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.

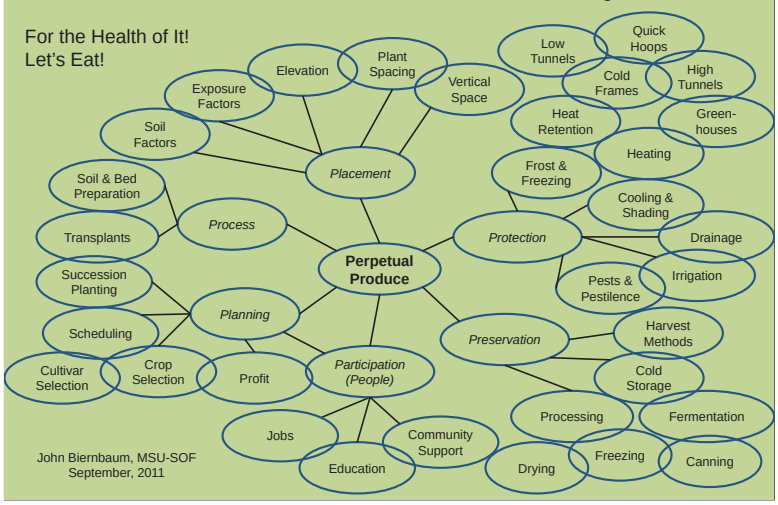
Reducing Risk for Small Scale Farmers

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



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

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?

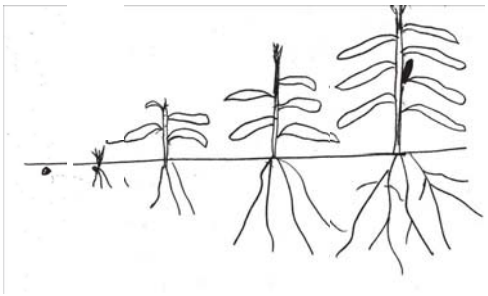
What are some advantages of perennial crops?

- 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

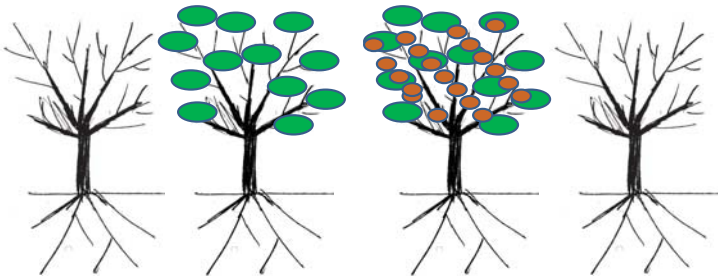


How is Leaf Area Index calculated and why is it important?

Annual Perennial Leaf Area Index (LIA)

April May June July August September October November

Chestnut Tree



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?

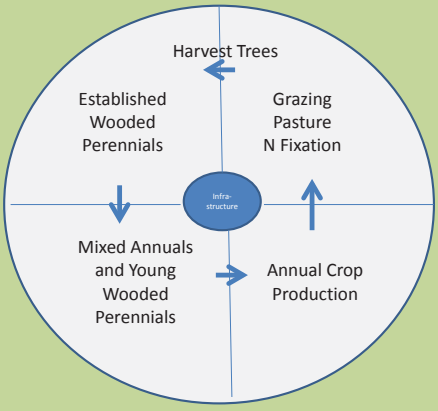
Tall Trees, hard to pick and spray, were replaced by trees pruned to keep them lower to the ground.

Perennial Crop Ground Floor Management: Impact on Soil Biology and Pest Populations?

Where's the Mulch?

Orchard Floor Management

Long Term Rotation?



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 managment)
- 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 some thing 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

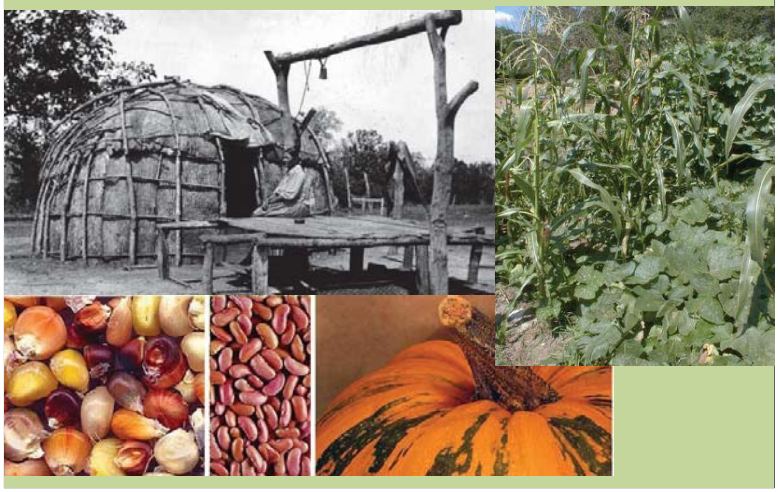
Examples of Ecological Farming Methods:

- Biodynamic
- Organic
- Biointensive (*Bio*logical and French *Intensive*)
- Sustainable Agriculture
- Permaculture (*Perma*nent+Agri*culture+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: ***perma***nent culture and agri***culture***

