

Aldo Leopold's "land ethic"

“Conservation is a state of harmony between men and land. By land is meant all of the things on, over, or in the earth. Harmony with the land is like harmony with a friend; you cannot cherish his right hand and chop off his left. That is to say, you cannot love game and hate predators; you cannot conserve the water and waste the ranges; you cannot build the forest and mine the farm. The land is one organism.” (Leopold 1966, J&J p 17)



Fitting into Place: Farming with the Wild

Martha Rosemeyer

Farm to Table

May 9, 2005

Outline

- Connecting food systems with ecosystems
- Farms as part of watershed
 - Positive and negative flows between them
- Nature as model of sustainability
 - Potentially minimizes negative flows
- Models of agriculture based on place
 - International
 - US
 - PNW
- How we propose to learn how to “fit into place” and identify/develop/design agroecosystems in the watershed

What is the concept of “place”?

- Important to goal of sustainable agriculture
- Wes Jackson in *Becoming Native to this Place*:

“We are unlikely to achieve anything close to sustainability in any area unless we work for the broader goal of becoming native in the modern world, and that means becoming native in a coherent community that is in turn embedded in the realities of a surrounding landscape.”

Why is this important?

“How we eat determines to a considerable extent how the world will be used.”

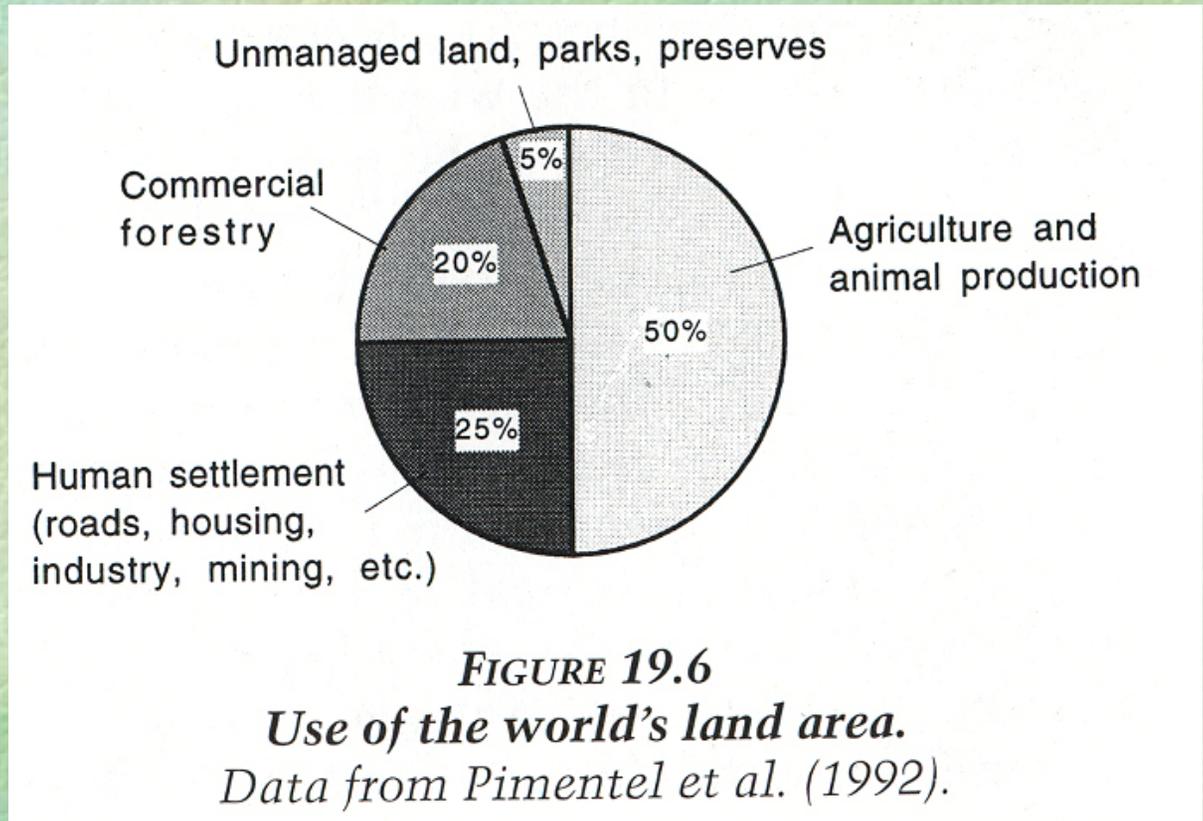
--Wendell Berry

Books by Wendell Berry include:

- *The Unsettling of America*
- *The Dream of the Earth*

World land use

Half of US
managed by
less than 2%
of population



What is becoming native?

- What is the name of the watershed we are in?
- What types of salmon are found in that watershed?
- What are the average frost dates?
- What is the average rainfall? What is its seasonal pattern (frequency)? Hours of sunlight? Average monthly temperature?
- Traditional people's land use? Land use history? Ag history?
- Where your food comes from?

More than biophysical

- History- environmental and economic
- Cultural history of land use
 - Squaxin in South Sound (Thursday)
 - Settlers
- Social systems
- Older folks who have lived here know the history

Ecosystem

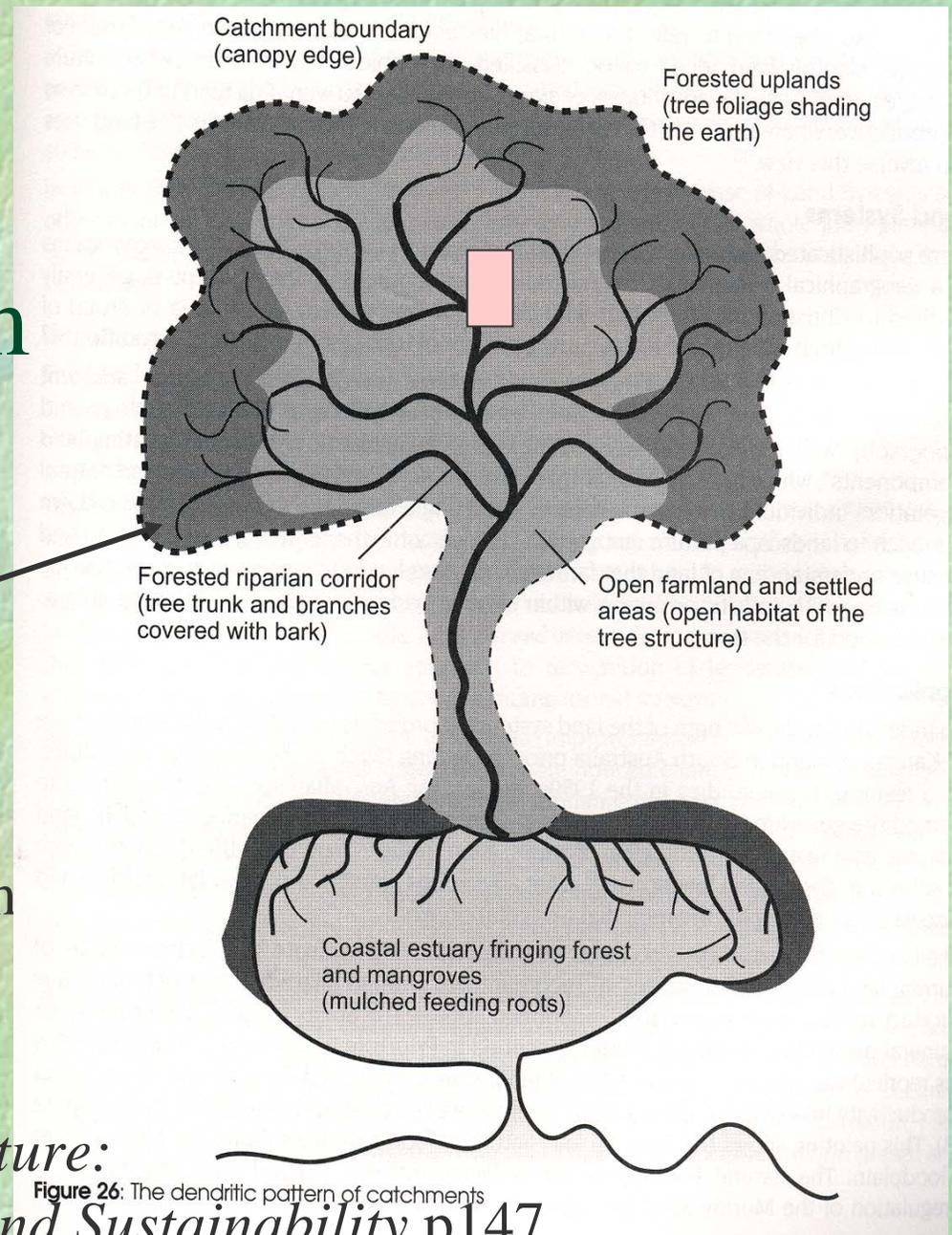
- The functional system of complementary relations between living organisms and their environments, delimited by arbitrarily chosen boundaries, yet which in time appear to maintain a steady yet dynamic equilibrium. (Gliessman 1998 Ch2)
 - **Structure:** the components
 - humans, animals, plants, microbes, soil, water, rocks
 - **Function:** how the components interact

The watershed (drainage basin): natural ecosystem boundary

Fractal patterns of river system: mathematical description of endless repetition of the whole
Branching of trees, landform surfaces follow this mathematical form

Holmgren, D. 2002. *Permaculture:*

Principles and Pathways Beyond Sustainability p147



Agroecosystem

- Site of agricultural production
- Provides framework to analyze food production systems as wholes, including complex sets of inputs and outputs and interconnections of their component parts.
 - Gliessman, *Agroecology* 1998 Ch 2)

Systems thinking

- Occurs when there is deliberate consideration of interrelationships
- Impossible to examine any change in a component or subsystem in isolation
- Includes social and economic factors

Wilkins, J. 1999. The Food System in Extension and Research.

Systems theory helps inform us about the function of a place

- A system is a group of interacting, interrelated and oftentimes interdependent elements that function together as a complex, unified whole.
 - A changes in one element affects change in another
 - Provides a holistic perspective
 - Components (stocks) cannot be considered in isolation
 - Flows are the interactions between components
 - Feedback causes self-regulation
 - Involve social components as well

How do farms function within the watershed?

