

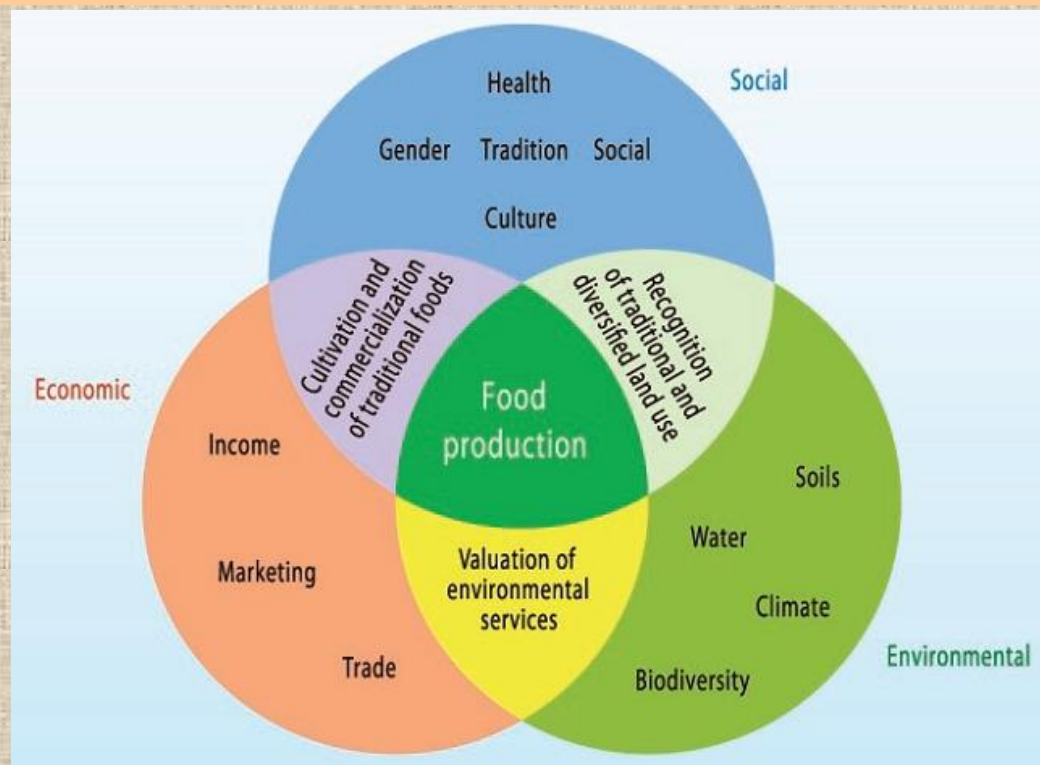
UF/IFAS Extension

The Journey to Sustainability Begins with Education



AGROECOLOGY: THE SCIENCE OF SUSTAINABLE AGRICULTURE & FOOD SYSTEMS

Part Two



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Outline

❖ Topics of this course

➤ Part 1

- Introductory Activity
- Definitions/History/Pioneers
- Ecosystem and Agroecosystem Science
- Environmental Agroecology
- Instructor Introduction

➤ Part 2

- Social and Economic Agroecology
- Resilient Food Systems

➤ Part 3

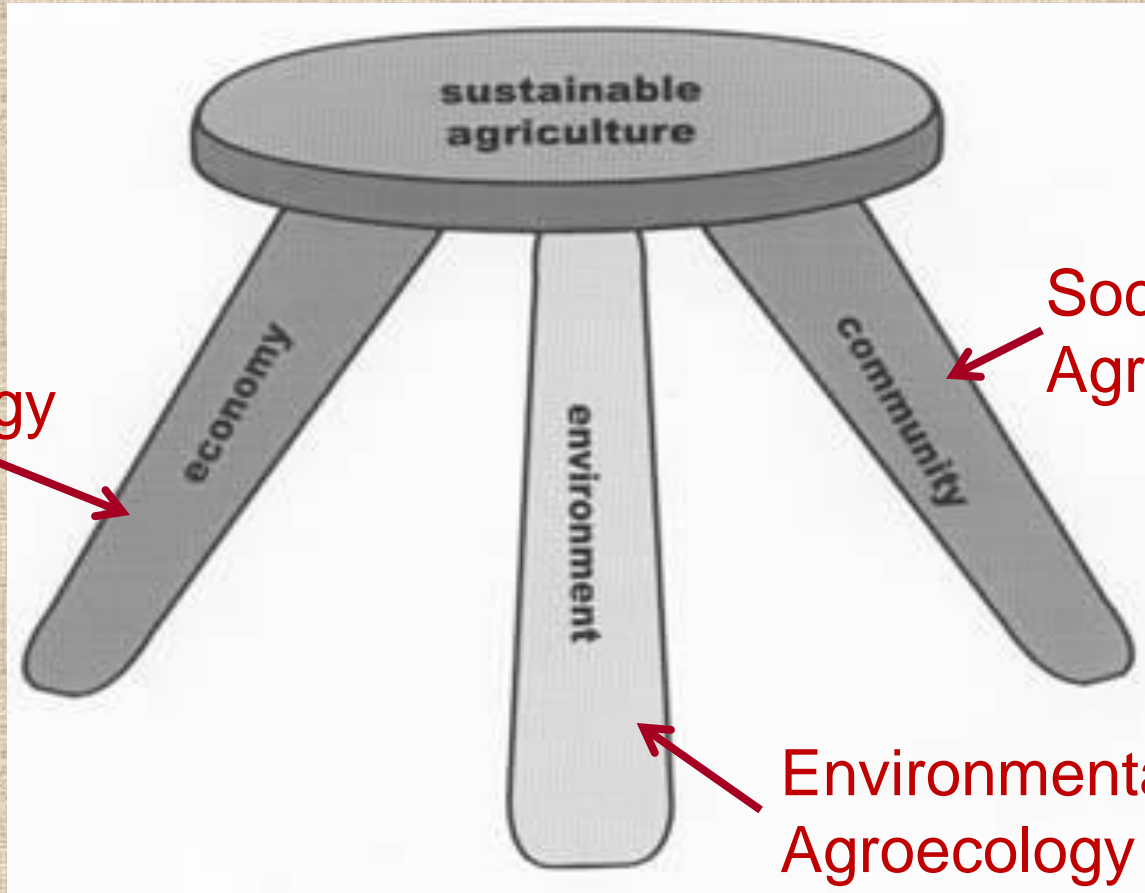
- Agroecology and the Right to Food Report
- Climate Change Resilience

Agroecology and Sustainable Local and Global Food Systems



Watch the short video “Voices from 6th Agroecology Congress, Curitiba, Brazil” - see <https://www.youtube.com/watch?v=eFHjXzgy7es>

Review: What Is Agroecology?



Agroecology provide the science for the practices to achieve the goals of sustainable agriculture.⁵

Review: What Is Agroecology?

- ❖ Agroecology provides the knowledge and methodology for developing a sustainable agriculture that is:
 - Environmental sound
 - Socially equitable
 - Economically viable
- ❖ Agroecological design achieves:
 - Improved overall biological efficiency
 - Biodiversity preservation
 - Maintenance of productivity and self-regulating capacity

Improved Biological Efficiency

Example

❖ Concept of Land Equivalent Ratio (LER)

- Method of comparing yields of monoculture (M) vs intercropping (I) systems
- LER of intercropping is calculated as
 - $LER = (\text{crop 1-I})/(\text{crop 1-M}) + (\text{crop 2-I})/(\text{crop 2-M})$
 - Overyielding is indicated when $LER > 1.0$

