Organic Farming and Permaculture at the MSU Student Organic Farm

Presented to the North Central Nut Growers Association at the Annual Meeting held at Michigan State University, August 13, 2013

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Parts of this Power Point Presentation were prepared by Jay Tomczak as part of his Masters Thesis Project.
What is a Farm?
Possible Farming Perspectives

• Purpose - Focus
• Place – Farm, Field, Forest, Frontyard (Where?)
• People – Farmers, Families, Friends (Who?)
• Process – Farming (How?)
• Product – Function (Food, Fiber, Flowers, Fuel, etc) (What?)
• Policies, Politics – Funding, Finances
• Possibilities – Friends and Families
• Profit - Finish
• Passion – Fun
Integral Agriculture

Farmers, Friends and Families
Using Facts and Feelings to
Faithfully, Physically and Fearlessly
Farm
Front-yards, Forests, and Fields For Food, Feed,
Fodder, Fiber, Fuel, Flowers, Fertility, Fun,
Freedom, Fairness and the Future.
Reducing Risk for Small Scale Farmers

Basic Curriculum Assumptions

• Build Soil Organic Matter
  – Use of cover crops, compost, etc
  – Reduce risk of flooding, drought, disease, erosion

• Increase Product Diversity
  – Mix annual and perennial crops and animals
  – Reduce risk of production or market failure

• Use Season Extension
  – Greenhouses, cold frames, hoophouses, transplants
  – Reduce risk of crop loss and extend marketing

• Use Direct Marketing
  – Farmer’s markets, CSA, Farm Stand
  – Reduce risk of market loss due to falling price
Practical Profitable Prolific Perpetual Produce
Extended Season, Four Season, Year-Round Farming

For the Health of It! Let’s Eat!

Perpetual Produce

Placement

Elevation

Vertical Space

Process

Exposure Factors

Soil Factors

Soil & Bed Preparation

Transplants

Succession Planting

Scheduling

Cultivar Selection

Crop Selection

Planning

Profit

Participation (People)

Jobs

Community Support

Education

Preservation

Frost & Freezing

Heat Retention

Cooling & Shading

Drainage

Irrigation

Processing

Cold Storage

Fermentation

Canning

Protection

Low Tunnels

Cold Frames

Quick Hoops

High Tunnels

Greenhouses

Harvest Methods

Fermentation

Cold Storage

Processing

Freezing

Drying

Preservation

Heat Retention

Cooling & Shading

Drainage

Irrigation

For the Health of It! Let’s Eat!

John Biernbaum, MSU-SOF September, 2011
Practical Pieces of the Puzzle

• Perennials
• Organic
• Permaculture
• Productive/Prolific
• Profitable
• Perpetual
Majority of World Food Supply from Four Major Crops- What are they?

- Wheat
- Rice
- Potatoes
- Corn
- Two others to consider:
  - Sugarcane
  - Soybeans
- Are these annual or perennial crops?
With animal production, we would also consider pasture and range land made up of grasses and broadleaf crops as perennial systems.

What are other perennial food crops that you can identify?
Possible Categories to Consider

Midwest Zone 5
Perennial Farm &
Garden Crops

“tree fruit”
“tree nuts”
“tree berries”
“vine berries”
“bush berries”
“berries”
“services – N-fixation”
“mushrooms”
“services – biodiversity”
“tree other”
“herbaceous”
“vegetables”
“root crops”
40 Midwest Zone 5 Perennial Farm & Garden Crops