- Though they have different structure (components) they are part of **energy flow** (the flow of the sun's energy through the ecosystem) and **nutrient cycling**

Energy Flow- one way

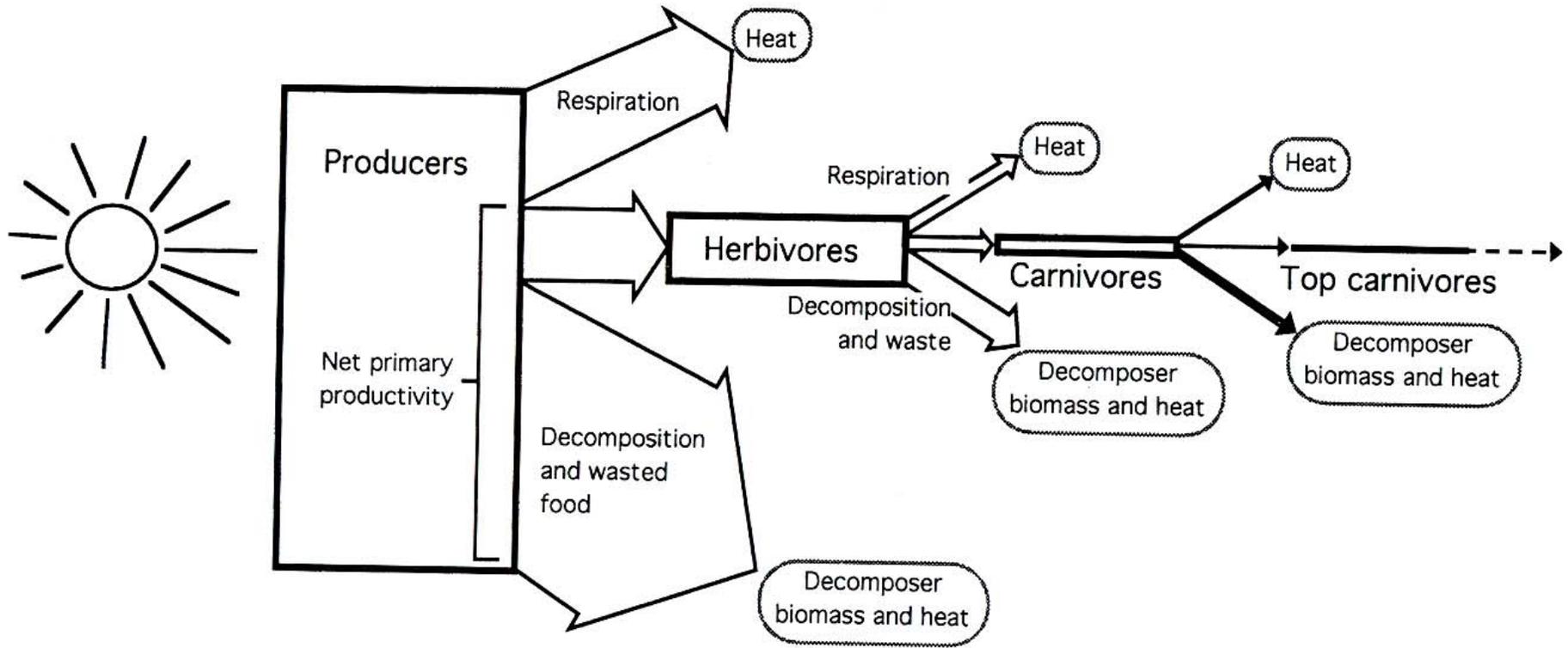
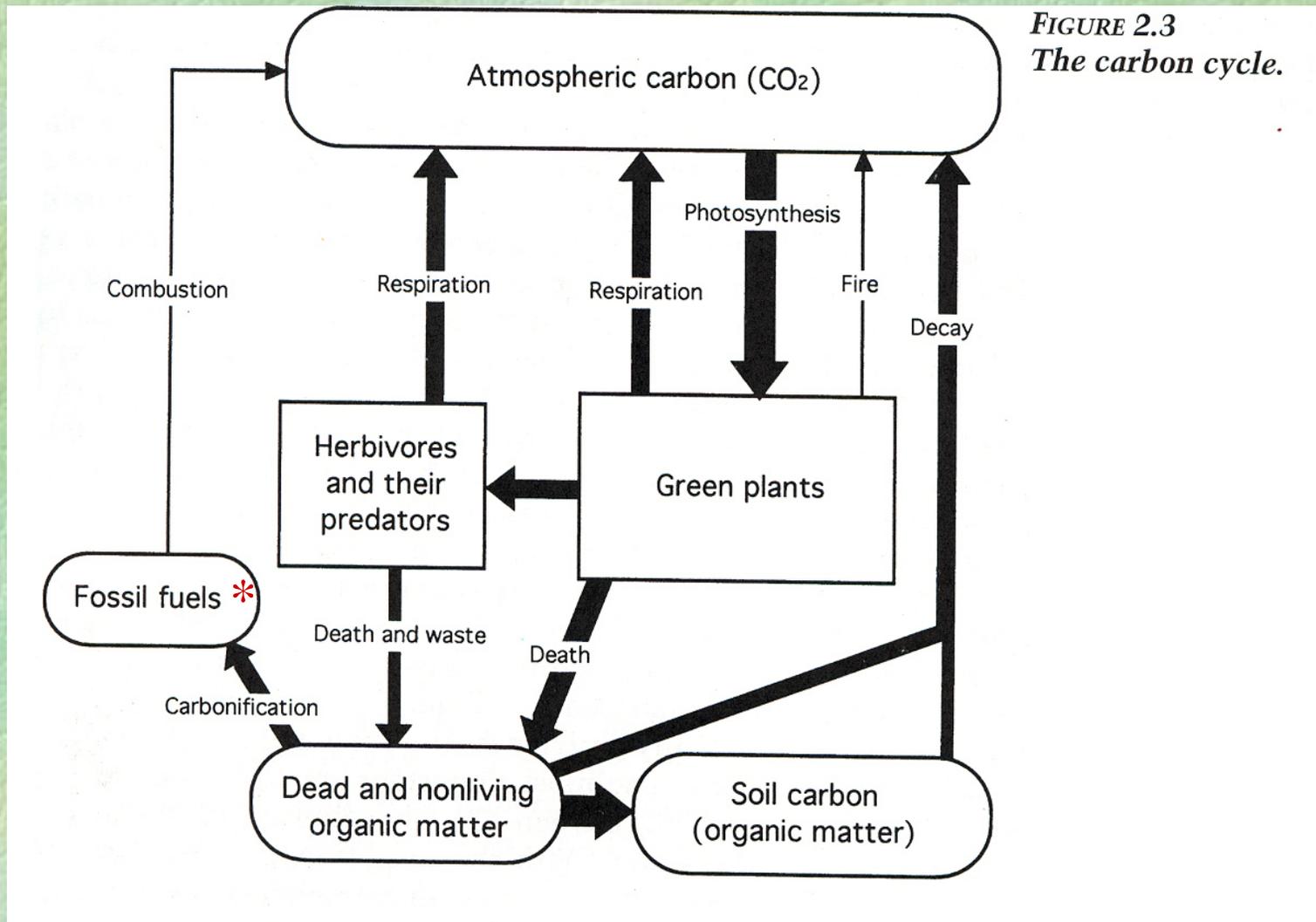


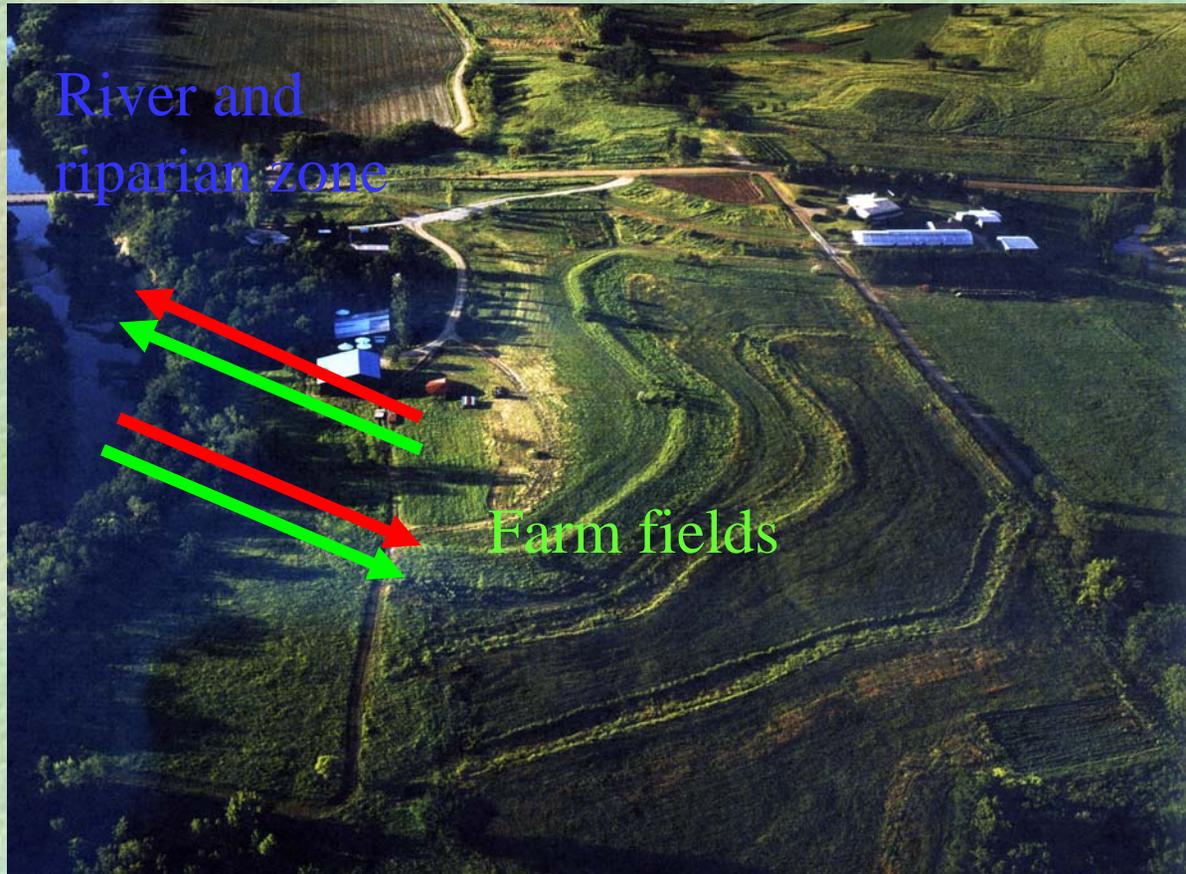
FIGURE 2.2

Ecosystem energy flow. The size of each box represents the relative amount of energy flowing through that trophic level. In the average ecosystem, only about 10% of the energy in a trophic level is transferred to the next trophic level. Nearly all the energy that enters an ecosystem is eventually dissipated as heat.