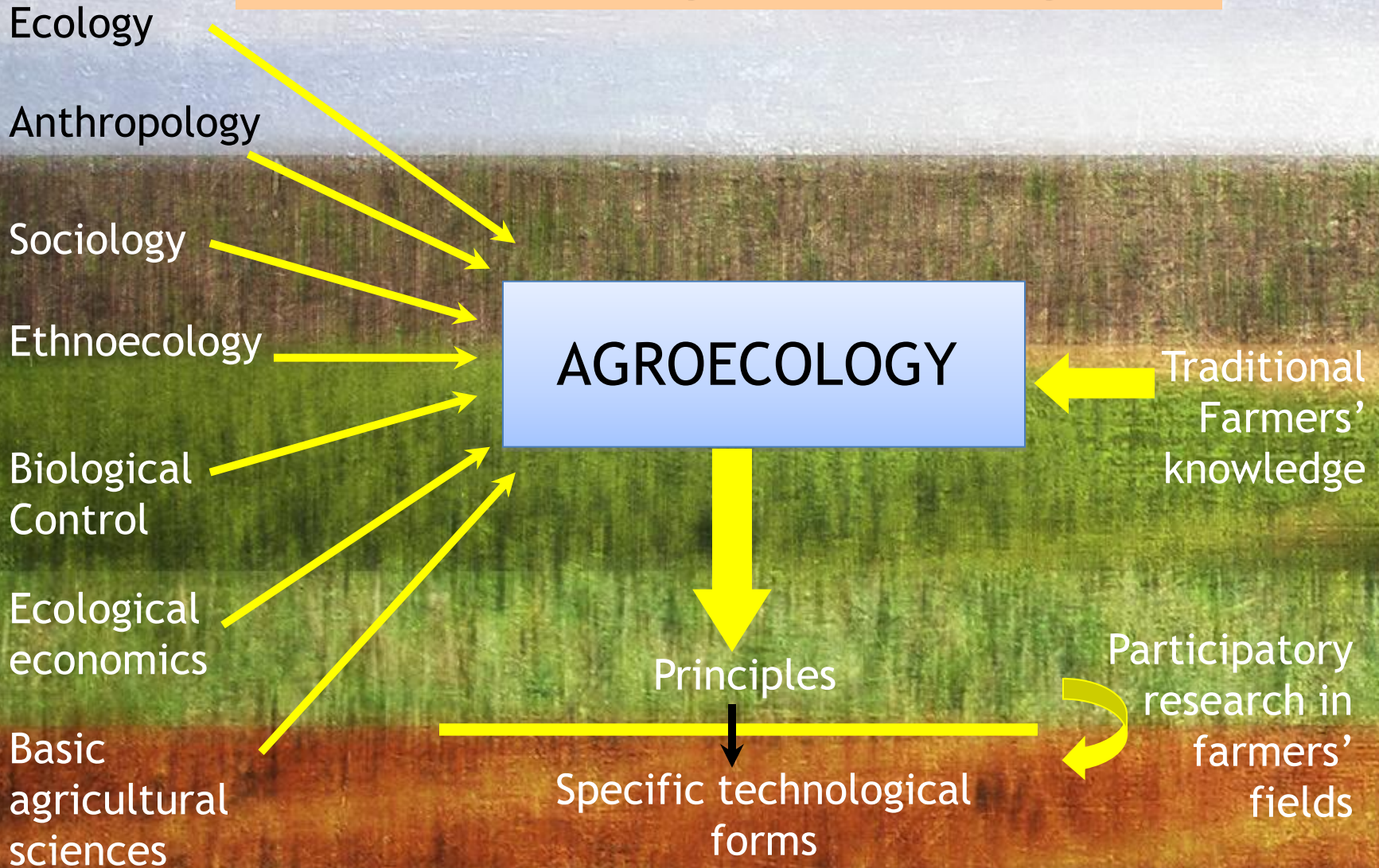
Field Experiment Results & Calculation Example

$$\begin{aligned} LER &= (1533/1096) + (98/544) + (71/383) \\ &= 1.40 + 0.18 + 0.18 \\ &= 1.76 \end{aligned}$$

Table 2. Yields of corn, beans and squash grown alone or in a mixture (7)

Crop	Pure Stand (pounds/acre)	Intercrop (pounds/acre)
Corn	1096	1533
Beans	544	98
Squash	383	71

What Is Agroecology?



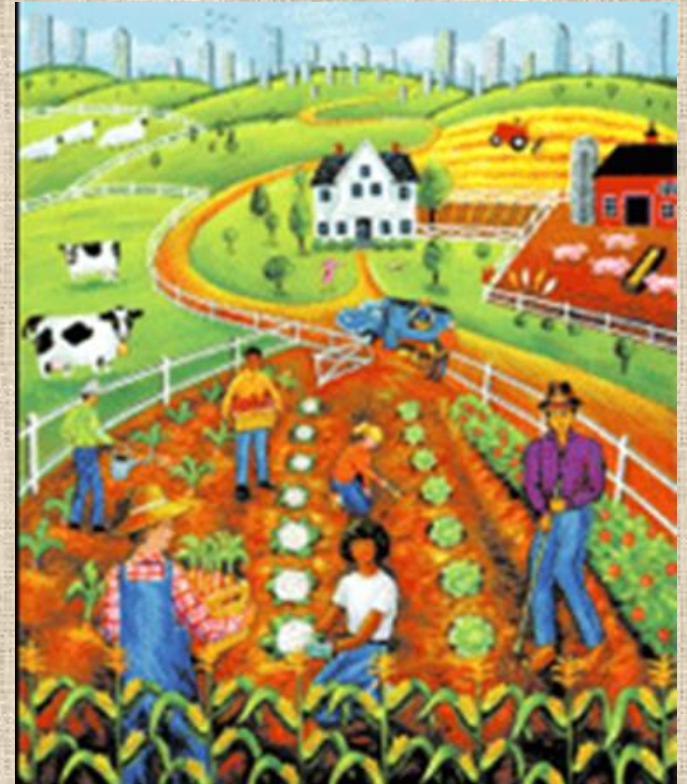
What Is Agroecology?

Steps for Progress to Sustainable Food Systems

- Move beyond the natural-science framework within which agroecology was originally established and access the insights of the social sciences
- Develop analytical tools that pay attention to beliefs, values, and assumptions of the structures of social, political, and economic life
- Advocate and work for fundamental change in the entire food system and work to manifest this change on the ground in partnership with those who actually work the land and consume the food it produces

Social Agroecology

- Traditional Agroecosystems
- Food System Democracy
- Participatory Research & Education
- Community Food Systems



Watch the short video “Meet the AgriCultures Network” at <https://www.youtube.com/watch?v=8n-TAXSQV1w>



Social Agroecology

Traditional & Natural Ecosystems

❖ Traditional Agroecosystems:

- Provide many examples of how a culture and its local environment have coevolved with processes that balance the needs of the people, expressed as ecological, and socio-economic factors.
- Many traditional agroecosystems are very sophisticated examples of application of ecological knowledge.

❖ Natural Ecosystems:

- Reference systems for understanding ecological basis for sustainability.
- The greater structural and functional similarity of an agroecosystem to the natural ecosystem the greater likelihood the agroecosystem will be sustainable.

Social Agroecology

Mayan Traditional Agriculture Example



Watch the short video “Mayan Cities and Agriculture” - see <https://www.youtube.com/watch?v=yGQiHe0u83w> and the short video “El Pilar: Archaeology in the Borderlands” – see <https://www.youtube.com/watch?v=fQ5n5V0ATVY>

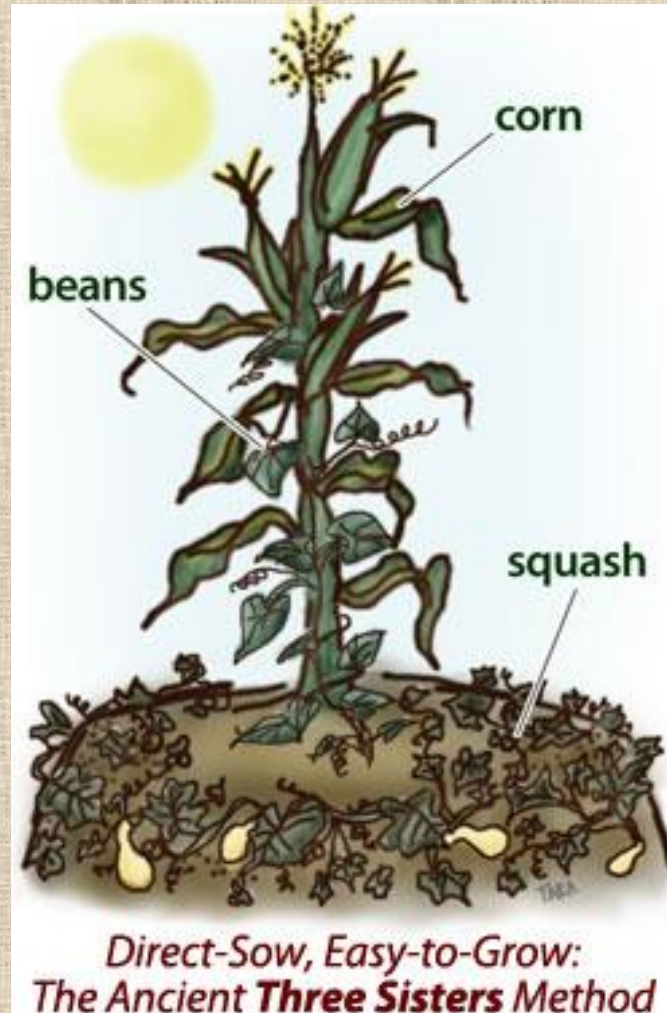


Social Agroecology:

