AGROECOLOGY:
THE SCIENCE OF SUSTAINABLE AGRICULTURE & FOOD SYSTEMS

Part Two

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http://www.groundswellinternational.org/how-we-work/agroecological-farming/
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
Agroecology provide the science for the practices to achieve the goals of sustainable agriculture.
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 = (crop 1-I)/(crop 1-M) + (crop 2-I)/(crop 2-M)
  - Overyielding is indicated when LER > 1.0

Field Experiment Results & Calculation Example

LER = (1533/1096) + (98/544) + (71/383)
= 1.40 + 0.18 + 0.18
= 1.76
What Is Agroecology?

Ecology

Anthropology

Sociology

Ethnoecology

Biological Control

Ecological economics

Basic agricultural sciences

Principles

Specific technological forms

Traditional Farmers’ knowledge

Participatory research in farmers’ fields

http://www.slideshare.net/qsimbol/agroecology-principles-and-practices
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
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.
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
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”

Direct-Sow, Easy-to-Grow: The Ancient Three Sisters Method
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

• 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

Seeds Planted In Holes

**Figure 1: Circular Wampanoag Garden (Northeast & South)**

- 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 2: Hidatsa Garden Design (Northern Plains)**

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

**Figure 3: Zuni Waffle Garden (Southwest Desert)**
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

J. Diamond, 1997
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.
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.
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
The Green Revolution

- The dramatic changes brought about by 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
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
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
Practical Farmers of Iowa
(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, fieldays, annual conferences and a listserv
- 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
Farmer to Farmer Network
National Example

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

Adopted from CS Mott Group at MSU 36
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
Watch the short video “CAFF - Building Sustainable and Resilient Food Systems” at https://www.youtube.com/watch?v=nIHS2un9XXc
Watch the short video “Food System Thinking” at https://www.youtube.com/watch?v=MX3blTbMx4
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

<table>
<thead>
<tr>
<th>Food system function</th>
<th>Scale</th>
<th>Resilience features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordable food</td>
<td>National</td>
<td>Buffered against price shocks</td>
</tr>
<tr>
<td>Nutritious food</td>
<td>Local</td>
<td>Unprocessed, safe, trusted sources</td>
</tr>
<tr>
<td>Agro-diversity</td>
<td>Landscape</td>
<td>Land use planning enforced</td>
</tr>
<tr>
<td>Agricultural income</td>
<td>Local</td>
<td>Buffered against commodity price shocks</td>
</tr>
</tbody>
</table>

See the video “How to Build a Resilient Food System” at [https://www.youtube.com/watch?v=kBFgNz63kAI](https://www.youtube.com/watch?v=kBFgNz63kAI)

“Food Within Climate Policies for Cities” at [https://www.youtube.com/watch?v=zoBhghBVGhA](https://www.youtube.com/watch?v=zoBhghBVGhA) and

‘Food Systems and Community Resilience in Washington County’ at [https://www.youtube.com/watch?v=InOqtCt9MTA](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

Richard and his wife have created their own food + energy sources that are less dependent on fossil fuels and other unsustainable inputs.
See the short video “Biodiversity” at https://www.facebook.com/pg/agricultures/videos/?ref=page_internal
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 “Nurtral Capital and Ecosystems Services” - see [https://www.youtube.com/watch?v=i1OTQvNV1lo](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=PLqICqVzAlBQ616sLhMeT_S7Zd3xUg7A3G&index=2
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.

http://edis.ifas.ufl.edu/fe935
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
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=WJUcaVtifg 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
“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 corporations 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
Watch the video “What Can Cuba Teach America About Organic Farming?” – see https://www.youtube.com/watch?v=1YUxPJVopaY

**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)
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

- Gliessman, S.
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/
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

• 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**

- **Youtube Video**
  - Agroecology as a Transdisciplinary, Participatory and Action Oriented Approach – see [https://www.youtube.com/watch?v=g2DL4tGaHeE](https://www.youtube.com/watch?v=g2DL4tGaHeE)