Element cycles- nitrogen, carbon, phosphorus, sulfur and others



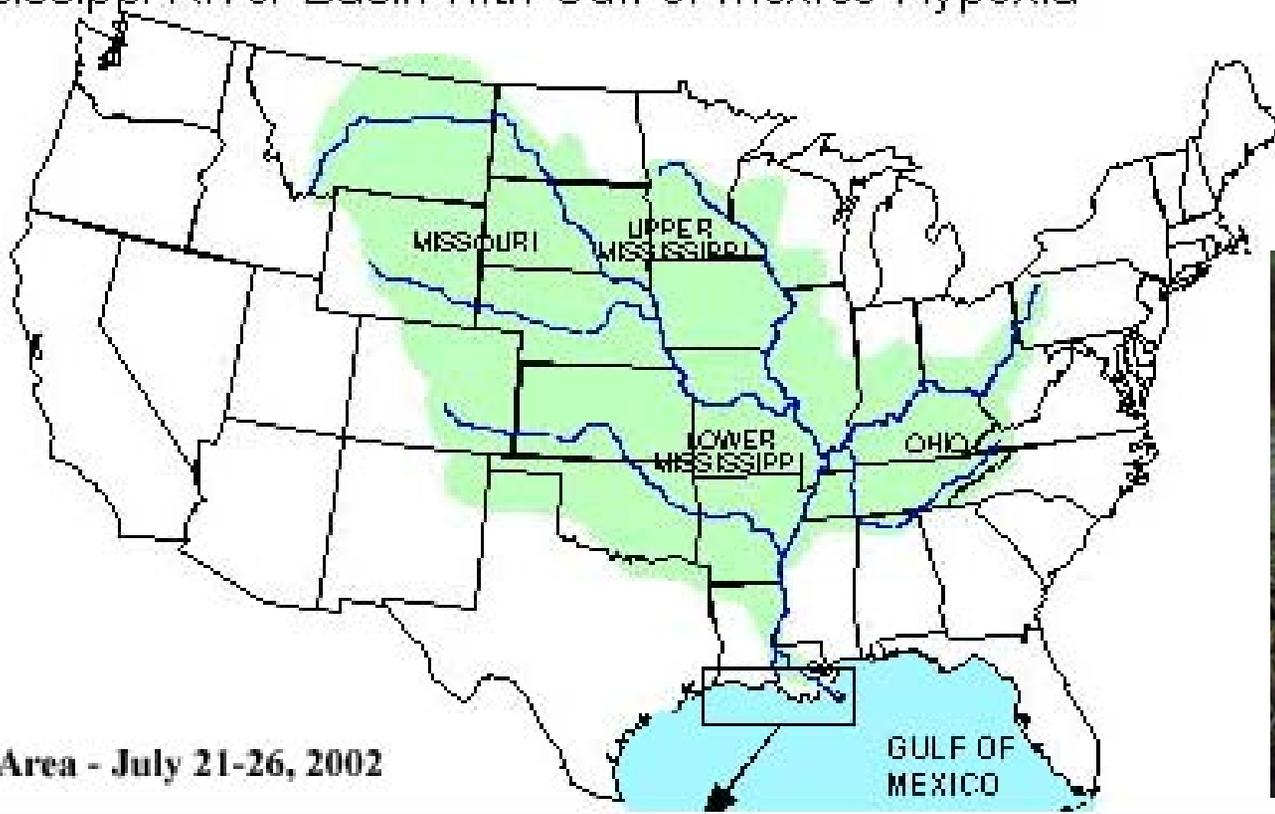
What are the positive and negative interactions between the natural and agroecosystem environment?



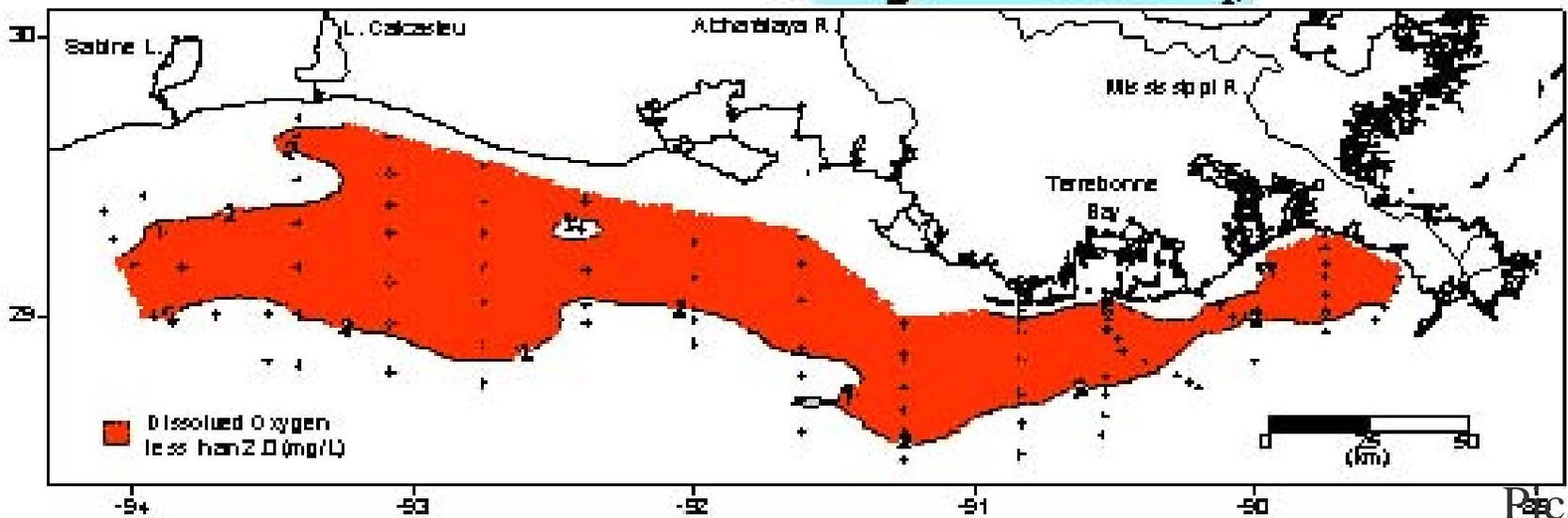
Can be positive or negative flows from agriculture to natural system

- Soil can escape = soil erosion
 - **Or soil can be built**
- Nutrients escape = especially nitrates
 - **Or be naturally increased (nitrogen fixation) in form that is difficult to escape**
- Pesticides escape
 - **Or be removed/decomposed/detoxified**

Mississippi River Basin with Gulf of Mexico Hypoxia



Hypoxia Area - July 21-26, 2002



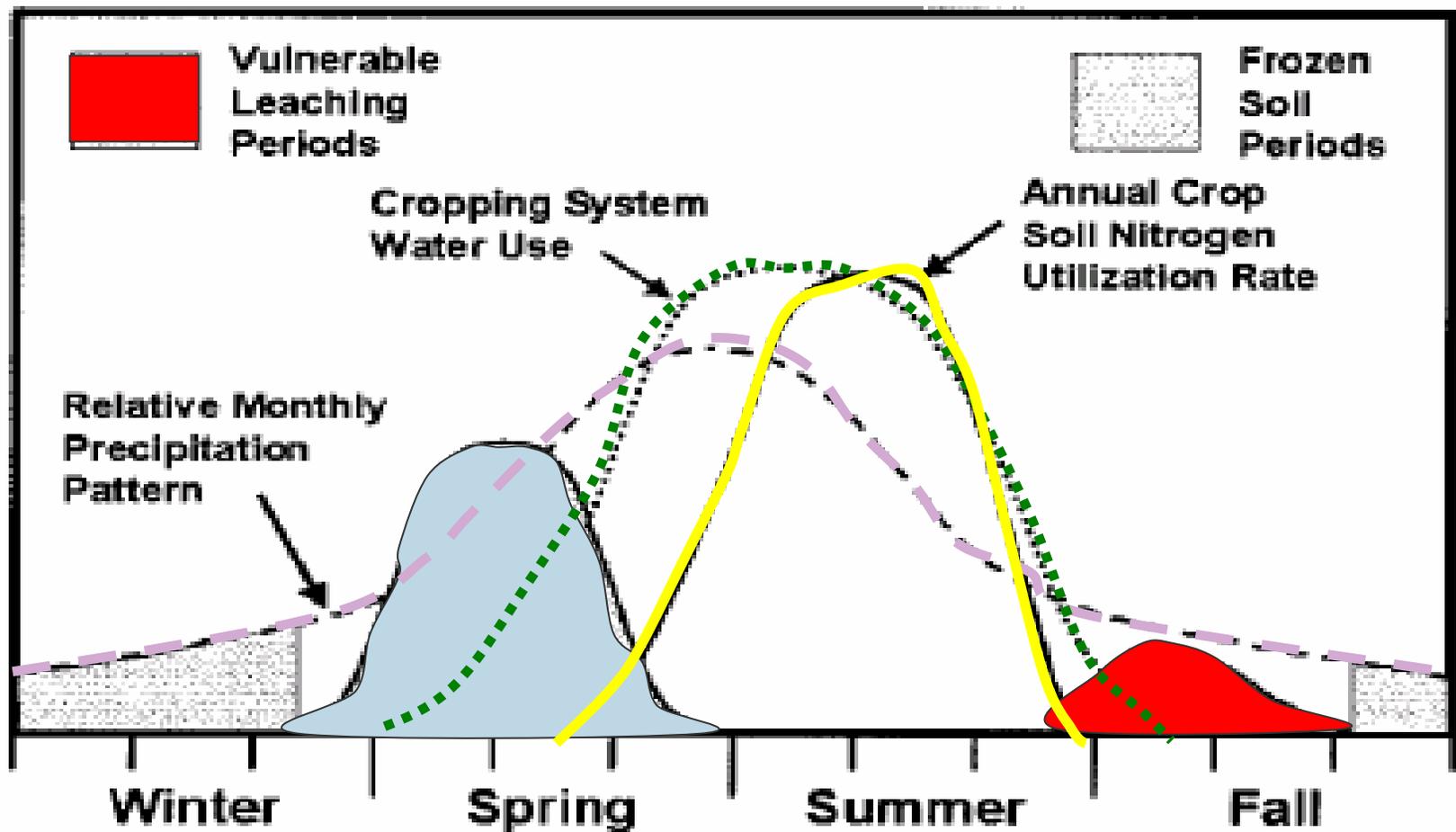


Fig. 3. General seasonal patterns for precipitation, N uptake rate by a corn crop, cropping system water use, and periods potentially favorable for NO₃ leaching from midwestern corn production (adapted from Fig. 4 of Power et al., 1998).