- tree fruit: apples, pears, peaches, nectarines, plums, cherry, apricots, peach, pear, apple, apricot, cherry, prunus, nectarine, plum, cherry, prunus
- tree nuts: chestnut, hickory, walnut, hazelnut, walnut, hickory, chestnut, walnut, hickory, chestnut, walnut
- tree berries: currant, blackberry, raspberry, cranberry, blueberry, mulberry, serviceberry, elderberry, gooseberry, currant, blackberry, raspberry, cranberry, blueberry, mulberry, serviceberry, elderberry, gooseberry
- berries: strawberry, raspberry, blackberry, blueberry, mulberry, serviceberry, elderberry, gooseberry, currant, blackberry, raspberry, cranberry, blueberry, mulberry, serviceberry, elderberry, gooseberry
- vines: grapes, hardy kiwi, blueberries, cranberries, gooseberries, currants, bush cherries, strawberries, raspberries, blackberries, melissa, asparagus, rhubarb, horseradish, sunchoke
- bush berries: strawberry, raspberry, blackberry, blueberry, mulberry, serviceberry, elderberry, gooseberry, currant, blackberry, raspberry, cranberry, blueberry, mulberry, serviceberry, elderberry, gooseberry
- vegetables: alfalfa, clover, siberian pea, horseradish, burdock, rhubarb, asparagus, chives, garlic, onion, celery, carrot, potato, squash, pumpkin, zucchini, cucumber, lettuce, spinach, kale, collard, broccoli, cauliflower, brussels sprout, cabbage, radish, beet, turnip, rutabaga, swede, mustard, horseradish
- root crops: horseradish, burdock
- mushrooms: many
- tree other: windbreaks, water management, air purification, nitrogen fixation, biodiversity
- b) herbs: horseradish, burdock
- c) flowers: many
- d) pollinators: alfalfa, clover, siberian pea, horseradish, horseradish, alfalfa, clover, siberian pea, horseradish, horseradish
- e) medicinal: many
- f) culinary: many
- g) flowers: many
- h) pollinators: alfalfa, clover, siberian pea, horseradish, horseradish, alfalfa, clover, siberian pea, horseradish, horseradish
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- q) medicinal: many
- r) culinary: many
- s) flowers: many
Important Perennial Food Crops in Tropical and Subtropical Climates

- Banana
- Coconut
- Coffee
- Tea
- Bamboo
- Olives
- Mango
- Yam or sweet potato
- Cassava
Why are perennials important?
What are some advantages of perennial crops?

• More rapid development in spring so longer growing period (season extension).
• Larger root system so more potential to survive or tolerate drought.
• Root system stores energy reserves and helps with survival under temperature extremes.
• No regular cultivation of soil so potential to prevent soil erosion and build soil organic matter.
Annual Perennial Leaf Area Index (LIA)

April      May      June      July      August     September  October     November
Corn Plant from Seed

How is Leaf Area Index calculated and why is it important?
Nitrogen and minerals are moved from leaves back into the woody part of the plant. Leaves provide important biomass for soil microorganisms as do dead roots.
Why are perennials used less?

What are some disadvantages of perennial crops?

• No regular cultivation of soil so competition from ground cover occurs (like quack grass).
• Longer term rotations so potential for root pathogens to build up in the soil.
• Takes a longer time to establish and to get a harvest.
• Higher initial cost of plant material.
• Takes time to learn how to manage all the different crops – pruning and plant protection.
Yield is a function of many integrated and interacting factors

- Variety
- Pruning
- Training
- Spacing
- Light and Canopy Management
- Rootstock – dwarfing (How does it work?)
- Flowering (flower formation the year before)
- Flower Set and Pollination
- Thinning (Non organic vs organic methods?)
- Pest and Disease Susceptibility
More than Yield; Profit relates to Fruit Number, Size, Quality

• Fruit number up, fruit size down
• Fruit number down, fruit size up
• Quality usually associated with larger size
• Biennial Bearing – a higher yield year followed by a lower yield year; depends on the variety.
• Key factor is profit more than yield.
• Perennial crops are more challenging to manage than annual crops? Maybe not?
Tall Trees, hard to pick and spray, were replaced by trees pruned to keep them lower to the ground.
Perennial Crop Ground Floor Management: Impact on Soil Biology and Pest Populations?

Where’s the Mulch?
Orchard Floor Management
Long Term Rotation?

- Harvest Trees
- Established Wooded Perennials
- Grazing Pasture N Fixation
- Mixed Annuals and Young Wooded Perennials
- Annual Crop Production

Infrastructure
What is a Organic Farming?

NOP (National Organic Program)

• Organic production. A production system that is managed in accordance with the Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity.
Required Components

• No Prohibited Inputs 3yrs prior to first harvest
  – Synthetic Pesticides or Fertilizers
  – Prohibited non-synthetic substances (e.g. rotenone, KCL)

• Crop Rotation

• Pro-active / preventative mgnt of weeds, pests, disease.
Required Components

- 3rd Party certification by USDA accredited certifier
- Annual Inspection
- Organic Systems Plan & Record Keeping
- National Organic Standards Board governs and updates standards.
Organic Farming & Ethic
Not what it “isn’t” but what it “is”

• Emphasis on maintenance and building of Soils, Natural resources and Biodiversity
• Soil Health
• Crop and Animal Health
  – rather than insect and disease management
• Stewardship and care of the land and animals
International Federation of Organic Agriculture Movements (IFOAM)

• IFOAM Principles 2005
  – Health
  – Ecology
  – Fairness
  – Care

• Developed over two years with a participatory process.