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

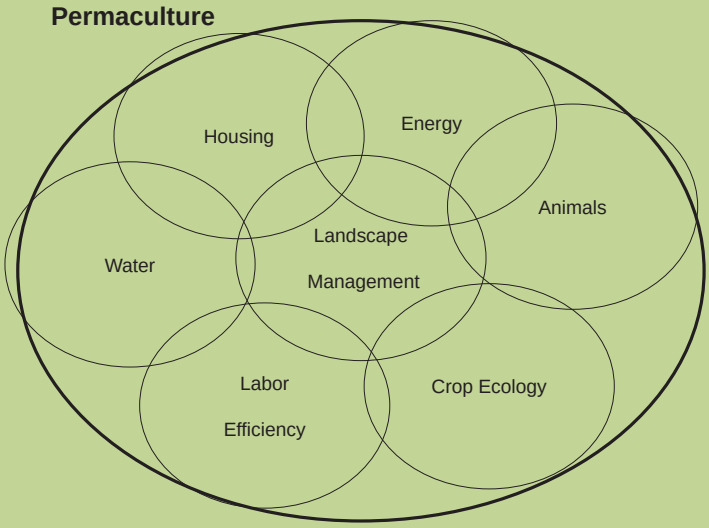
- **Observe and interact:** Get to know the Place
  Beauty is in the eye of the beholder (i.e. systems thinking).
- **Catch and store energy:**
  Make hay while the sun shines.
- **Obtain a yield:**
  You can't work on an empty stomach.
- **Apply self-regulation and accept feedback:**
  The sins of the fathers are visited on the children unto the seventh generalization.

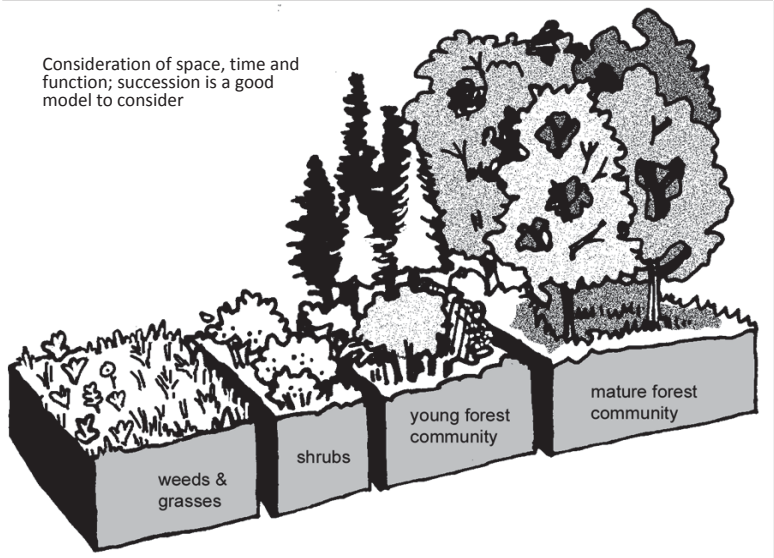
Permaculture Principles

- **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.





Working With Succession
vs
Against Succession

Organic Farming---> <--- Permaculture

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

Ecosystem Niche

Spacial	Temporal	Functional	Human use
- tree	-successional stage	- pollinator	- food
- shrub	- sun/shade	- insectary	- fiber
- vine	- ephemeral	- mulch producer	- fuel
- ground cover	- pollination timing	- nutrient accumulator	- animal feed
-herbaceous perennial		- food producer	- mulch
- annual		- weed suppressor	- medicine
			- aesthetics

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

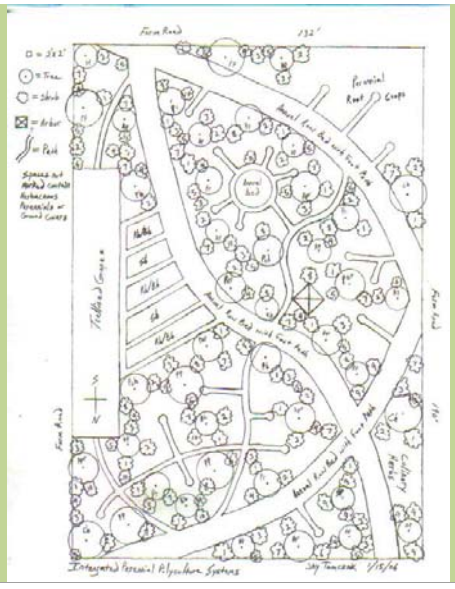
- Students participating at the Student Organic Farm expressed interest in Permaculture – 2004-2005
  - Jay Tomczak, Trevor Johnson, Andy Fles and others
  - Trevor Johnson - Sustainability Course at Findhorn
- A plot was being developed for perennial plantings
- Initiated as a graduate student project – 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

Incorporating Organic Matter

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

Trees
- Pawpaw
- Chestnut
- Apple
- Pear
- Asian Pear
- Peach
- Persimmon
- Dwarf Spruce

Shrubs
- Blueberry
- Beach Plum
- Hazels
- Bush Cherry
- Siberian Pea
- Currents
- Gooseberry
- Serviceberry
- Raspberry

Vines
- Hops
- Grapes
- Hardy Kiwi
- Groundnut

Ground covers
- White clover
- Strawberry

Herbaceous Perennials

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

Hand planting and mulching

Annuals: Flowers, grains, beans

Hops

Deer foraging was a major issue

Three Sisters Garden

corn, beans and squash

Irrigation: Hand watering - good rainfall and mulch helped conserve water

Fall of First Growing Season

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

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