Short History of Ag in the Americas

- Around 7000 BCE agriculture revolution began in what is now central Mexico.
- By 5000 BCE many began to grow squash, gourds, beans, avocados, and chilies.
- By 3400 BCE these early farmers grew maize, or corn.
 - Maize soon became the most important crop.
- Gradually people settled in permanent villages in the Tehuacan Valley (south of Mexico City).
 - These people raised corn and other crops
- The techniques of agriculture spread over North and South America.
- In areas like Peru and eastern North America they discovered the secrets of cultivating local edible plants independently.

Social Agroecology Example: ‘Three Sisters’ Planting Method



“Sustainers of Life”

The Legend of the Three Sisters

- Corn, beans and squash were among the first important crops domesticated by ancient Mesoamerican societies.
- Corn was the primary crop, providing more calories or energy per acre than any other.
- According to multiple Three Sisters legends corn must grow in community with other crops rather than on its own - it needs the beneficial company and aide of its companions.

The Legend of the Three Sisters

- Like the myths, the application of this tradition was varied across the different indigenous tribes of Mesoamerica.
- In each region the planting design was modified according to the site specific conditions in soil, weather, rain, growing season length, varieties, etc.
- In other words, the concept also was based on site-specific ecological conditions

3 Sisters Planting Management

- Example different spatial arrangements for Native American “3 sisters” planting:

Legend: C = corn; B = bean; S = squash; SF = sunflower

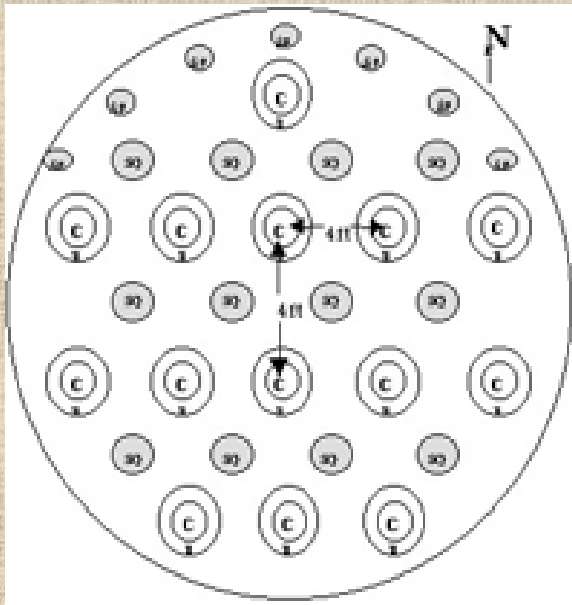


Figure 1: Circular Wampanoag Garden (Northeast & South)

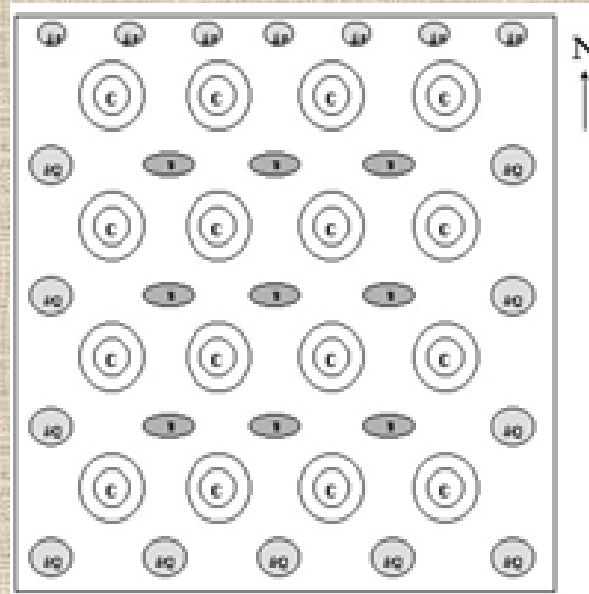


Figure 2: Hidatsa Garden Design (Northern Plains)

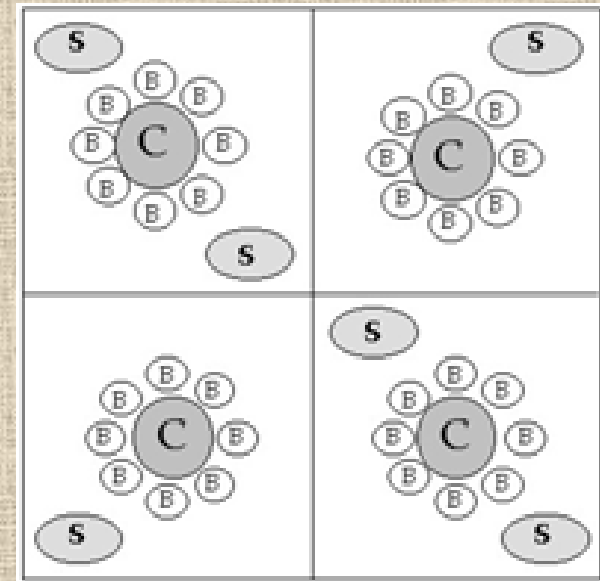
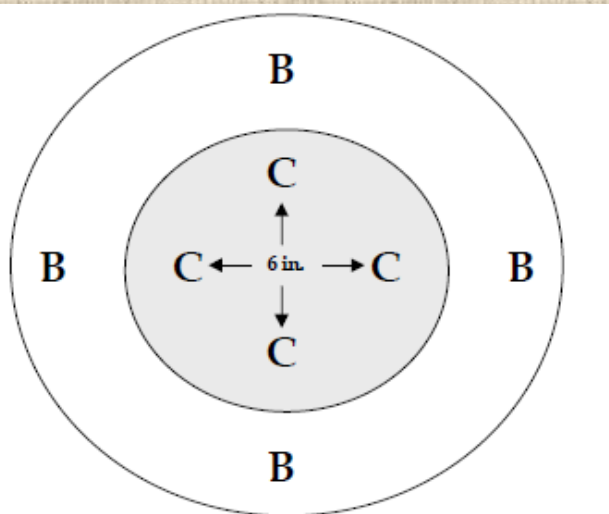


Figure 3: Zuni Waffle Garden (Southwest Desert)

3 Sisters Planting Management

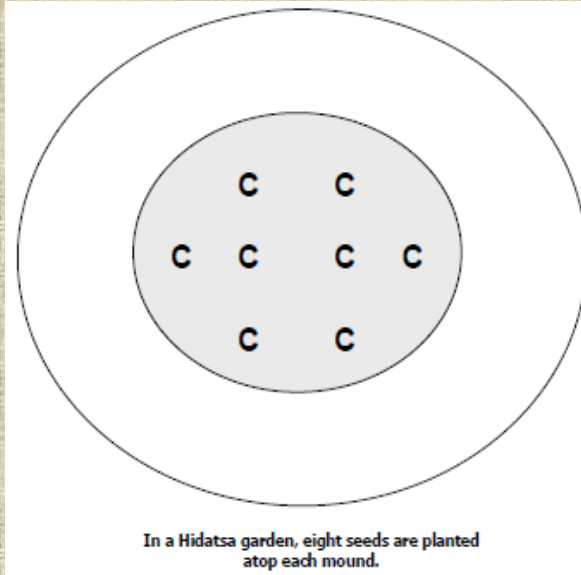
- Example different methods for native American “3 sisters” planting:

Seeds Planted on Mounds



Corn is planted 6 inches apart in the flat top of the mound. Beans are planted halfway down the slopes on the sides of the mound.