• Details available at www.ifoam.org
Organic Farming: What must you know to create a productive agroecosystem?

- Biology & Ecology of the different parts of the system and how to manage them.
  - Soil Management
  - Ground Cover Management
  - Herbivore, Decomposer, Natural Enemy Management
  - Crop Selection and Management
How are these factors applied/relevant/different in a Perennial Cropping System?
Soil Management

• Pre-Establishment (site preparation)
• Post-Establishment (site management)
• Amendments
  – Compost, Minerals, Mulch
• Cover Crops (how would you use these?)
• Excess nutrients cause un-balanced growth (too much shoot/leaf and not enough wood production)
Non-Crop Competitors (Weeds)

• Perennial weeds vs annual weeds
• Effect/roles of weeds/competition on crop
• Pre-Establishment (site preparation)
• Post-Establishment (site management)
• Techniques
  – Mow and or grazing with animals
  – Mulch
  – Flame
  – Till (Swiss Sandwich)
  – Organic Herbicides?
Swiss sandwich system/new orchard floor management practice finds acceptance in the organic orchard production system in Mason County.
Pest & Disease Management

- Pest population - preventing build up
- Farm-scaping / beneficial attraction
- Low/Zero damage tolerance
- Intensive Monitoring & IPM
- Pheromone Traps & Disruption
- Use of Organic Sprays
Edible Forest Gardening

• Focus on the crop ecology aspect of permaculture
• Developing landscape evaluation, implementation and management plans for a sustainable agriculture
• Incorporates concepts of efficient use of space and the developmental changes that occur over time
• Integration of annual and perennial crops
Gardening Like the Forest
and not
Gardening in the Forest
Model of the Three Sisters Garden

• Putting parts together in a way that the combination works better than the sum of the parts.
• Corn, Beans and Squash
• Beans grow up the corn.
• Beans eventually provide nitrogen through nitrogen fixation.
• Prickly squash vines protect them all from animals and cover the ground to reduce weeds and conserve water.
• All three provide food that can be stored for the winter.
Edible Forest Gardening

• Establishing a wide diversity of perennial crops for long term food security and productivity
• Managing the system to develop self sustaining soil fertility and quality.
• Managing the landscape and crops based on the site characteristics and availability of water, light and energy.
• Integrating annual crops to improve the efficiency of space use over time.
• What is the future of food and the food system?
Add Rising Energy Costs, Energy/Biofuels and Climate Change to the Big Picture

• Will food still travel so far?
• Is land use going to change?
• Increased potential for degradation of the soil for short term gain?
• Will animal production systems be even more vulnerable to confinement operations?
• What will the food system of the future look like?
• What do you want it to look like?
• Why not just do something that works for you?
Human Interaction With Our Environment and Food Over the Ages

- Hunting/Foraging
- Herding
- Horticultural – use of hand tools
- Agrarian – use of animals for plowing
- Industrial – use of tractors and large equipment

What’s Next?
Human Interaction With Our Environment and Food Over the Ages

- Hunting/Foraging
- Herding
- Horticultural – use of hand tools
- Agrarian – use of animals for plowing
- Industrial – use of tractors and large equipment

- Ecological – integration of all of the above and working with natural processes while anticipating the changes that occur over time
Examples of Ecological Farming Methods:

- Biodynamic
- Organic
- Biointensive (Biological and French Intensive)
- Sustainable Agriculture
- Permaculture (Permanent+ Agriculture+ Culture)
- Integrated Perennial Polyculture
- Agroforestry; Silvopasture
- Edible Forest Gardening
  (“Like a Forest” and not “In a Forest”)
- Multistrata Home Gardens – planting perennials and annuals – harvesting perennials later in life
Permaculture: *permanent* culture and agriculture

Simply Stated: A stable, sustainable culture can not exist without an integrated relationship with a system of sustainable or “permanent” agriculture.
Very old and proven ideas
Simply Stated (again): A stable, sustainable culture cannot exist without an integrated relationship with a system of sustainable or “permanent” agriculture.
Ethics of Permaculture

Care of the Earth
...includes all living and non-living things- plants, animals, land, water, air.

Care of People
...promotes self-reliance and community responsibility- access to resources necessary for existence.