Nitrogen Management Strategies to Reduce Nitrate Leaching in Tile-Drained Midwestern Soils

Dana L. Dinnes,* Douglas L. Karlen, Dan B. Jaynes, Thomas C. Kaspar, Jerry L. Hatfield, Thomas S. Colvin, and Cynthia A. Cambardella

Conflict with agriculture and the endangered Spectacled Bear



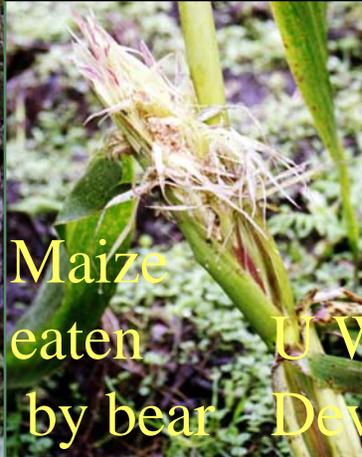
Cattle pasture
at forest edge



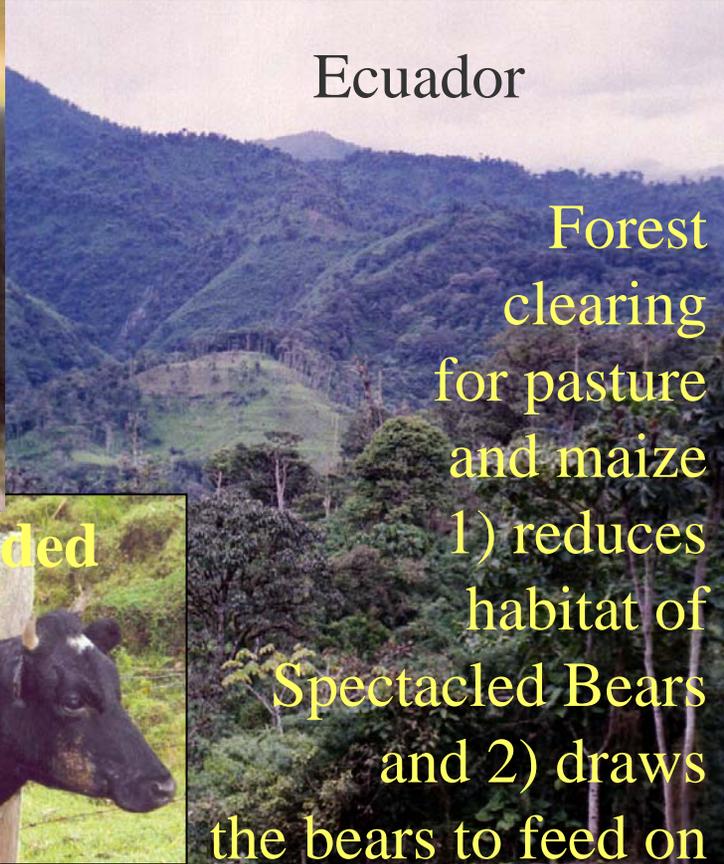
Cow wounded
by
bear



Field of maize



Maize
eaten
by bear



Ecuador

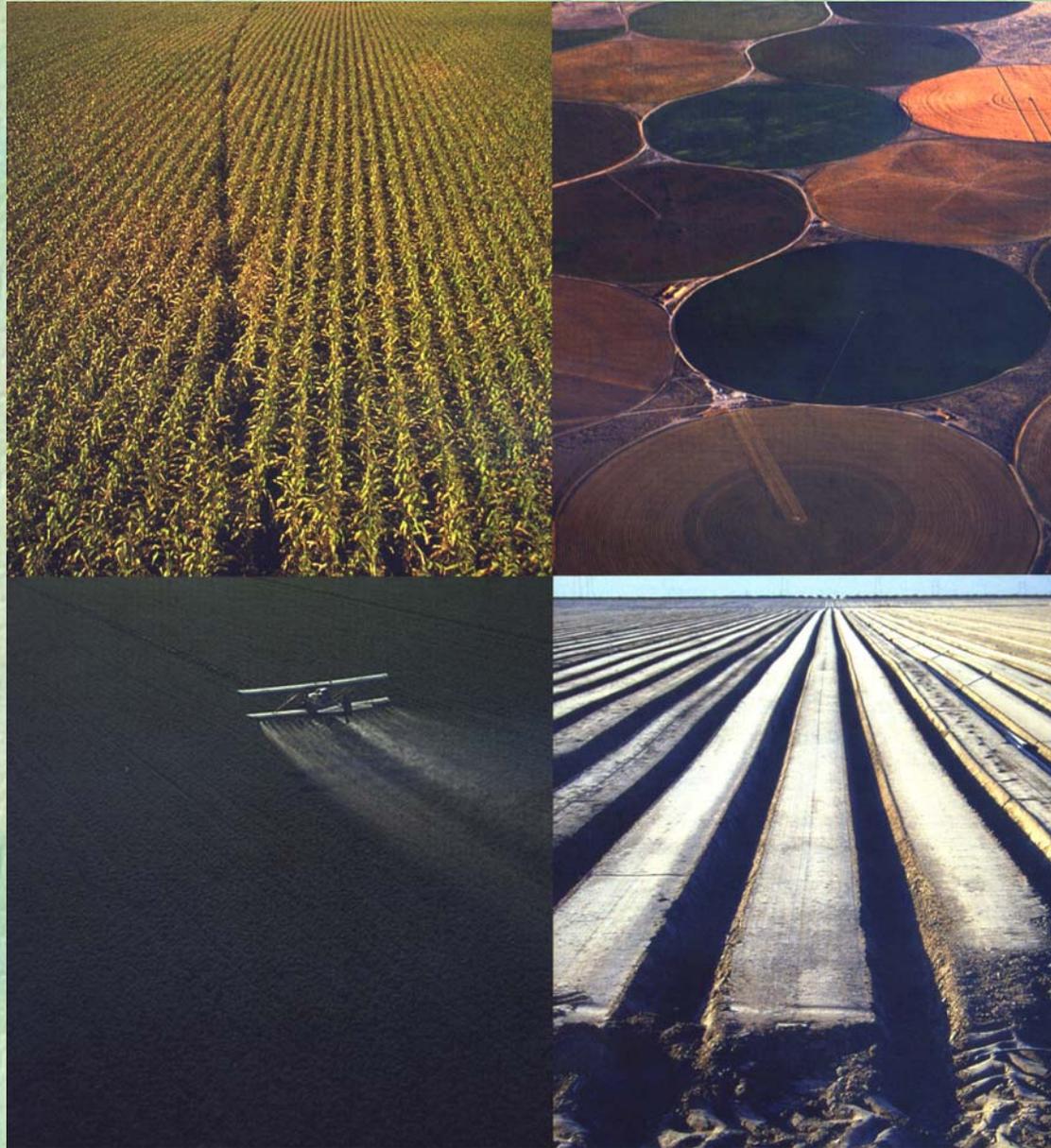
Forest clearing for pasture and maize 1) reduces habitat of Spectacled Bears and 2) draws the bears to feed on maize and cattle



“Place-based” agriculture has a different approach than conventional and less negative flows to natural

- Understands process and function from systems point of view
- Place-based agriculture uses plants and systems that are adapted to place
 - Why the consolidation of seed companies is particularly devastating— loss of locally adapted varieties
- **Agriculture usually taught by “recipe”-- the environment is modified for the plant**
 - **Fossil fuel energy used in modifying the environment to suit the plant**

Monoculture
central Pivot
Irrigation



Imhoff, *Farming with the Wild*

Another alternative: Nature as Model

Sir Albert Howard 1940

“The main characteristic of Nature’s farming can therefore be summed up in a few words: Mother nature never attempts to farm without livestock, she always raises mixed crops, great pains are taken to preserve the soil and prevent erosion; the mixed vegetable wastes are converted into humus; there is no waste; the processes of growth and the processes of decay balance one another; ample provision is made to maintain large reserves of fertility; greatest care is taken to store the rainfall; both plants and animals are left to protect themselves against disease.”

Nature as model of structure and function: will be different depending on place

- Mimicry the natural ecosystem means less negative flows between agricultural and natural ecosystems
 - The slash mulch system
 - Used with beans, corn, rice in Central and South America
 - Wes Jackson and The Land Institute
 - Developing edible perennial polycultures of prairie plants, perennialization of sorghum, wheat (WSU)
 - Ch 1 *New Agrarianism*
 - The Pacific Northwest
 - Salmon

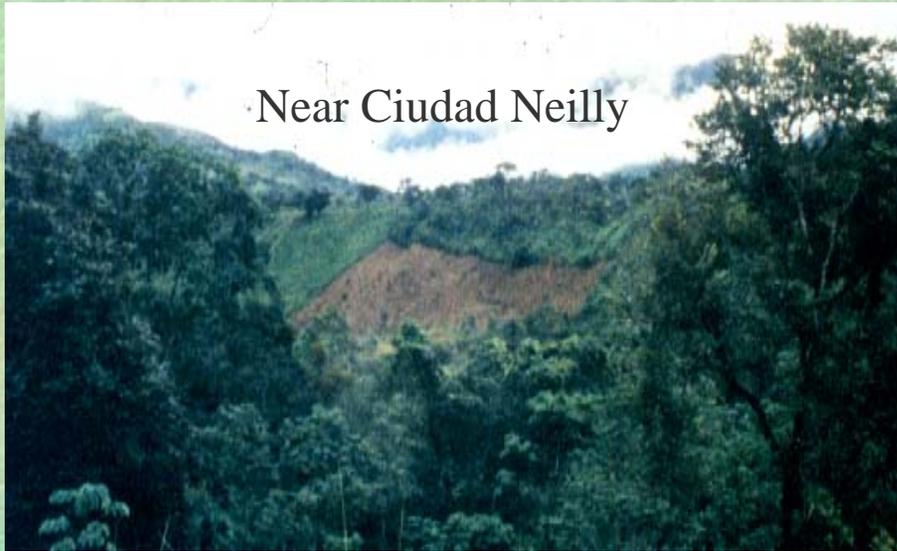
Appropriate second growth vegetation for slash mulch system



