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The Need for a Culture of Sustainable Agricultural Ethics as a Response to Biocultural Homogenization, Food Shortages, and Environmental Degradation

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I. **Research Problem:** Exploration of permaculture as a form of sustainable agriculture to address the issues of:
   i. Environmental Degradation
   ii. Food Security
   iii. Biocultural Homogenization

II. **Methods:** Literature Review of Permaculture & Internship at Rising Locust Farm

III. **Permaculture in Practice & Theory as a Solution**
   i. Permaculture Ethics & Practices
   ii. Reversing Environmental Degradation
   iii. Food Security
   iv. Biocultural Framework

IV. **Next Steps & Take Away Message:** Reframe industrial agriculture in terms of the values and practices found in permaculture and biocultural ethics
   i. Continue internship with Rising Locust Farm
I. Problem 1: Environmental Degradation

- **Environmental Degradation**: deterioration of the environment in respect to habitats, ecosystems, and resources
  - Extinction & loss of biodiversity
  - Pollution
  - Decreased health in relation to water, air, and soil
  - Human health issues
- Causes:
  - Land disturbance
  - Pollution
  - Overpopulation
  - Waste
  - Deforestation
  - Natural causes

I. Problem 2: Food Security

- **Food Deserts**: “parts of the country vapid of fresh fruit, vegetables, and other healthful whole foods, usually found in impoverished areas
  - Injustice related to race and socioeconomic status
  - Foods available are high in sugar, salt, and fat
  - Increased health problems

- **Declining Nutrition**
  - Loss of minerals and trace elements in foods
  - Rising health issues
  - Corn, soy, wheat, and rice make up 2/3 daily calories for the American diet
    - Annuals are generally less nutritious than perennials
    - Related to poor soil health


I. Problem 3: Biocultural Homogenization

- **Biocultural Homogenization**: the reduction in biodiversity, linguistic diversity, and cultural diversity
  - “favor[s] a narrow set of species, languages, and cultural habits at the expenses of the regional native ones”

- Example: In traditional agriculture, polycultures were typically used. In industrial agriculture, monocultures are the dominant method.
  - Monocultures reduce biodiversity, deplete soil health, and encourage pests and disease, among other issues

II. Literature Review

- “Practical Permaculture: for Home Landscapes, Your Community, and the Whole Earth” by Jessi Bloom & Dave Boehnlein

- Dr. Christine Jones, Australian Soil Ecologist, amazingcarbon.com

- “In Defense of Food: An Eater’s Manifesto” by Michael Pollan

- “Biocultural Ethics: From Biocultural Homogenization Toward Biocultural Conservation” by Ricardo Rozzi, ecologist & philosopher, professor at University of North Texas & La Universidad de Magallanes (Chile)
II. Internship with Rising Locust Farm

- Permaculture & Regenerative Agriculture
  - Agroforestry, Silvopasture, Rotational Grazing, Perennial Polycultures, among other practices
  - Scottish Highlander Cows, Idaho Pasture Pigs, Sheep, Ducks, & Chickens
- 3 Permaculture Ethics:
  - Earth Care
  - People Care
  - Fair Share
- 40 acres, operated by the Rhoades family since 2015
- http://www.risinglocustfarm.com/
So what is permaculture?

A “Permanent Agriculture”

"Permaculture is the conscious design of agriculturally productive ecosystems which have diversity, stability, and resilience of natural ecosystems."

~Bill Mollison
III. Permaculture

- Designed by mimicking natural patterns and systems for greater resiliency, sustainability, and self-sufficiency

- Designed with the thought that the system will continue to thrive if left untended for a period of time

- Implements systems thinking: holism, relationships between parts of the system, imitation of nature, recycling of materials, primarily closed systems

- Includes an ethical system
12 Principles of Permaculture

1. Creatively use & respond to change
2. Observe & interact
3. Catch & store energy
4. Obtain a yield
5. Apply self-regulation & accept feedback
6. Use & value renewable resources & services
7. Produce no waste
8. Design from patterns to details
9. Integrate rather than segregate
10. Use small & slow solutions
11. Use & value diversity
12. Use edges & value the marginal

EARTH CARE

FAIR SHARE

PEOPLE CARE
Permaculture Ethics

**Earth Care**
- Intrinsic value for all parts
- Help and care for the Earth
- Do no harm: avoid damaging intact, natural ecosystems
- Regenerate damaged landscapes

**People Care**
- Meet the present and future needs of people
- When people’s needs are met, they can be better stewards themselves
- Awareness of humans as part of nature and the ecosystem

**Fair Share**
- Limits: take only what is needed
- Redistribution of Surplus: share with others
- Work towards a more just and fair community

Niche: An organism’s space or position within the ecosystem in relation to other members, as well as its role or function it provides.

Ecological Succession: Stages of development of an ecosystem from establishment to maturity or disturbance.

Bioregion: A region characterized by ecological features and defined by geological boundaries.

