	2	1.645	0.00
Vegetables	37	1.064	0.10	31	0.876	0.03	6	2.038	0.44
Fruits, excl. wine	7	2.080	0.43	2	0.955	0.04	5	2.530	0.46
All plant foods	266	1.325	0.05	138	0.914	0.02	128	1.736	0.09
Meat and offal	8	0.988	0.03	8	0.988	0.03			
Milk, excl. butter	18	1.434	0.24	13	0.949	0.04	5	2.694	0.57
Eggs	1	1.060		1	1.060				
All animal foods	27	1.288	0.16	22	0.968	0.02	5	2.694	0.57
All plant and animal foods	293	1.321	0.05	160	0.922	0.01	133	1.802	0.09

Casi 300 estudios comparativos de agricultura orgánica/agroecológica y agricultura convencional

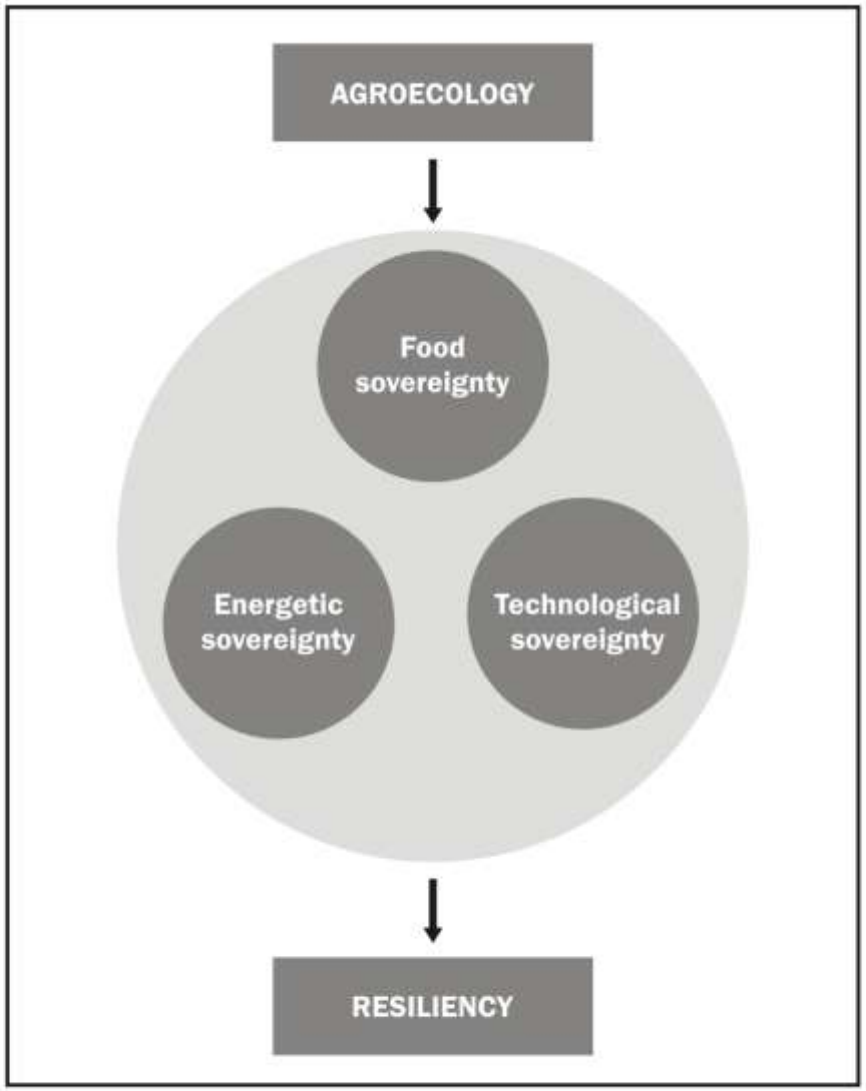


Figure 2. Agroecology, resiliency and the three types of sovereignty to be reached in a rural community.