**After sowing seed, vegetation cut down
and distributed to form a mulch**



The slash mulch system on steep hillsides in Costa Rica



Finca Loma Linda, Cañas Gordas



Slash mulch beans

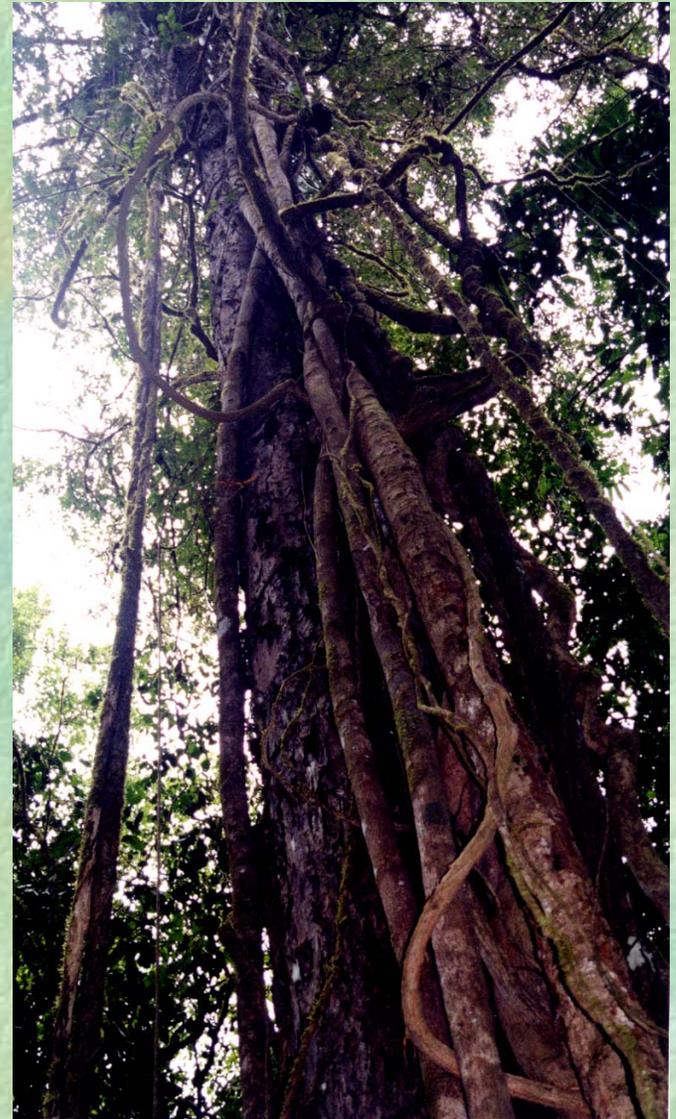


**75-85% of bean roots
found in the mulch
layer**

--Woike and Rosemeyer,
msc in prep



Slash mulch mimic of rainforest root-litter mat





Natural Systems Agriculture Productivity and Ecological Benefits of Plant Species Diversity in Perennial Polycultures

Valentin Picasso

vpicasso@iastate.edu

PhD student in Sustainable Agriculture

Iowa State University

The Land Institute – Natural Systems Agriculture Fellowship
Agronomy Department, Baker Center for Plant Breeding, ISU



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Picasso, 2005



Valentin's questions

How does plant diversity in perennial polycultures affects:

- biomass production?
- seed/grain production?
- **weed invasion?**
- stability of plant communities over time?
- other ecosystem indicators (light interception, soil quality, microbial communities, insects)?



Materials and Methods I

- Species:
 - legumes
 - alfalfa (*Medicago sativa*)
 - white clover (*Trifolium repens*)
 - Illinois bundle flower (*Desmanthus illinoensis*)
 - cool-season (C3) grasses
 - orchard grass (*Dactylis glomerata*)
 - intermediate wheatgrass (*Agropyron spp.*)
 - warm-season (C4) grasses
 - switchgrass (*Panicum virgatum*)
 - eastern gamagrass (*Tripsacum dactyloides*)
 - composites
 - Maximilian sunflower (*Helianthus maximiliani*)



Alfalfa



Illinois bundleflower



White clover



Orchardgrass



Intermediate wheatgrass



Picasso, 2005





Eastern gamagrass



Switchgrass

Picasso, 2005



Maximilian sunflower

Picasso, 2005

Materials and Methods

■ Treatments

- No crop
- Monocultures
- 2-sp:
 - 2 legumes
 - legume + C3 grasses
 - legume + C4 grasses
- 3-sp
 - 3 legumes
 - legume + 2 grass (C3 or C4)
 - legume + C3 grass + C4 grass
- 4-sp
 - legume + C3 grass + C4 grass + composite
- 6-sp
 - legumes + C3 grasses + C4 grasses
- 8-sp (all)

■ Measurements

- Initial plant counts and cover
- Light interception (LAI)
- Aboveground plant biomass (total and sp.)
- **Weed biomass**
- Grain/seed production (4 sp.)
- Soil indicators (N, P, K, texture, structure, biological)
- N in plant