Figure 1: Circular Wampanoag Garden (Northeast & South)



In a Hidatsa garden, eight seeds are planted atop each mound.

Figure 2: Hidatsa Garden Design (Northern Plains)

Seeds Planted In Holes

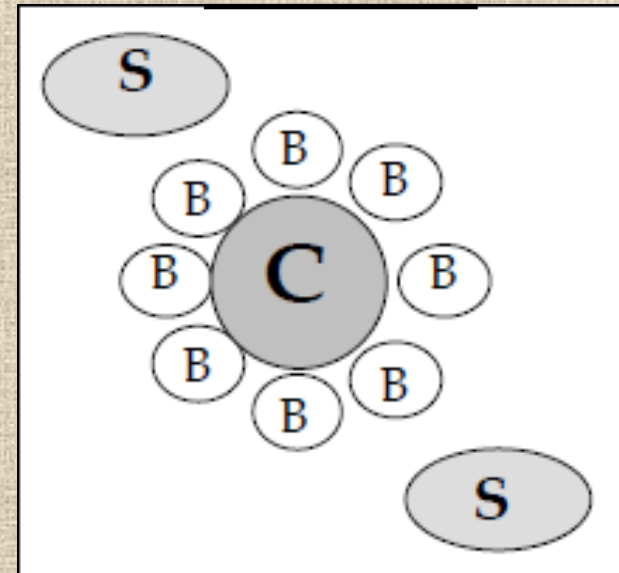


Figure 3: Zuni Waffle Garden (Southwest Desert)

Archaeological Chronology of The Three Sisters Planting Method

- ❖ Archaeological research of eastern North American indigenous cultures has shown:
 - Squash - domesticated in the period BCE 2500-1500 but served as minor dietary supplement for 2000 years
 - Corn – arrived CE 200 but remained a minor crop for centuries until appearance of short season varieties around CE 900
 - Bean – arrived around CE 1100
- ❖ Afterwards – intensification of farming using the Three Sisters Planting Method and the rise of densely populated chiefdoms, especially along Mississippi River

Lessons From The Origins of The Three Sisters Planting Method

- ❖ Social systems over a long period of time developed and were dependent on an integrated sustainable agriculture system that provided:
 - Concept of companion planting of different food crops for beneficial interactions and increased productivity
 - **Concept of nutrition complementarity**
 - Concept of site-specific adaptation for its successful application.

Social Agroecology

Green Revolution

➤ By the 1970s, the collection of modern agricultural techniques developed in the 20th century was called the Green Revolution.

- For example, through selective breeding, Norman Borlaug, an American biologist, created a dwarf variety of wheat that put most of its energy into edible kernels rather than long, inedible stems. The result: more grain per acre.
- Similar work at the International Rice Research Institute (IRRI) in the Philippines dramatically improved the productivity of the grain that feeds nearly half the world.

➤ This transformation of global agriculture continues today.

Social Agroecology

Green Revolution

➤ These practices included the following:

- the use of new higher-yield seed
- the expanded use of fertilizers
- mechanization of the farm
- genetically modified organisms
- agribusiness corporations
- crop specialization
- monocultures
- pesticide technology
- large scale farms



Social Agroecology

The Green Revolution

- ❖ The dramatic changes brought about the Green Revolution have been both praised and criticized.

Praise

- Famines that have occurred throughout history can now be avoided, since agricultural production now outpaces population growth.

Criticisms

- Poor farmers cannot always afford the items necessary to get new foods to citizens such as:
 - Machinery; seeds; fertilizers
- Environmental negative impacts

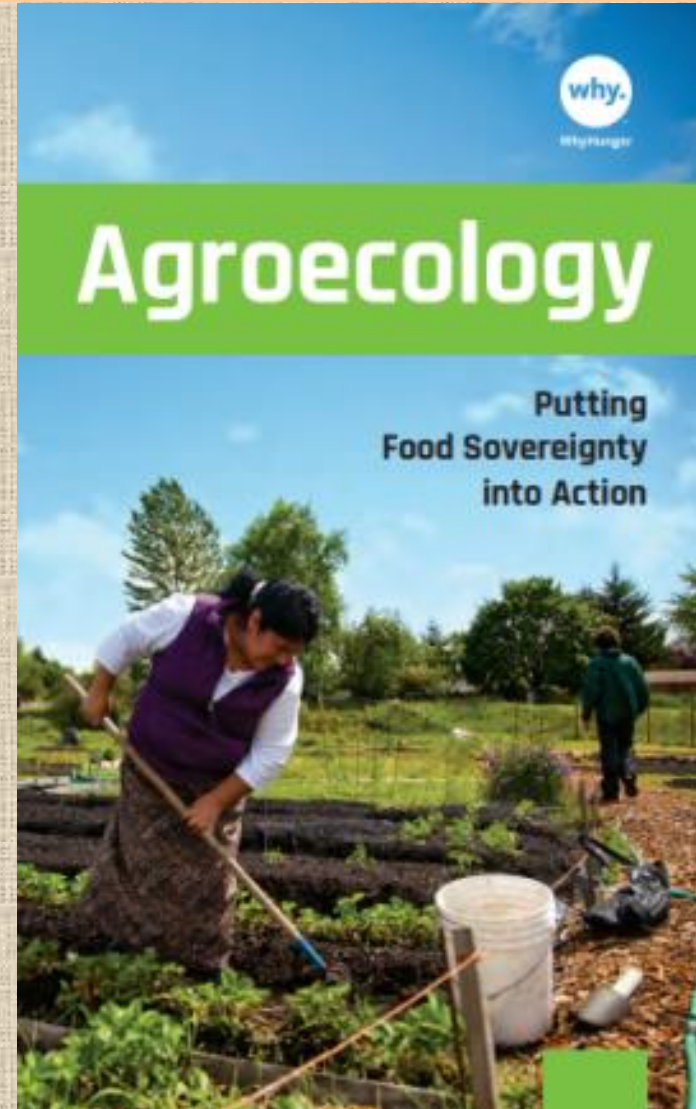
Watch the video “Green Revolution and Impact in India” at <https://www.youtube.com/watch?v=hq8b-iCgvLM> and “Not A Very Green Revolution” at <https://www.youtube.com/watch?v=QpZvGAeF2Ws>



Social Agroecology

Food Sovereignty

- a term coined by members of Via Campesina in 1996, asserts that the people who produce, distribute, and consume food should control the mechanisms and policies of food production and distribution, rather than the corporations and market institutions they believe have come to dominate the global food system.



Watch the short video “Food Sovereignty” at <https://www.youtube.com/watch?v=9fYGCHoP-HY>

Social Agroecology

Role of Farmer Networks



See the short video “Learning from Farmers - Practical Farmers of Iowa Field Day” at

<https://www.youtube.com/watch?v=VBPuzJHcBE0>

Farmer to Farmer Networks

- Background -

- Effective grass-roots networks to help farmers distribute information, offer moral and technical support, and share resource leads.
- Successful farmer-to-farmer networks assume that each person has valuable knowledge and experience to contribute

Farmer to Farmer Networks

- Background in U.S. -

- ❖ Developed by farmers due to being underserved by institutions and agencies
- ❖ Unique needs due to diversified production and marketing systems
- ❖ Sustainable Agriculture Approach
(<http://www.sare.org/coreinfo/ceprogram.htm>)
 - Participatory
 - Team approach
 - Multi-disciplinary

Farmer to Farmer Network - Midwest USA Example -

❖ *Practical Farmers of Iowa*

[\(http://www.practicalfarmers.org/\)](http://www.practicalfarmers.org/)

- “farmers learn best from other farmers”
- began in 1985 and now with 700 members including farmers of every scale, growing and raising every imaginable type of crop and livestock
- offers a Farming Systems Program, On-Farm Research projects, fielddays, annual conferences and a listserve
- partnering with extension, educators and other Ag professionals