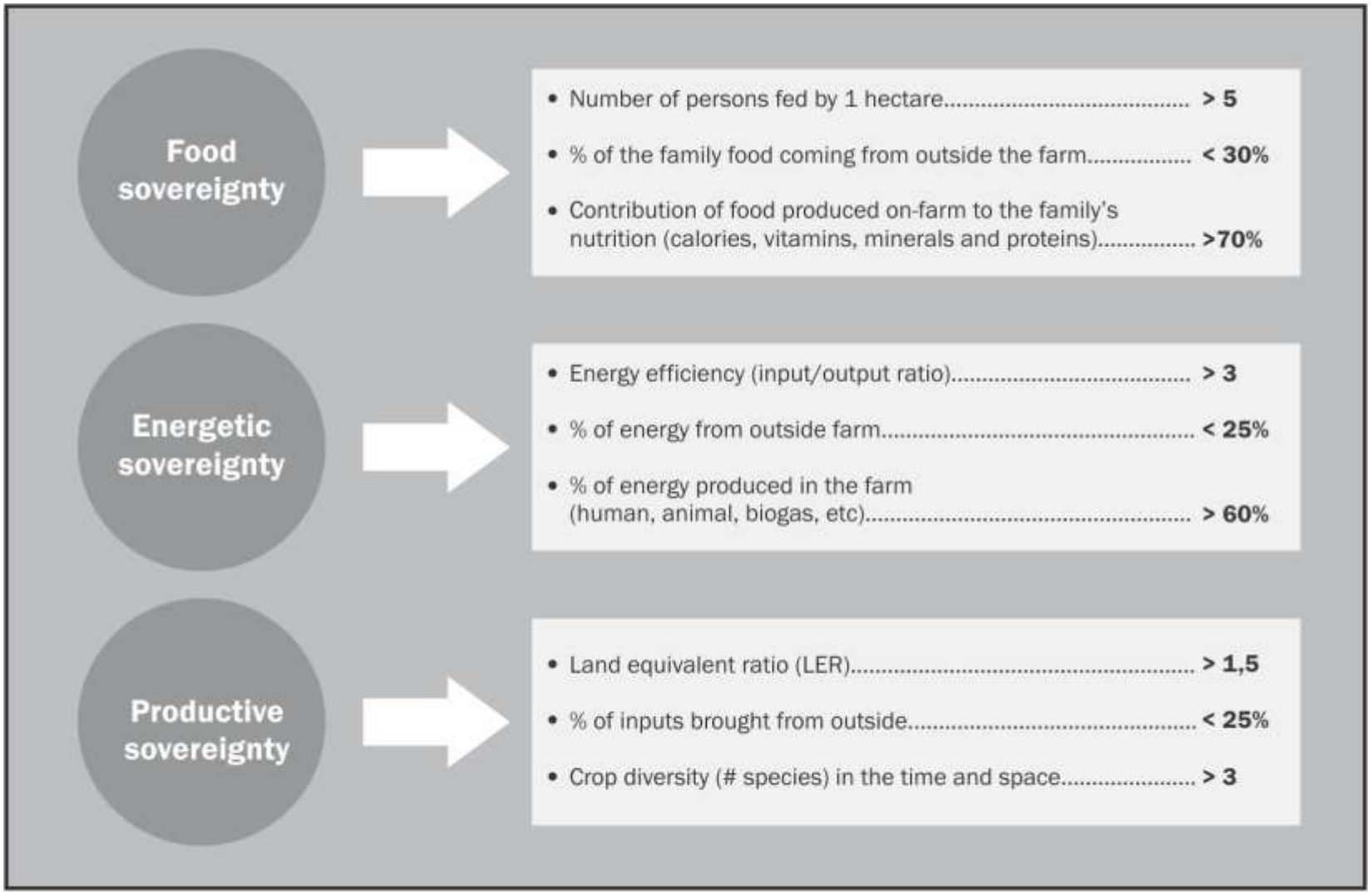


Figure 5. Hypothetical threshold values established for an agricultural community for each type of sovereignty.