Agronomy, June 15, 2004

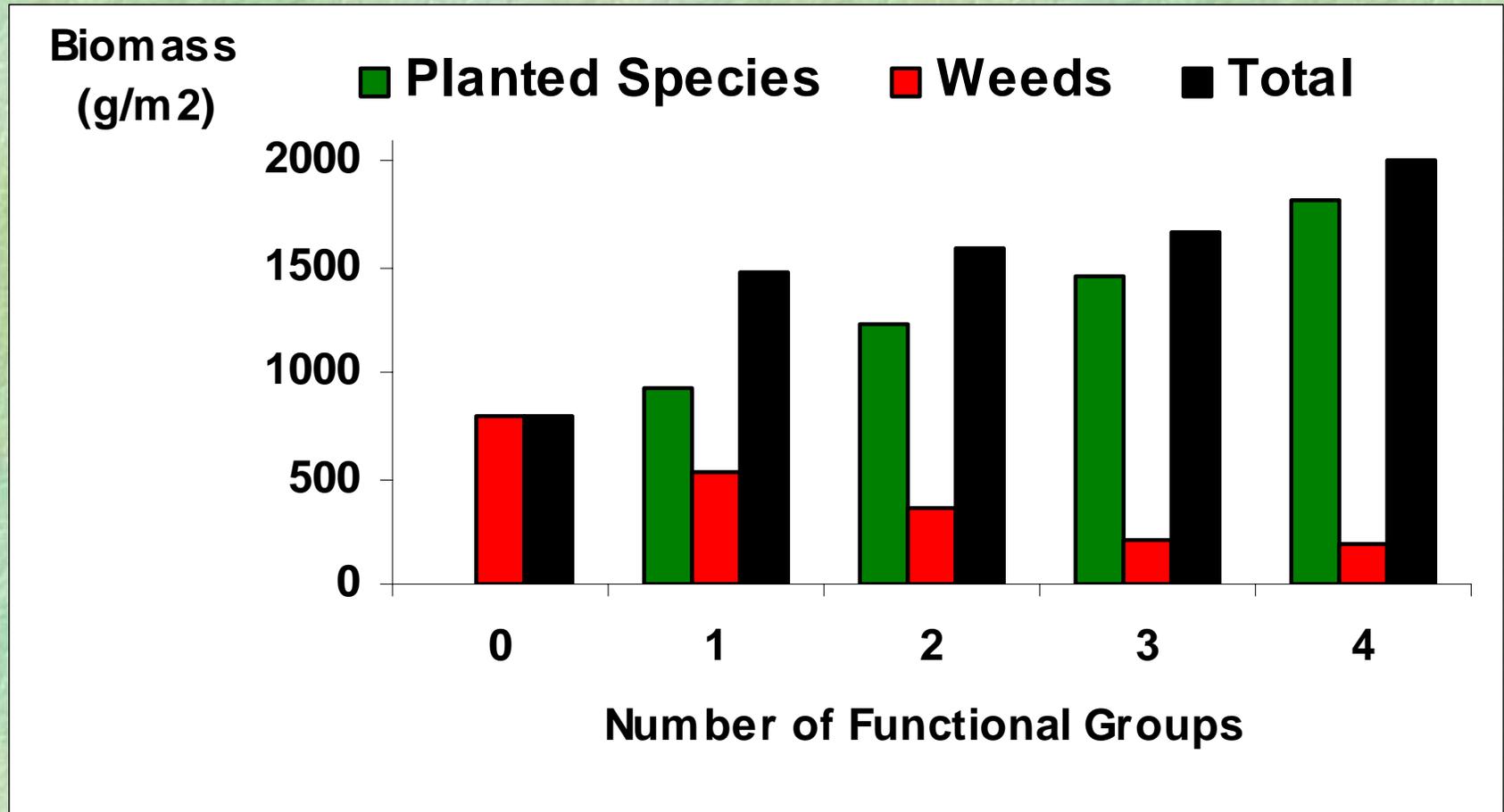
Picasso, 2005



Hinds, August, 2004

Picasso, 2005

Preliminary Results: less weeds where more functional groups

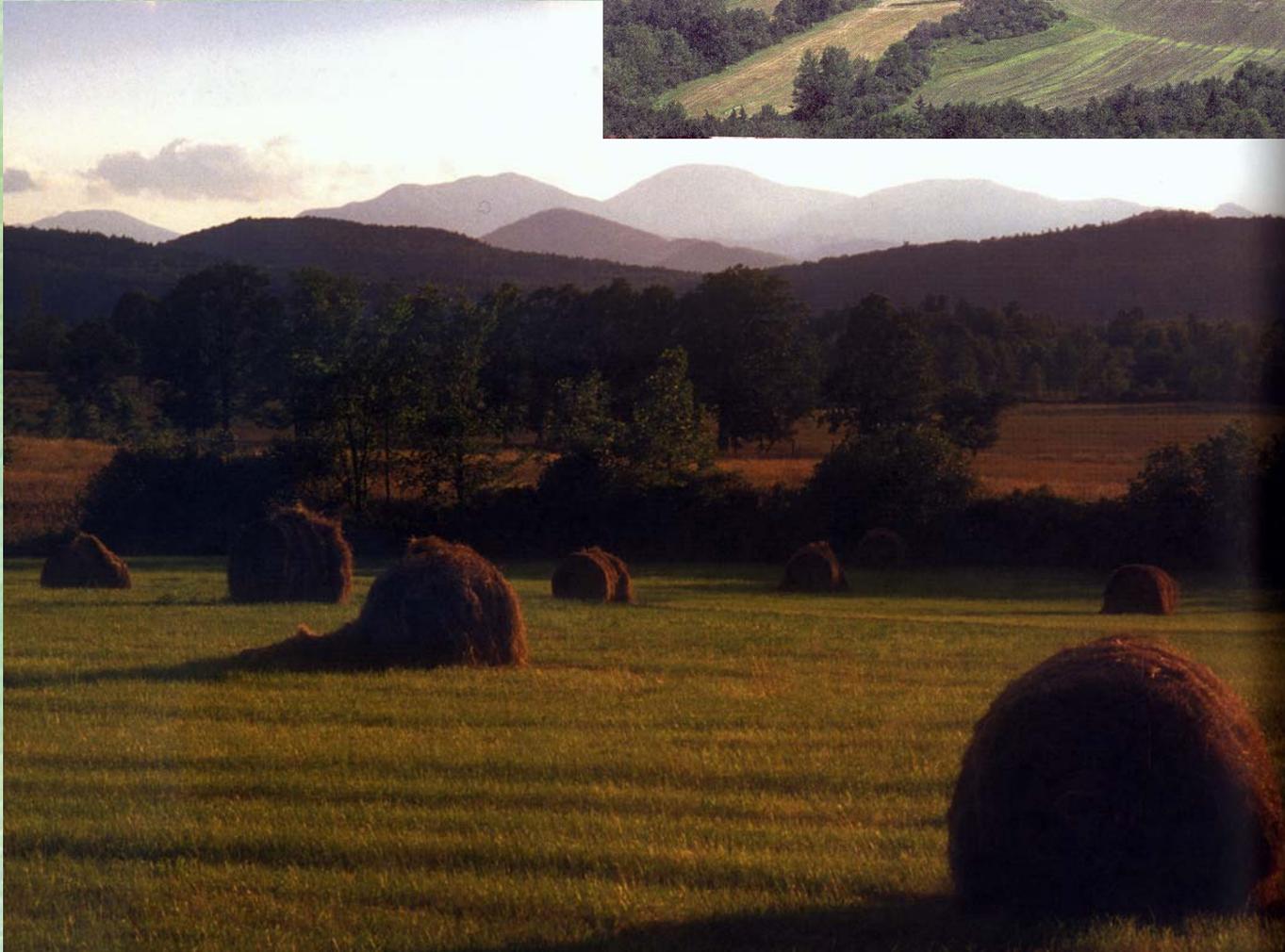




The Land Institute, KS

- Short Course, for undergraduates on NSA (May 27-29, 2005)
- Prairie Festival (October)
- Internships
- NSA Graduate Fellowship
- www.landinstitute.org

Adirondacks



Management intensive rotational grazing (MIRG)

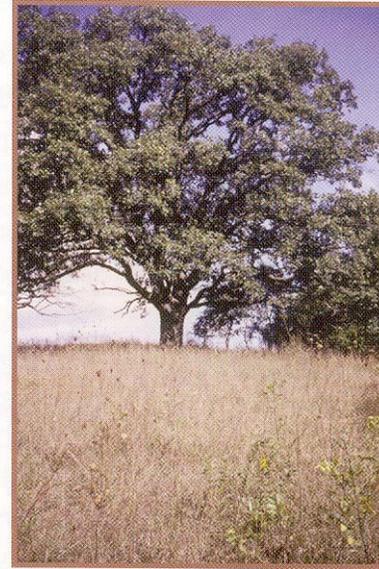


photo: Emily Kathol

Oak tree with prairie grass and flowers beneath.

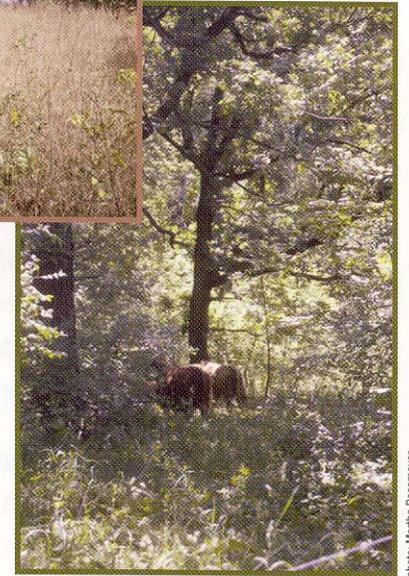
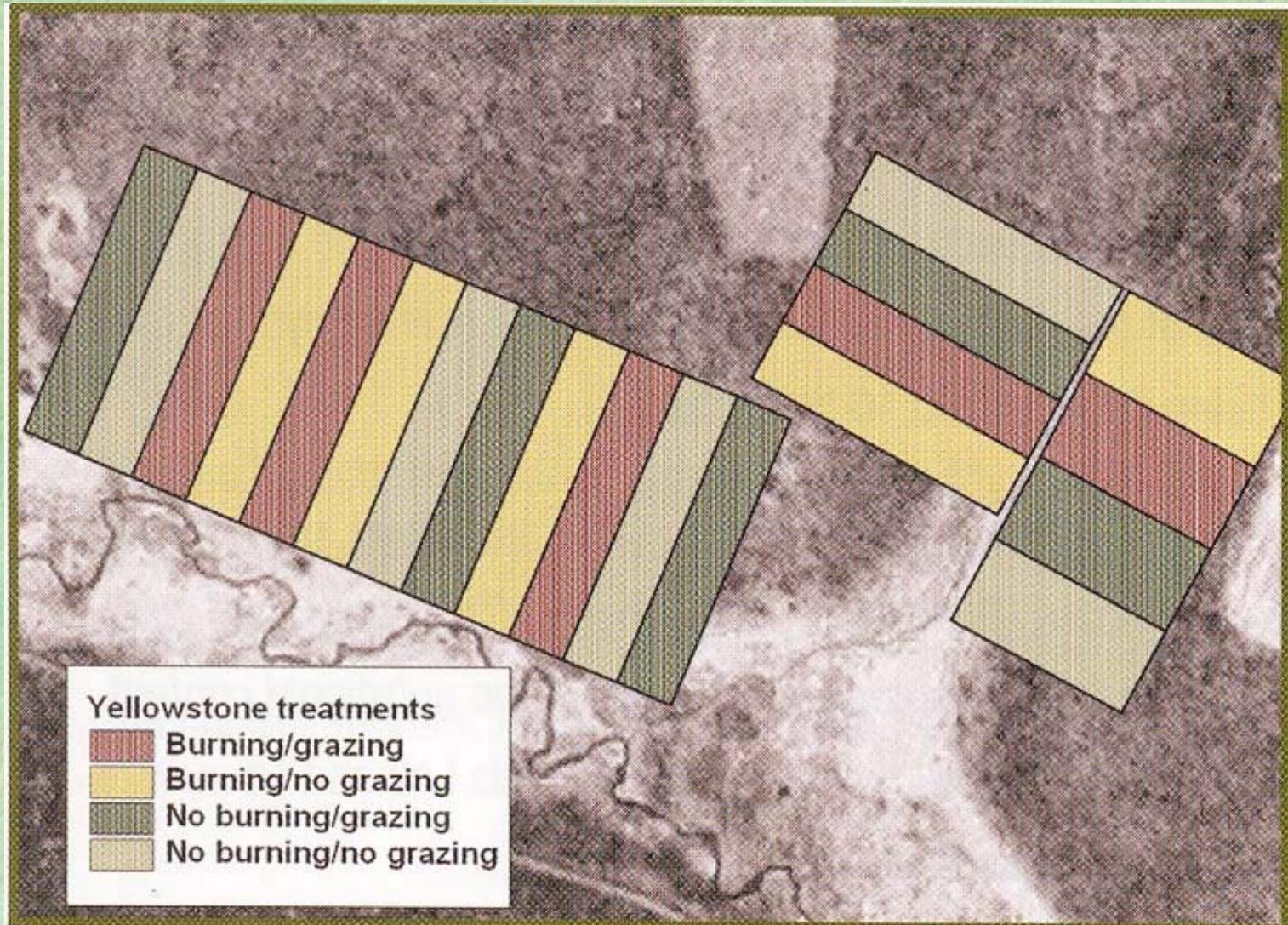


photo: Martha Rosemeyer

Cattle grazing beneath oak tree.

Highland cattle foraging on brush and grass and hopefully restoring oak savanna, Rathbun farm WI

MIRG- acting as bison and elk in oak savanna



Hedgerows increasing landscape connectivity of wild areas and diversity

- Narrow strips of vegetation that occur along borders and transitions from one type of land to another
- Last remaining refuge of biodiversity in some areas, e.g. south Britain
- Many remnants of ancient woodland, mark boundaries, predate the Enclosure Acts, passed mainly between 1720 and 1840 in Britain
- Common species: Hazel *Corylus avellana*, oak *Quercus robur*, hornbeam *Carpinus betula* and field maple *Acer campestre* and harbour woodland or woodland edge flora including bluebell *Hyacinthoides non-scripta*, primrose *Primula vulgaris*, wood anemone *Anemone nemerosa* and honeysuckle *Lonicera periclymenum*.

- Over 600 plant species (including some endemic species such as a whitebeam *Sorbus devoniensis*), 1500 insects, 65 birds and 20 mammals have been recorded at some time living or feeding in hedgerows.
- Hedgerows may also act as wildlife corridors for many species, including reptiles and amphibians, allowing dispersal and movement between other habitats
- Cultural aspects- right of way, historic
- Legal protection 1995 Environment Act



Hedgerows in south Britian. UK Biodiversity Project

Corridors between wild lands



Farming region between Lake Champlain and the Adirondacks,
in Wildways program

- Integration of conservation and agriculture.
- Combined org. ag., cert. green-forestry, other “green products”, Black Kettle Farm
- “Need to capture local markets and urban consumers outside of area”
- “Clean, Green, Local and Wild”

US rediscovering hedgerows

- 1930s many planted for windbreaks, 1970s cut
- Functions include: food, fuel, fibers, mulch, wildlife habitat, nectar for pollinators and honey, medicine, windbreak, animal barrier, visual and noise screen, erosion control, microclimate control, pollutant filter, propagation materials, flowers, dye plants, etc.
- Now supported in farm conservation programs?



Multi-story densely planted hedgerow contains grapes, currants, and other plants. Lost Valley, OR

Living fences

- Used cascara and willow fast growing tree that is flexible when green
- Lost Valley permaculture



PNW Bioregion

- Success stories: songbirds and salmon
- Songbirds are an easily identifiable indicator
- Salmon is major “charismatic megafauna” that the public has rallied around
- Native food of indigenous peoples of this area
- Salmon: Dams, long struggle to help riparian areas with some success at numbers, but contaminated with industrial and agricultural waste

PNW: Methow Valley

- Songbird survey of 225 landowners resulted in 1/3 of landowners with conservation easements
- Songbirds as indicators of restored habitat— easy and fun for farmers and their families (J&J)



West of the Cascades

Top left, Katharine Bill conducted a songbird survey that resulted in more than 1/3 of landowners expressing interest in conservation easements.

Top right, the western entrance to the Methow Valley was preserved by a state initiative.

Center right, the native sunflower after which the valley was named.