Farmer to Farmer Network - Southeast USA Example -

- ❖ *SSAWG Experienced Organic Farmer (EOF) Network (<http://www.ssawg.org/>)*
 - *funded 2002-04 in partnership w/ USDA Risk Mgt Agency*
 - *email and other internet services based*
 - *farm profiles, farm photos, electronic discussions, and in-depth videos*
 - *EOF network producers reported new strategies adoption with much lower risk and a shorter learning curve than when farming in isolation and by trial and error*

SW FL Small Farmers Network - Introduction -

- *Supported by the FL Small Farms and Alternative Enterprises Program Since 2007*
(<http://smallfarms.ifas.ufl.edu/>)



- *Geographic scope*
 - *Counties: Pinellas, Hillsborough, Manatee, Sarasota, Hardee, DeSoto, Charlotte, Lee & Collier*

SW FL Small Farmers Network

- Activities -

- *Regional outreach*
- *Diversified agroecosystems*
- *On-farm meetings*
- *Participatory, e.g., research; cooperatives*
- *Farmer-led farm tours*
- *Grower networking sessions*
- *Extension agent presentations & activities*



E.C.H.O. Farm
North Ft. Myers, FL



My Mother's Garden Farm
Wimauma, FL



Jessica's Organic Farm
Sarasota, FL



Farmer to Farmer Network National Example

FARM HACK
A COMMUNITY FOR FARM INNOVATION

<http://farmhack.org/tools>



Watch the short video “Farm Hack” at
<https://www.youtube.com/watch?v=mZFG5jSGyGI>



Social Agroecology: Gender Issues

- ❖ Women play a critical role in agriculture in the developing world, accounting for household food production levels of
 - ❖ 70 to 80 % in Sub-Saharan Africa
 - ❖ 65 % in Asia
 - ❖ 45 % in Latin America.
- ❖ Agriculture advances have often bypassed women farmers and reduced their productivity: women are thus underperformers in agricultural production



Watch the short video “Closing the Gap Between Men & Women in Agriculture” at <https://www.youtube.com/watch?v=uDM828TpVpY>

Social Agroecology: Food System Concepts

The Local Food System



Social Agroecology: Food System Concepts

The Community Food System



Community Food System Concept

- ❖ Examples of expanded food system issues
 - food security
 - local food economy
 - diet-related diseases
 - hunger
 - farmland loss
 - lack of economic opportunity for rural and low-income communities
 - sustainability
 - urban Ag

Watch the short video “Food Security” at
<https://www.youtube.com/watch?v=HTYWKrxnYD4>



Social Agroecology

Building Community Food Systems



Watch the short video “CAFF - Building Sustainable and Resilient Food Systems” at
<https://www.youtube.com/watch?v=nIHS2un9XXc>



Social Agroecology

Agroecosystem Health



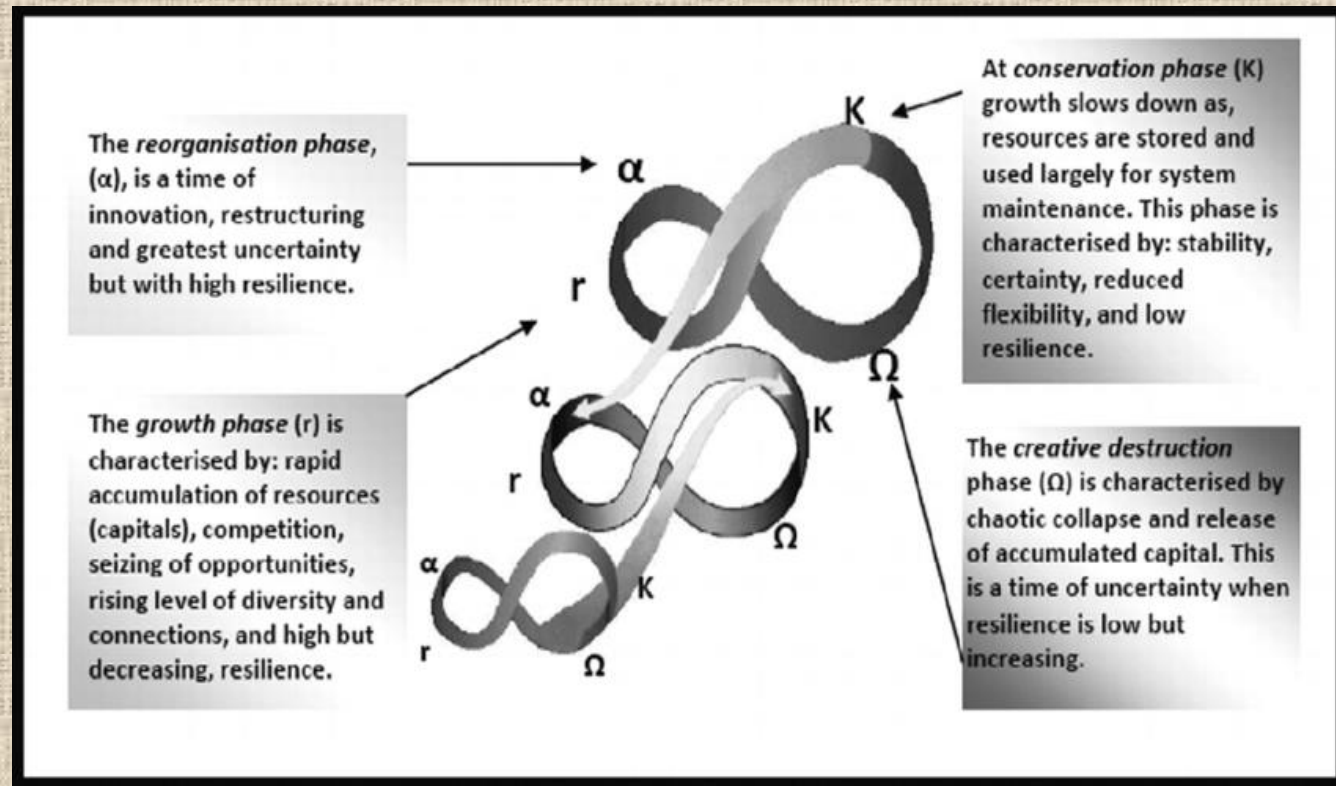
<http://www.ucsusa.org/food-agriculture/advance-sustainable-agriculture/counting-on-agroecology#.Wlj6n1MrK00>

Watch the short video “Food System Thinking” at <https://www.youtube.com/watch?v=MX3bITbMx4>



Social Agroecology

❖ Ecosystem Science Resiliency Theory Applied to Socio-Economic Systems



For a conceptual explanation see the short video “Sustainable Development: Resilience - Following Nature’s Example” at <https://www.youtube.com/watch?v=Q3tJL4JRgnA>