Setting Limits to Population and Consumption
...contribution of surplus time, labor, money, information, and energy to achieve the aims of earth and people care.
Permaculture Principles

- **Observe and interact:** Get to know the Place
  Beauty is in the eye of the beholder (i.e. systems thinking).

- **Catch and store energy:**
  Make hay while the sun shines.

- **Obtain a yield:**
  You can't work on an empty stomach.

- **Apply self-regulation and accept feedback:**
  The sins of the fathers are visited on the children unto the seventh generalization.
Permaculture Principles

- **Use and value renewable resources and services:** Let nature take its course.

- **Produce no waste:** Waste not, want not.

- **Design from patterns to details:** Can't see the wood for the trees.

- **Integrate rather than segregate:** Many hands make light work.
Permaculture Principles

- **Use small and slow solutions:**
  The bigger they are, the harder they fall. Slow and steady wins the race. Local vs long distance food.

- **Use and value diversity:**
  Don't put all your eggs in one basket.

- **Use both conceptual and physical edges and value the marginal:**
  Don't think you are on the right path just because it is well traveled.

- **Creatively use and respond to change:**
  Vision is not seeing things as they are but as they will be.
Permaculture

- Housing
- Water
- Landscape
- Labor
- Efficiency
- Energy
- Management
- Crop Ecology
- Animals
Consideration of space, time and function; succession is a good model to consider.
Working With Succession  
vs  
Against Succession

Organic Farming--->        <--- Permaculture

Conventional Ag--------> Balance <------Native Ecosystem
# Ecosystem Niche

<table>
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<tr>
<th>Spacial</th>
<th>Temporal</th>
<th>Functional</th>
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<tr>
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<td>-successional stage</td>
<td>- pollinator</td>
<td>- food</td>
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<td>- fiber</td>
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<td>suppressor</td>
<td>- aesthetics</td>
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Edible Forest Garden Polycultures

“...the art and science of putting organisms together to forge mutually beneficial relationships, creating an edible ecosystem that is more than the sum of its parts.”

- Dave Jacke
Large Scale: Zones
Permaculture Guild
Perennial Hazel Nuts with Annuals

Efficient use of space while nuts develop
From Forest to Field
Applying Permaculture and Forest Gardening Principles to the Farm

- Plan to “develop” all the space available
  - Above ground and below ground
  - Zones for efficiency of work
  - Cultivate Diversity

- Anticipate and plan for changes over time
  - Integration of annuals and perennials

- Plan for multiple functions
  - Scale, intensity and diversity influence options
  - Use of animals when appropriate
MSU Forest Garden Project

- Students participating at the Student Organic Farm expressed interest in Permaculture – 2004-2005
  - Jay Tomczak, Trevor Johnson, Andy Fles and others
  - Trevor Johnson - Sustainability Course at Findhorn
- A plot was being developed for perennial plantings
- Initiated as a graduate student project – literature review started in Fall 2005.
- Mark Shepard and David Jacke were invited to MSU to give presentations and advice (Fall 2005)
- Planting Plan was developed in December 2005
- Planting started spring 2006
- USDA Risk Management Agency funding starting Fall 2006 (Proposal in May based on site visit in March)
- Workshops planned for Spring and Summer 2007
Aging Animal Bedding (straw) by Sheet or Cold Composting
Regular Cultivation (disc and drag) to Remove Perennial Weeds and Reduce Seed Density
Design Plan
Initial Plot Layout for Paths
# Plant Species by Ecosystem Niche

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<tr>
<th>Trees</th>
<th>Shrubs</th>
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<td>Pawpaw</td>
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Path Establishment to minimize compaction
Marking Tree Locations
Grape Vines and Trellis
Herb Garden

Tree Planting
Tree Planting in Rye Cover
Small Fruit Establishment

Strawberry, raspberry, blackberry
Small Fruit Mulching with Straw
Protection from Rabbits and Rodents

Mulching with Wood Chips
Rye cover crop cut back – was increasing rabbit damage.
String trimmer with plastic cutting blade attachment
Annual Planting Bed
Designed for tractor cultivation
Hand planting and mulching
Annuals: Flowers, grains, beans
Garden Sitting Space

Hops
Deer foraging was a major issue
Three Sisters Garden

corn, beans and squash
Irrigation: Hand watering - good rainfall and mulch helped conserve water
Grapes and Berries Late in Season
Herb Garden First Year – Late in Season
January 2007 – Start of Second Year
Integral Agriculture

Farmers, Friends and Families
Using Facts and Feelings to Faithfully, Physically and Fearlessly Farm