Bottom photos, Sam Lucy grows organic grains as a way to suppress the spread of noxious weeds on leased farms. His own 30 acres are dry farmed.



Kenagy Family Farm, OR

- Combination of riparian areas and hedgerows
- Riparian and hedgerows are multi-storied with lumber, fruit, nut and medicinals
- No-till row crop designed for area in attempt to mimic nature
- Use herbicides
- Worked for 20 years on system
- Aesthetics as a goal

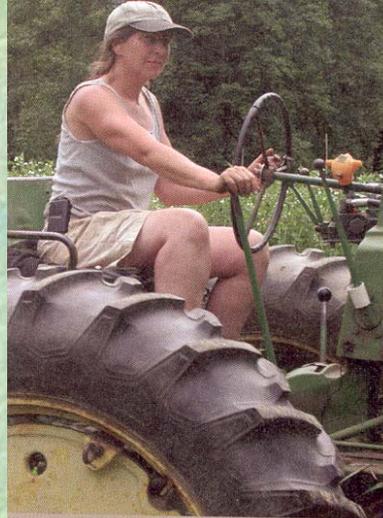


Imhoff, *Farming with the Wild*

Skagit Valley

■ Anne Schwartz, Blue Heron Farm

- Vegetable farm
- Sells at Pike Place Mkt.
- Riparian buffers
- Buffers of native trees
- Needs interns!



World-class Topsoils

Top left, Anne Schwartz of Blue Heron Farm. Her CSA farm includes buffers of native trees for restoration as well as a robust riparian margin.

Center right, winter stubble provides foraging habitat for snow geese, swans, and dabbling ducks.

Bottom row, the Mauer family operates a dairy farm on the Upper Skagit. Wetland habitat is inter-mixed throughout. Kim Mauer has a reputation for breeding rare domesticated

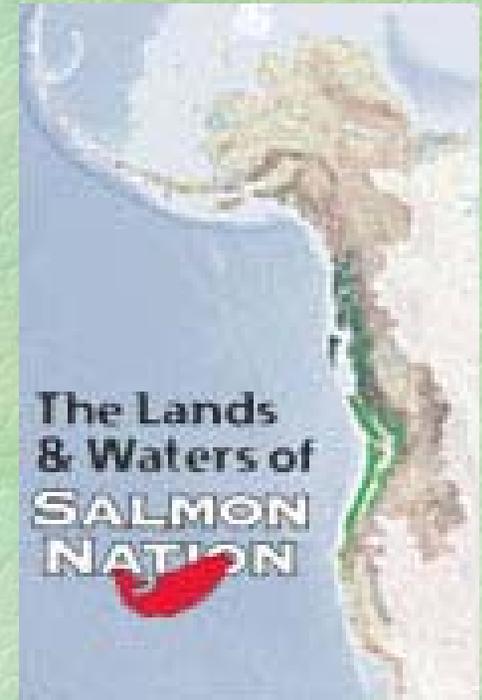
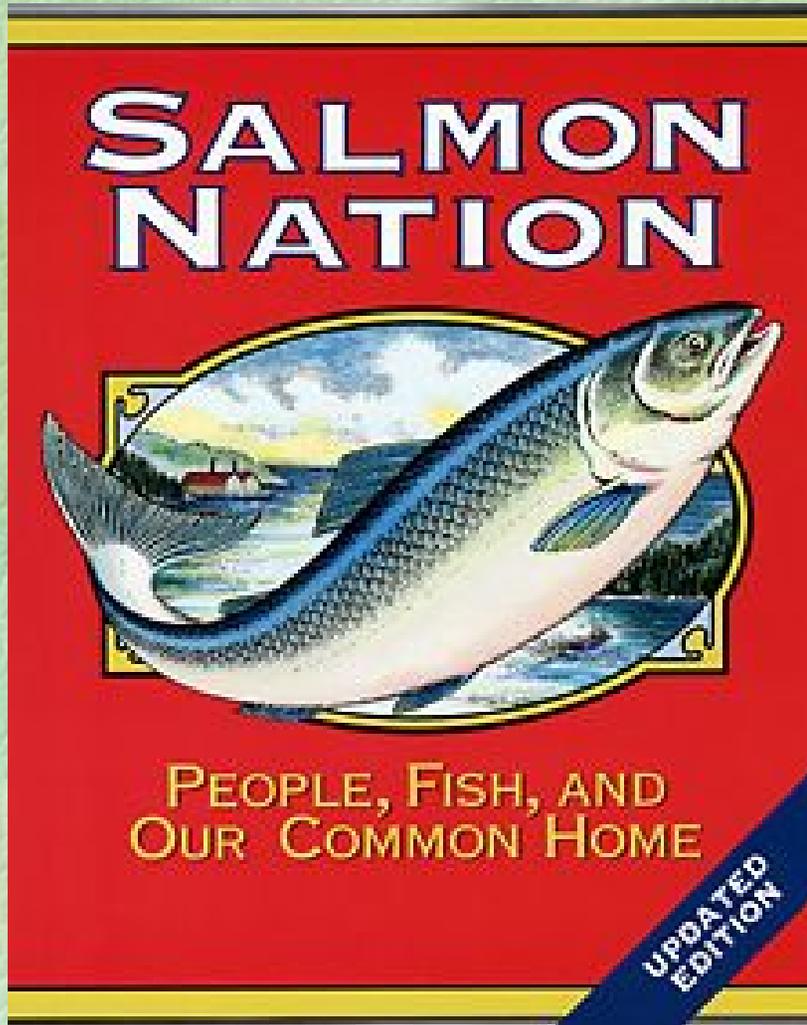


Imhoff, *Farming with the Wild*

Skagitonians to Preserve Farmland

- Pro-salmon groups struggles for 100-200' buffers for riparian margin for endangered salmon, but farmers can only afford <75'
- SPF against buffers, with argument that the farm is the buffer, and better than development
- 1996 increased property tax to raise money for Skagit County Farmland Legacy Program to to purchase development rights from willing farmers
- Conflict in Klamath Basin, Ch 13

“The Soul of the PNW”



By Seth Zuckerman,
Ecotrust

www.salmonnation.com

Salmon-safe Eco-label for Willamette Valley



- Pacific Rivers Council worked with farmers door-to-door to help with riparian buffer system
- Is it recognized by consumer?
- Difficult for PRC to maintain

Imhoff, *Farming with the Wild*

Seven species of salmonids, genus *Onchorhynchus*, in WA

- Chum (Dog)
- Chinook (King)
- Coho (Silver), natural populations on ESL
- Pink (Humpie)
- Sockeye (Red salmon)
- Cutthroat Trout
- Steelhead

<http://www.wdfw.wa.gov/outreach/fishing/salmon.htm>

Salmon Diversity

© 2005 State of the Salmon, a joint program of Wild Salmon Center and EcoTrust



Ecological aspects: GE Salmon



- Increased copies of natural growth hormone, males may be 3x bigger and more attractive to mates, but are sterile
- Ban GM fish in CA, Alaska Grounds of escape and interbreeding with wild LA Times 28 Feb 2002, SF Chronicle 28 Aug 02
- First animal to be reviewed by FDA, Maryland and OR regulated
- Canadian study demonstration that regulation may be based on predators, (4/11/04, www.comercioalternativo.com)
- Other fish- genetically modified carp in China and tilapia in Cuba (www.nwrage.org... BBC News, Briggs 2001)

Farmed vs. Wild

- Farmed are usually Atlantic salmon-endangered species in the wild
- Wild salmon season from Pacific is March to November
- In March 1/6 NYC stores labeled wild, fresh were actually– rest was farmed and misrepresented (NYT April 10, 2005)
- People confused

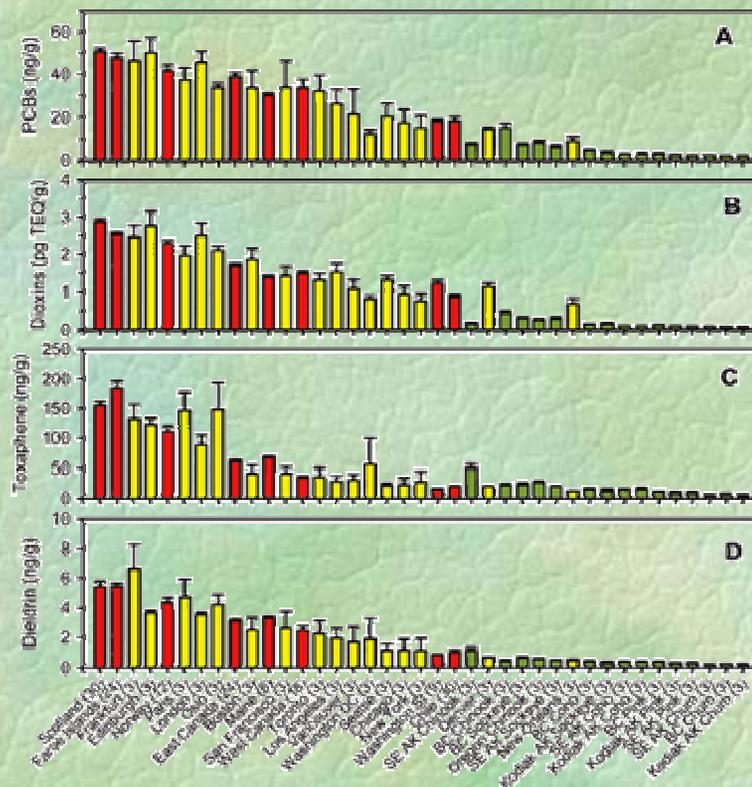
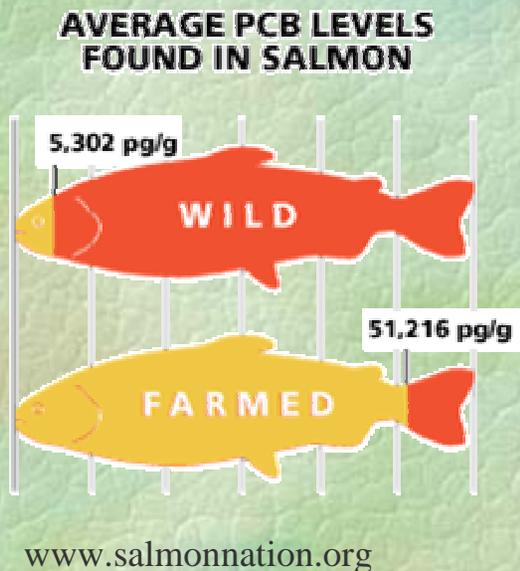
Toxicity of farmed salmon vs. wild