Social Agroecology

Resilient Food System Development Solutions



Food system resilience

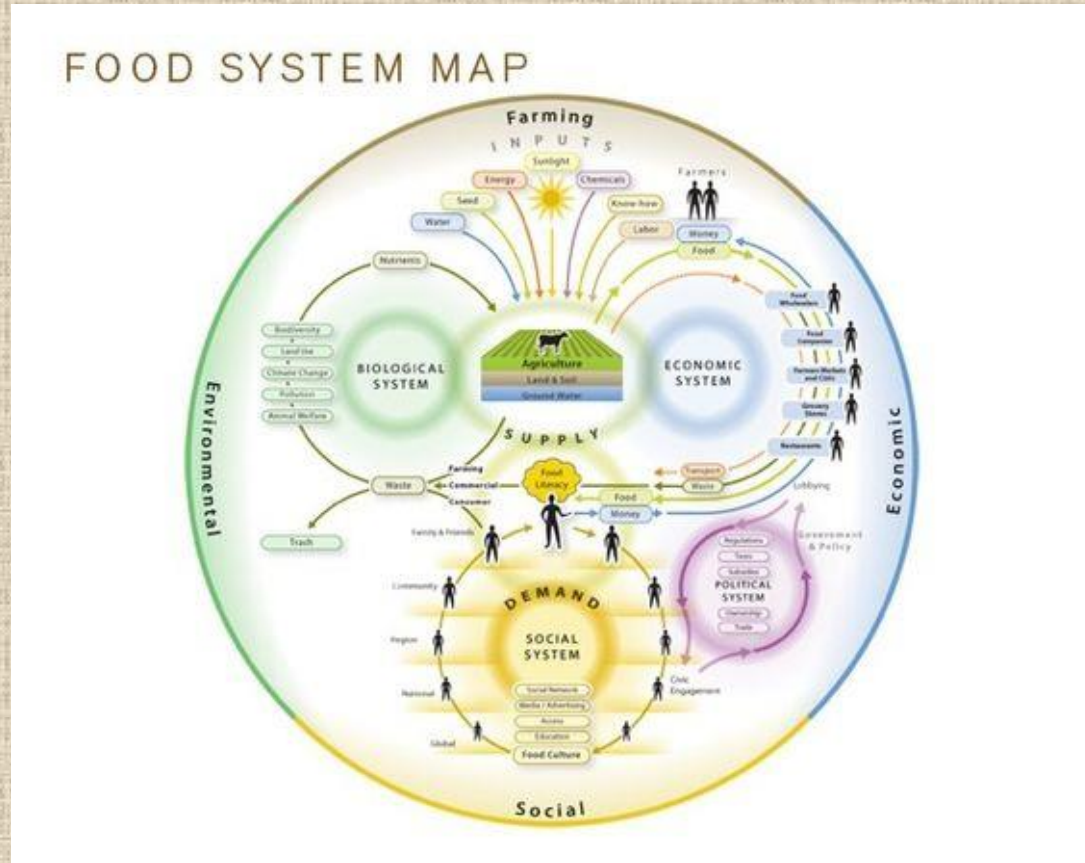
Food system function	Scale	Resilience features
Affordable food	National	Buffered against price shocks
Nutritious food	Local	Unprocessed, safe, trusted sources
Agro-diversity	Landscape	Land use planning enforced
Agricultural income	Local	Buffered against commodity price shocks

See the video “How to Build a Resilient Food System” at <https://www.youtube.com/watch?v=kBFgNz63kaI>
“Food Within Climate Policies for Cities” at <https://www.youtube.com/watch?v=zoBhghBVGhA> and
‘Food Systems and Community Resilience in Washington County’ at <https://www.youtube.com/watch?v=InOqtCt9MTA>



Social Agroecology

❖ Ecosystem
Science
Resiliency
Theory
Applied to
Food Systems

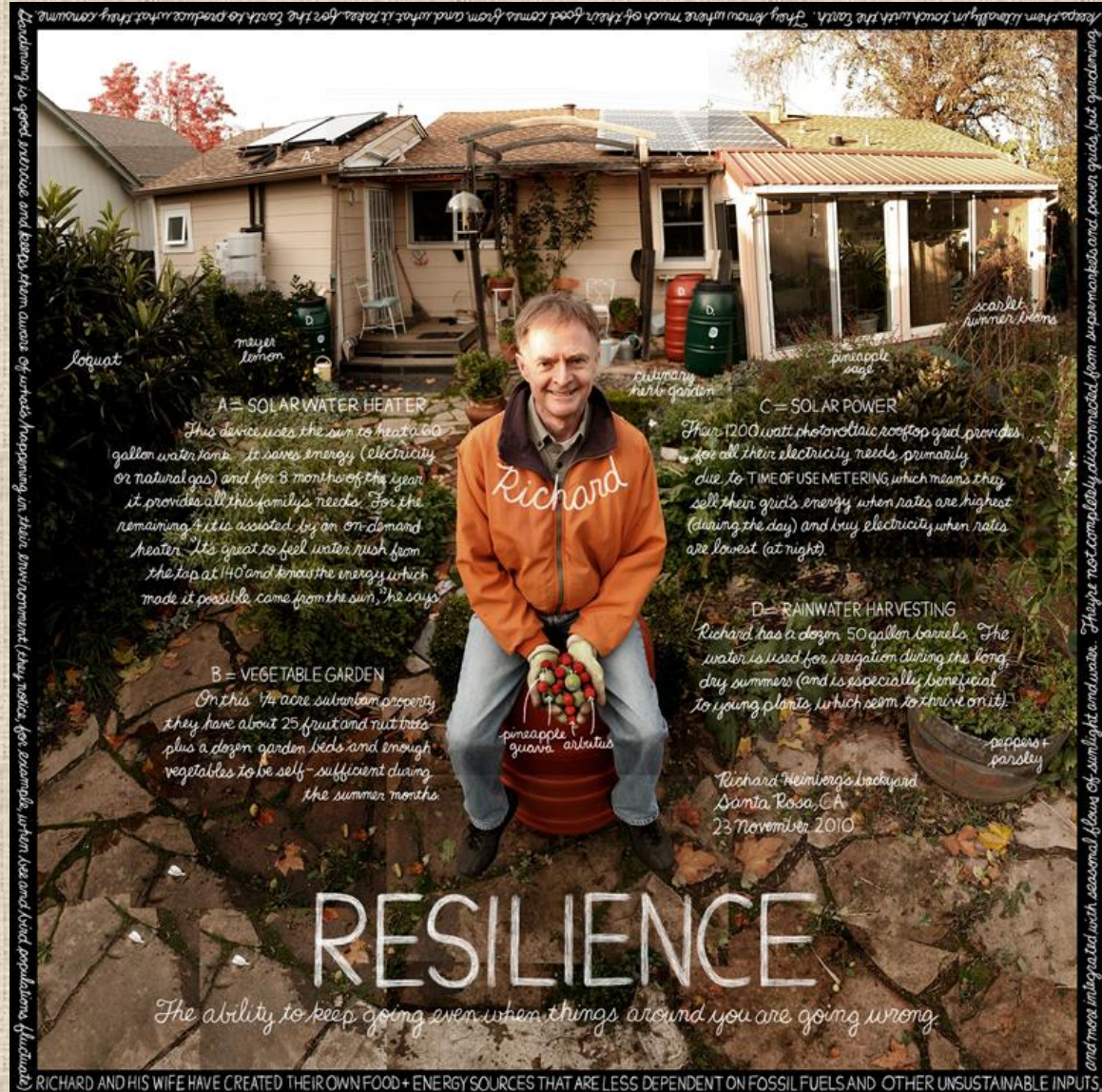


Watch the short video “Social Ecosystem - Maximize Stability and Resilience with Diverse Connections” at https://www.youtube.com/watch?v=TCQxQWCIL_A and the video “Resilient Food Systems” – see <https://www.youtube.com/watch?v=bjX0HVBrQlw>



Social Agroecology

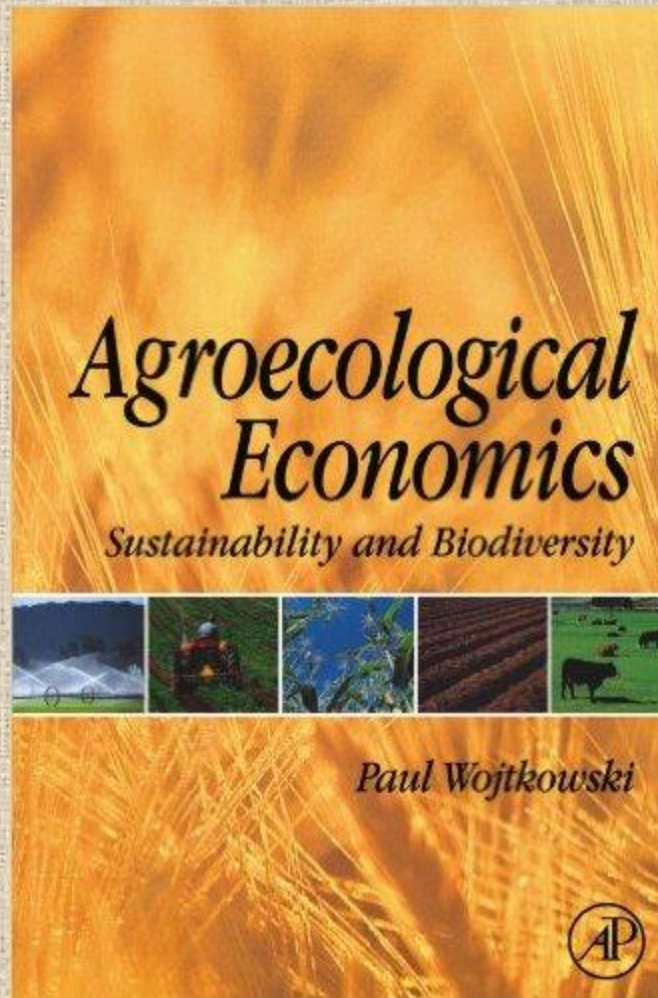
Resiliency Approach at All Scales of Food Systems



http://lexiconofsustainability.com/wp-content/uploads/2015/03/LEX75_RESILIENCE_BUILD_PG.jpg

Economic Agroecology

- Ag System Capital Assets
- Ecological Economics
- Financial Systems
- Cooptation



See the short video “Biodiversity” at
https://www.facebook.com/pg/agricultures/videos/?ref=page_internal

Economic Agroecology

Five Types of Multifunctional Assets of Ag Systems

- Natural Capital: Produces nature's goods and services, comprises food farmed and harvested or caught from the wild.
- Social Capital: yields a flow of mutually beneficial collective action, contributing to the cohesiveness of people in their societies. Assets: values and attitudes, relations of trust, reciprocity and obligations...
- Human Capital: total capability residing in individuals based on stock of knowledge skills, health and nutrition.
- Physical Capital: store of human made material resources.
- Financial capital: accounting concept, serves as facilitating role.