Biodiversity: Diversity of organism types within an environment; ecosystem health indicator.

Ecosystem Services: Functions provided by a healthy ecosystem; for example pest management, nutrient cycling, or erosion prevention.
Ecological Succession

Pioneer stages

Intermediate stages

Climax community

Bare rock
Lichens
Small annual plants, lichens
Perennial herbs, grasses
Grasses, shrubs, shade-intolerant trees
Shade-tolerant trees
Permaculture Practices

- Agroforestry
- Silvopasture
- Companion Planting & Guilds
- Urban Permaculture
Environmental & Ecological Benefits of Permaculture

Water
Cleaner water & reduced runoff

Soil
Increased ability to retain water; nutrient availability through mycorrhizal fungi & the microbial bridge; improved soil structure

Biodiversity
Promotes diversity of plants and animals within the system & brings native diversity as habitat is restored

Restoration
Can restore degraded landscapes through repairing ecosystem health

Plant Communities
Plants can provide for each others’ needs and flourish as the community ages

Carbon
Increased carbon sequestration & reduced atmospheric carbon

Soil: The Carbon Sink

- Carbon is stored in the solid phase within soil – *Carbon Sink*
- 30-75% carbon lost in agricultural soils worldwide in past 150 years
- 1% increase in soil carbon sequesters 154 tons CO₂ per hectare; 3% sequesters 462 tons CO₂ per hectare
- 30-40% carbon fixed in green leaves can enter the soil and become humified, sequestering 5-20 tons CO₂ per hectare per year
- 100 tons CO₂ taken from atmosphere for every 27 tons sequestered in soil
- Humus (60% carbon, 6-8% nitrogen) binds to minerals and builds topsoil

[Sources]
Environmental Degradation of the Liquid Carbon Pathway: Nutrient Pathways and Carbon Sequestering

- **Liquid Carbon Pathway**: plant roots exude carbon-based substances (sugars) to signal to other plants and microbes, as well as provide these microbes with energy; driven by photosynthesis
  - In return, these microbes and mycorrhizal fungi feed plants essential nutrients (85–90%)
  - Industrial agricultural practices threaten and erode the key microbial bridge that is necessary for plants to receive the essential nutrients & trace elements from the soil that are required for sustaining healthy life
    - *-cides
    - Synthetic fertilizers
    - Bare or disturbed soil

Building Soil & Biodiversity

- Plants with relationships with mycorrhizal fungi photosynthesize faster and more efficiently
  - Higher photosynthesis = higher Brix level; higher levels of plant-protection compounds increase resistance to insects and pathogens

- **Soil Aggregates**: clumps of soil particles bound together; provides pores in the soil for water and air, as well as root growth; structure also fueled by root exudates in Liquid Carbon Pathway
  - Increased water retention
  - Ideal soil structure

- Diversity of plants aboveground promotes diversity of life underground
  - 95% of life on land resides in soil
  - Companion planting fosters healthy communities – nutrient availability, pest resistance
Role of Animals in Soil Health

- Grazing less than 50% of the green leaf in a pasture at once reduces impact on photosynthesis
- Biomass is rapidly restored – triggers plants to respond and grow, exudates feed microbes
  - More forage produced per season
  - More carbon sequestered
  - Provides fertilizer and nutrients for the soil

- Ruminants were much more bountiful prior to the Industrial Revolution
- Grazing animals release methane that feed methanotrophic bacteria in the soil
- This methane is almost immediately recycled and does not enter into the atmosphere
- Changing practices (removing the animals from the land, and thus the methanotrophs) not only deplete the land, they also complicate the situation of methane (it cannot so easily be recycled)
- Grass-fed livestock recycle carbon while grain-fed livestock has high CO₂ emissions


Permaculture’s Role in Soil Health

- Perennial Polycultures
- Diverse soil microbes
- Healthy soil structure
- Nutrient cycling & availability
- Year-round green groundcover & photosynthesis
- Creates plant communities that promote mutual health

- Carbon Sequestration – *Carbon Sink*
- Composting & other practices play a role in soil fertility
- Lack of chemical use
- Animals integrated in design play crucial roles
Annuals

- Require planting every year
- Create a higher risk of bare soil – no year round groundcover
- Corn, soy, wheat, and rice make up much of the modern American diet
  - 2/3 daily calories come from these four foods:
    - Corn – 554 calories
    - Soy – 257 calories
    - Wheat – 768 calories
    - Rice – 91 calories
  - Less nutrition per calorie
- Growth efficiency in annuals reduces time spent accumulating nutrients; added chemicals that provide easy access to major nutrients reduces root growth and thus the ability to take up trace elements, especially when the mycorrhizal bridge is broken