Watch the video at "Natural Capital and Ecosystems Services"
- see <https://www.youtube.com/watch?v=i1OTQvNV1lo>



Economic Agroecology

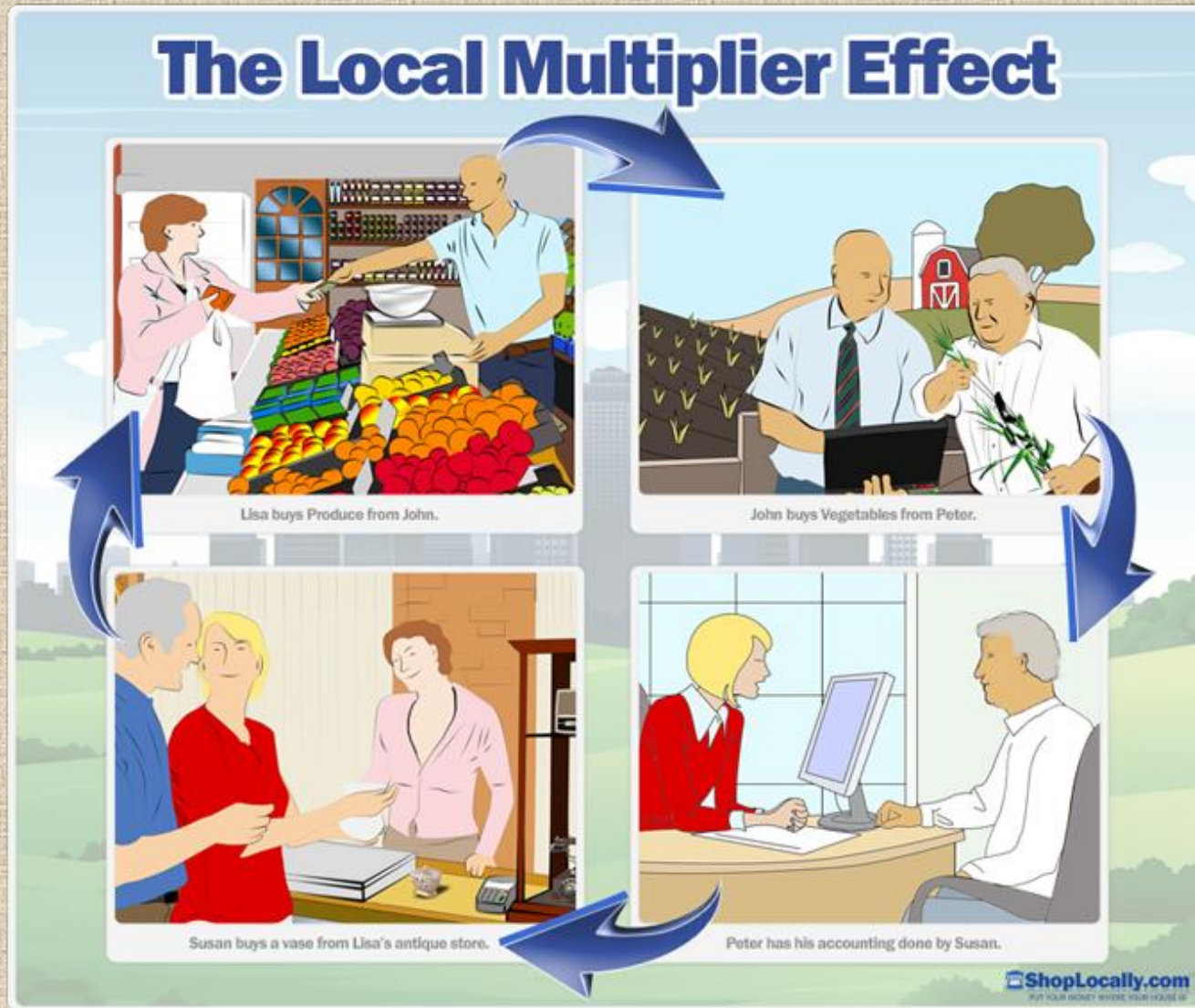
Ecological Economics

- ❖ A transdisciplinary & interdisciplinary field of academic research that aims to address the inter-dependence and coevolution of human economics & natural capital of ecosystems over time & space
- ❖ Sustainable Agriculture systems increase and not deplete multiple levels of natural capital:
 - On-farm level (e.g., wildlife for pest control contributes to wider stocks of biodiversity) - simplified Ag systems do not.
 - Landscape and society levels (e.g., clean water, wildlife, carbon sequestration in soils, flood protection and landscape quality)

Watch the short video “Nature’s Assets!” at
https://www.youtube.com/watch?v=V2WUIJ7YUMg&list=PLqICqVzAIBQ616sLhMeT_S7Zd3xUg7A3G&index=2



Food System Economic Planning



Watch the short video “Planning for a sustainable food system” at <https://www.youtube.com/watch?v=fbTxNkVdM38>

'Economic Multipliers'

Definitions

Multipliers capture the effect on overall economic activity in a specific region as the result of changes in sales, spending or employment in a given industry, or for a project or event.

- **Direct Effects** - the total changes to the economy associated with a unit change in output or employment in a given sector
- **Indirect Effects** - changes in sales, income, or employment within the region in backward-linked industries supplying goods and services to businesses
- **Induced Effects** - the increased sales within the region from household spending of the income earned in the direct and supporting industries for housing, utilities, food, etc.

Economic Agroecology

Value-Chain Investment in Community Food Systems

What value chain is all about?

A 'value chain' in agriculture describes the range of **activities** and set of **actors** that bring agricultural product from production in the field to final consumption, wherein at each stage value is added to the product.



Watch the video “Ag Value Chain for Development”
– see <https://www.youtube.com/watch?v=YiiBB2AZygk>



Economic Agroecology

Investment Best Practices Example

COMMUNITY
MICRo
LENDING



Watch the video “Muhammed Yunus” – see
<https://www.youtube.com/watch?v=Q3yUfZ2wTA4>

Economic Agroecology

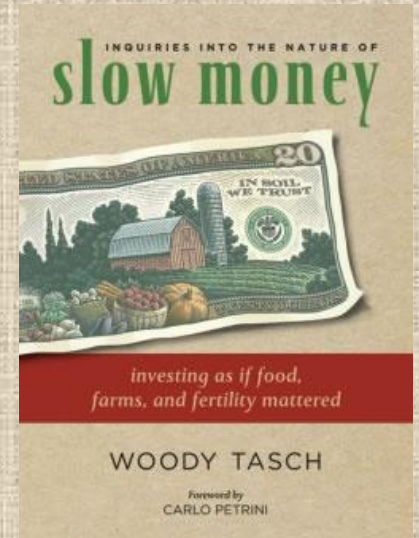
Investment Best Practices Examples

➤ Slow Money movement



see Youtube channel videos at

<https://www.youtube.com/watch?v=WJuUcaVtifg> and <http://www.slowmoney.org/>



➤ Local/Regional Food Economic Development Financing Strategies

see Michael Shuman video at

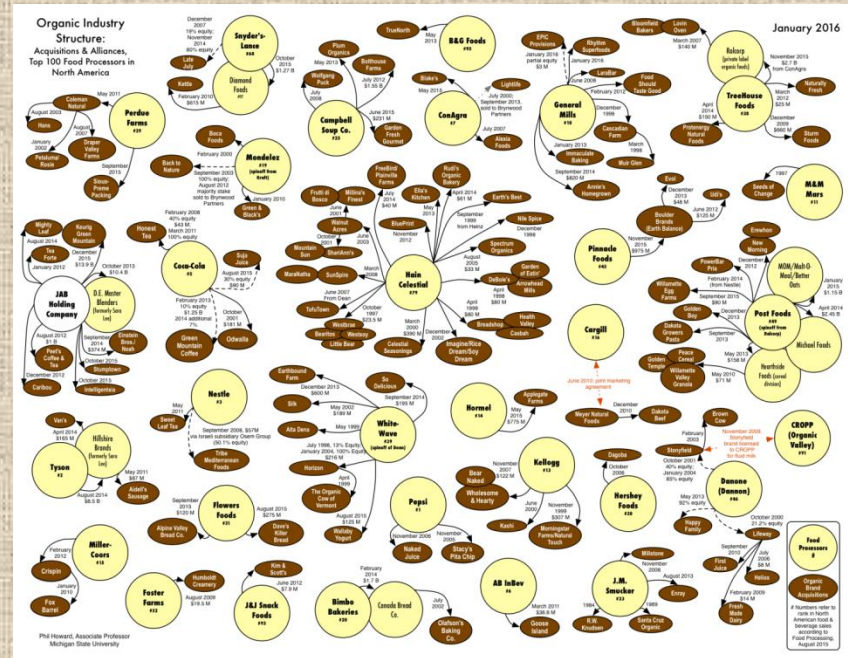
<http://www.youtube.com/watch?v=L-hxJXnBhK8>



Economic Agroecology

“Cooptation” is the Capacity to Diffuse and Absorb Demands for Real Change in Food Systems

Organic Foods Industry Corporate Structure Example



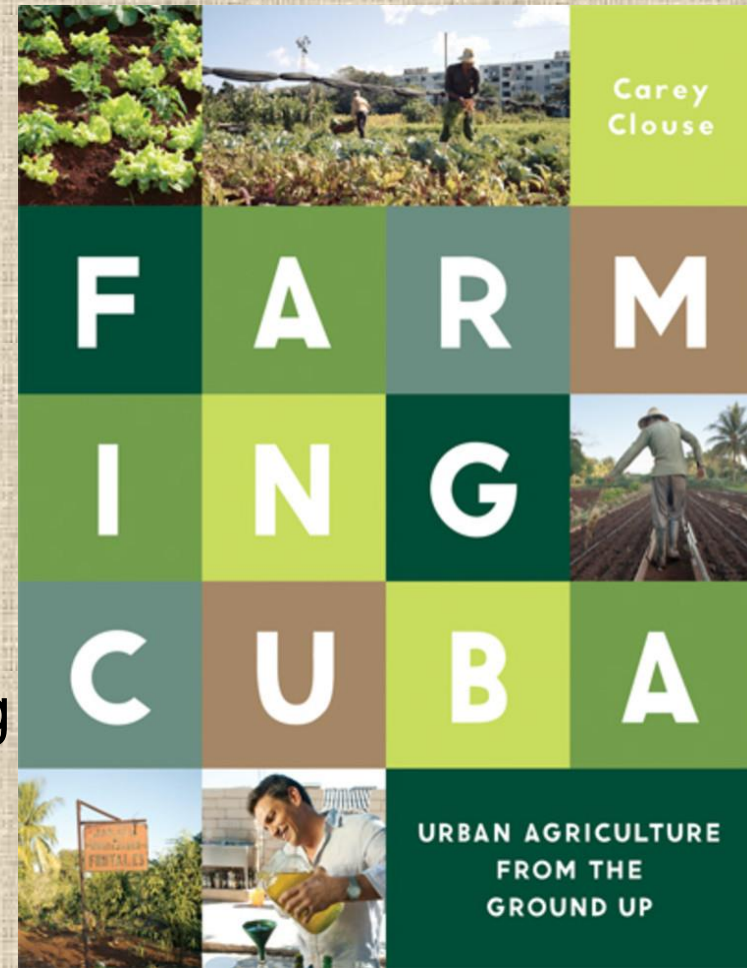
- ❖ The increasing presence of conventional food cooperations in the organic industry is raising debate among farmers, shoppers and consumer advocates about whether the values of organic agriculture and the motives of big business can co-exist – see http://www.alternet.org/story/19645/big_business_follows_the_green

Socio/Econ Agroecology

Cuban Agriculture Case Study

Modern Chronology

- 1959 – Cuban revolution
- 1959-1963 Agrarian reform
- 1963-1989 USSR Industrial model
- 1989 – “Special Period” begins
- 1993 – Break-up of state farms
- 1994 – Massive reorganization of Ag production; especially rise of independent, sustainable urban Ag (In Havana, 90% of the city's fresh produce come from local urban farms and gardens by 2002)



Watch the video “What Can Cuba Teach America About Organic Farming?” – see <https://www.youtube.com/watch?v=1YUxPJVopaY>



Summary

Socio/Economic Steps for Progress to Sustainable Food Systems

- Rely on farmer-generated agroecological knowledge
- Embrace a transdisciplinary approach
- Integrate research and action
- Build tomorrow's food system today in microcosm
- Increase public awareness of food politics
- Foster a food justice movement
- Avoid cooptation

References

- Altieri, M. Agroecology: Environmentally Sound and Socially Just Alternatives to the Industrial Farming Model – see <http://agroeco.org/wp-content/uploads/2011/02/Altieri-Alternatives-to-industrial-model-part-1.pdf>
- Diamond, J., 1997, Guns, Germs, and Steel. Norton & Company, NY.
- Gliessman, S.
 - 2006. Agroecology: Ecological Processes in Sustainable Agriculture. Ann Arbor Press
 - 2015. Agroecology: The Ecology of Sustainable Food Systems. CRC Press
- Matthewson, M., M. Fery, and M. Powell, Creating Farmer Networks: A Toolkit for Promoting Vibrant Farm Communities – see <https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/pnw638.pdf>

Online Resources

- AgriCultures Network – see <http://www.agriculturesnetwork.org/>
- Agroecology – see <http://www.agroecology.org/>
 - Milpas in the Yucatan – see www.agroecology.org/Case%20Studies/milpa.html
- Center for Agroecology and Sustainable Food Systems – see <http://casfs.ucsc.edu/>
- eXtension
 - Economic Impacts of Local and Regional Food Systems: Toolkit – see <http://www.localfoodeconomics.com/>
- Ford, A. 2010. The Milpa Cycle and the Making of the Maya Forest Garden – see <http://www.marc.ucsb.edu/sites/www.marc.ucsb.edu/files/pdfs/ResearchDevelopment/10%20AF%20Milpa%20Cycle%20MFG.pdf>

Online Resources

- Ikerd, J. Sustainable Food Systems – see <http://johnikerd.com/2015/09/is-a-new-sustainable-food-system-actually-possible/>
- Kerr Center for Sustainable Agriculture – see <http://kerrcenter.com/>
- Southern Center for Agroecology – see <http://southerncenterforagroecology.org/>
- UN/FAO
 - International Symposium on Agroecology for Food Security and Nutrition – see <http://www.fao.org/about/meetings/afns/en/>
- Youtube Videos
 - Community Agroecology Network Shortcourse – see <https://www.youtube.com/watch?v=LVXmxVLWW1E>
 - Sustainable Farming through Agroecology – see <https://www.youtube.com/watch?v=ObffHbRuJgc>

Take Home Assignments

❖ Reading

- “Agroecology and the Right to Food”, Report presented at the 16th Session of the United Nations Human Rights Council [A/HRC/16/49], 8 March 2011 – see <http://www.srfood.org/en/report-agroecology-and-the-right-to-food>

❖ Youtube Video

- Agroecology as a Transdisciplinary, Participatory and Action Oriented Approach – see <https://www.youtube.com/watch?v=g2DL4tGaHeE>