Perennials

- Support mycorrhizal fungi, have deep roots, and filter water
- Lose aboveground vegetation each year, which acts as a mulch that builds soil while keeping roots alive to support soil life
- Some roots die, which aerate soil and add humus
- Improve landscape functioning – nutrient cycling, water quality, soil stability, soil life, weed control, erosion management, healthy soil temperatures, slower evaporation
- Soil carbon can be increased between 1-3% when there is a change from annual to perennial groundcover
Nutrients within food have decreased as a result of declining soil health
Each nutrient level has fallen between 10 and 100% in almost every food
From 1940-1991 (UK):
• Copper reduced by 76%
• Calcium reduced by 46%
• Iron reduced by 27%
• Magnesium reduced by 24%
• Potassium reduced by 16%
• Steak contains ½ as much iron as 50 years prior (2007)

“An individual today would need to consume twice as much meat, three times as much fruit, and four to five times as many vegetables to obtain the same amount of minerals and trace elements as available in those same foods in 1940.”

Depleted Nutrition, Depleted Health

- Humans are struggling with illnesses that require vitamins, minerals, and trace elements to fight off

- Increased disease and health problems
  - Cancer has increased from 1 in 100 only 50 years ago to 1 in 2

- High omega-6 fats can promote tumor growth; high omega-3 fats can block it
  - Grass-fed beef has a better balance of omega-3s and -6s, while also being 3-5 times higher in conjugated linoleic acid (anti-cancer)

References:
Food Security: How Healthy Soil Affects Human Health & Nutrition

- Improving soil health through sustainable agricultural techniques that promote the function of natural cycles provides higher food security, better human health, and environmental wellbeing.

- Environmental health secures future food production.
Increased Food Security Through Permaculture

- Nutrient-dense food provided by sustainable agricultural practices
- High diversity of foods from natural areas or diverse agricultural ecosystems
- Urban permaculture provides relief from food deserts in both availability and nutrition
- Soil health secures a better future for food production
- Increased knowledge of food and native plants
Biocultural Ethics: how should humans co-inhabit the world?

**Biocultural Ethic**

It is ethically necessary to protect diverse native habitats and the interrelationships humans have with them.

It is socially and environmentally unjust to allow for biological and cultural diversity to be lost.
Biocultural Heritage:

“Knowledge, innovations and practices of indigenous and local communities that are collectively held and are inextricably linked to: traditional resources and territories, local economies, the diversity of genes, species and ecosystems, cultural and spiritual values, and customary laws shaped within the socio-ecological context of communities.”

How Do We Implement Biocultural Ethics?

Biocultural Conservation

Recognizing the importance of conserving this biocultural diversity is a major effort in sustainability.

Co-evolution with a local ecosystem allows for more adapted practices and cultures that allow the flourishing of people, biota, and natural systems.
The Role of Ecological Knowledge in Biocultural Ethics

**Local Ecological Knowledge (LEK)**
“tied to place...knowledge acquired through experience and observation. It can be acquired over a single lifetime or over many generations.”

- **Individual Observation**
  Does not require the accumulation of prior knowledge by others

- **Absent Cultural Ties**
  Does not necessitate embeddedness in any shared culture

- **Site Specific**
  Just like TEK, it is linked to the local environment and can connect an individual to it

**Traditional Ecological Knowledge (TEK)**
“a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environment”

- **Resource Use**
  Management and practices associated with using resources

- **Tied to Culture**
  Social norms, Spirituality, Linguistics

- **Dynamic**
  Evolves over time through observation and adaptation

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**How Do Permaculture & Sustainable Agriculture Assist Biocultural Conservation?**

**Local Environment & LEK**
Native Biota, Local Natural Systems, Created Agricultural Ecosystems Oriented to Local Place

**Care for the Earth**
Care Ethic rooted in understanding the Earth and how to interact with it to preserve its wellbeing

**Care for People**
Respect for others & their perspectives, sharing of abundance

**Strong & Resilient Communities**
Working together to create close-knit communities that share labor, skills, and ideas; mutually supportive

**Permaculture**

**Biocultural Conservation**

**Pairing Permaculture, Sustainable Agriculture, & Biocultural Conservation**

**Local Environment, LEK, & TEK**
Interactions with local environment shape worldview, practices, and other interactions

**Shared Culture**
Regions share culture largely based in local environment and traditions; worldview, spirituality, ritual, language, food, etc

**Co-Inhabitation**
Importance of living harmoniously with not only other humans but also all other beings in the local (and greater) environment

**Social & Environmental Justice**
Conserving biocultural diversity preserves diverse perspectives and environments in order to support a more just, equitable, and sustainable global interface based in flourishing local communities
IV. Conclusion: Why Permaculture Can Be The Solution

- Supports healthy ecosystems, land, and biodiversity
- Fosters strong and resilient human communities and relationships
- Promotes greater food security, availability, diversity, nutrition, and knowledge
- Encourages an ethic of care and reciprocity towards the natural environment
- Links people and culture to the local land and biota, increasing local ecological knowledge; helps with biocultural conservation
Thank you!
Questions?
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