- Farmed have substantially higher levels of persistent organic contaminants: PCB, dioxins and pesticides (PSR)
- Can vary widely with individual fish
- UK gov't study found farmed salmon to be most toxic product (ave 3) sold in British markets

Edinburgh Sunday Herald 20 Oct 2002

- **Antibiotics, permethrin (and other) insecticides for sea lice, and dyes (astaxanthin) used in production**

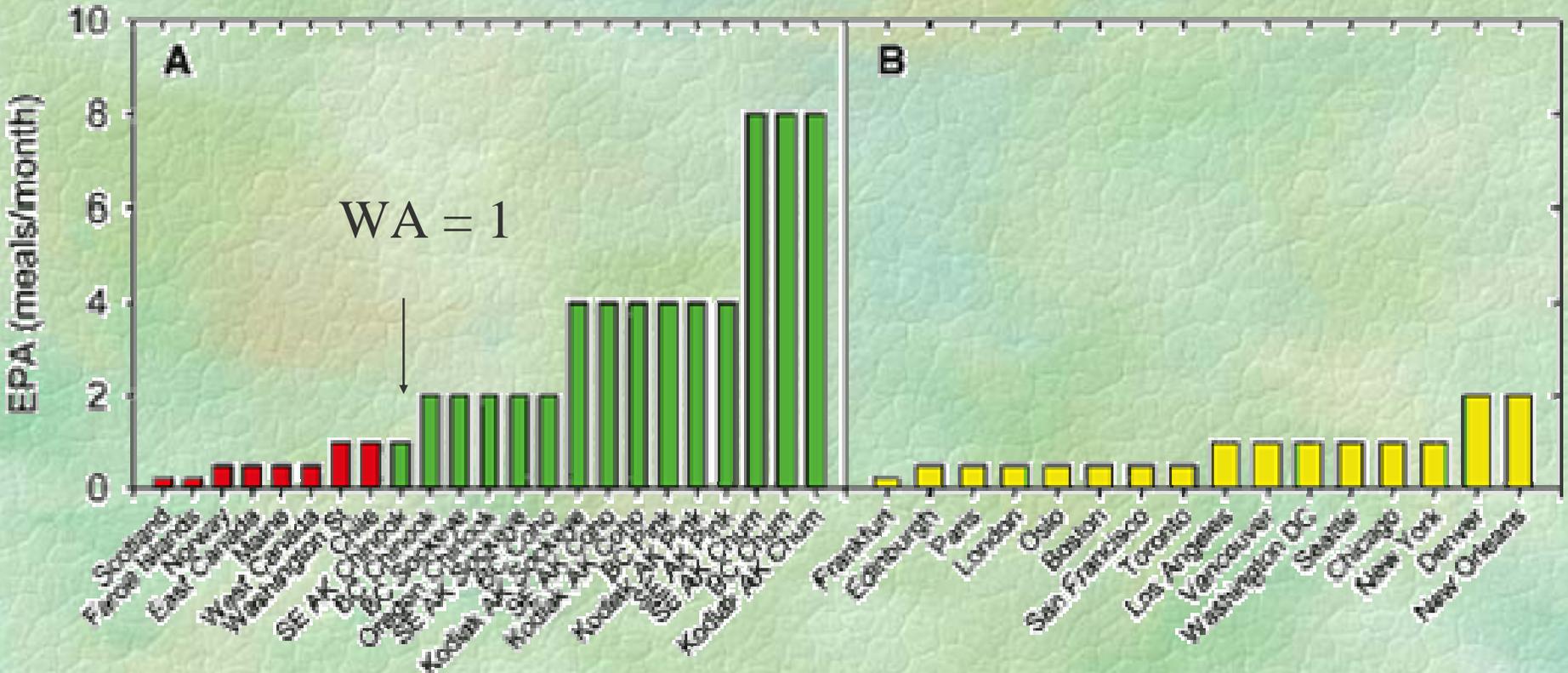
Fig. 2. Concentrations of (A) PCBs in ng/g wet weight, (B) dioxins (for detail, see Fig. 1) in pg of WHO-TEQ/g wet weight, (C) toxaphene in ng/g wet weight, and (D) dieldrin in ng/g wet weight in farmed, supermarket, and wild salmon.



Fish from WA state least contaminated of the farmed salmon Tested but...

Hites et al., Global Assessment of Organic Contaminants in Farmed Salmon, Science v.303, 9jan04

Number of safe fish meals per month = 1 for WA farmed salmon vs 2-6 for wild salmon



Contaminants in wild salmon: what happens when toxics escape ag and industrial systems

- Smaller salmon have had less time to bioaccumulate toxins
- Chinook live longer and are fattier- fats contain the omega-3
- Chinook (King) from Alaska are the most contaminated of all wild salmon
- Alaskan pink are smaller and least contaminated of all wild salmon

Why do farmed fish have contaminants?



- It is the feed that is contaminated— farmed fish can feed on larger, more contaminated fish that they would not in the wild
- FDA does not regulate contaminants (or GMOs) in feed or US or imported salmon
- Requirement that supermarkets have country of origin labels come into effect Sept 4 2004 (but fish markets not required!)
- Farmed fish need to be labeled as containing dyes

Standards being developed for organic salmon production for EU and Canada

- Similar to other IFOAM animal organic standards
- Stocking rates less/water flow greater
- Use of Chinook in BC, which are more resistant to sea lice
- Strict regulation of antibiotics
- Waste- lower stocking rate and proposed coupling with production of algae
- Plant-based organic feed sources and fish/fish oil parts from organic systems or “sustainable”
- Natural source (yeast) for the dye
- More at www.certifiedorganic.bc.ca

To close nutrient cycle and separate waste

- Larger questions of nutrient cycling- human manure separation from industrial waste stream
- Manufacturing may need to use biologically benign processes and recycle “technical cycle” waste
- Toxics need to be phase out of urban residential life
- Toxins out of agriculture as well
- This will reduce potential for negative flows between urban and agricultural to natural areas

Ultimately we may need landscape level management for ag and wildlife

- To take advantage of the mosaic of patchiness with respect to isolation of pests and facilitation of beneficials
- Buffer zones are an example of that = less intensively managed area at margin of agroecosystem that reduces impact on natural, e.g. uptake of excess nutrients

Why is all this important?

- Our conventional system of agriculture is currently run on fossil fuel energy (most organic, though better, still has substantial inputs)
- We have substituted fossil fuel for local knowledge of a place
- If we envision a life without fossil fuel we have to rediscover “place”

How do we “fit into place”?

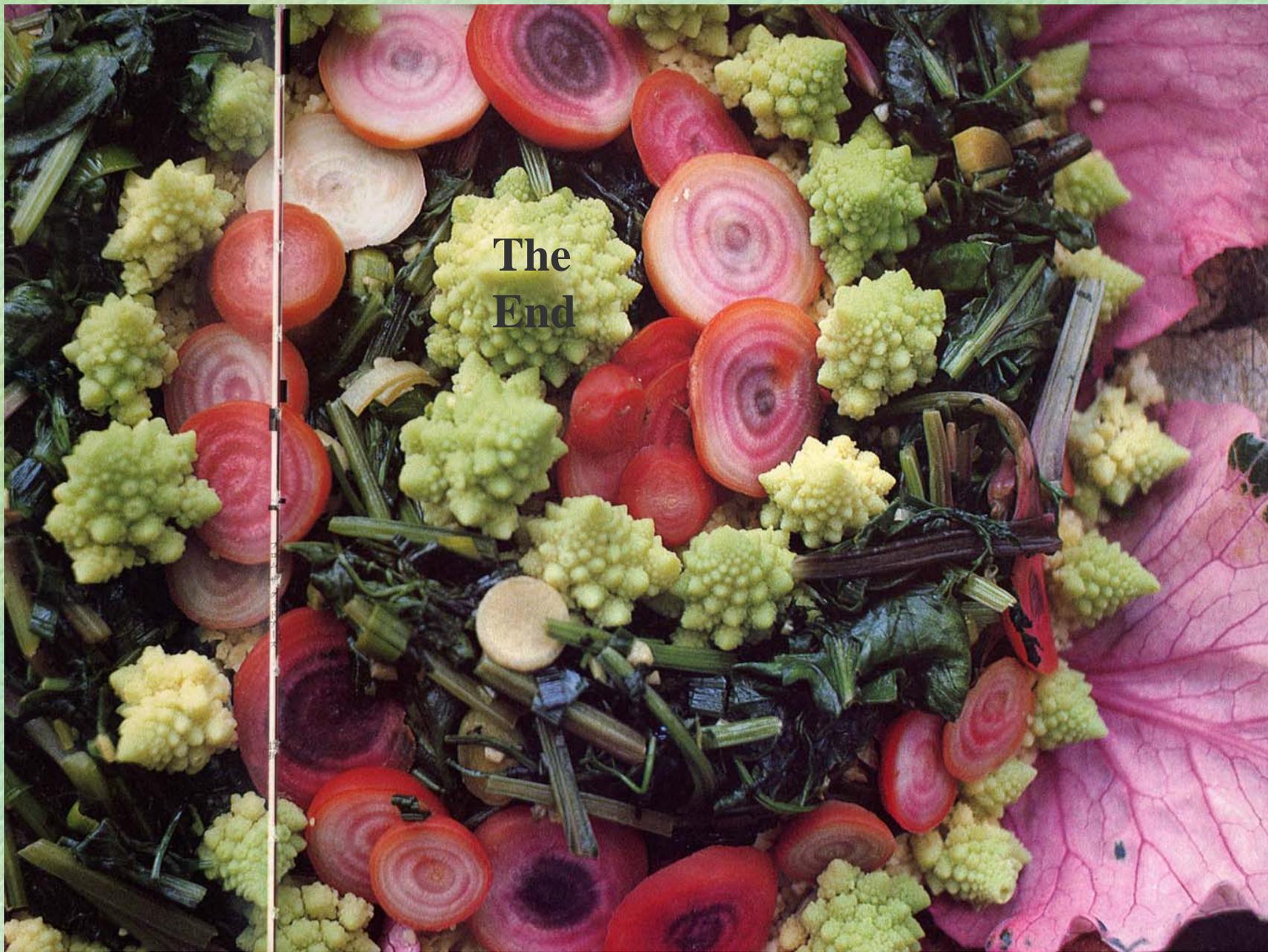
- Inform ourselves about it
- Develop powers of observation
- Observe the natural ecosystem throughout the seasons
- Design, test, re-design
- After about 10 years or so most farmers will tell you that the land “tells you” how it wants to be managed

Co-create model for wherever you put down roots

- Observe of natural and agroecosystem and what is present
- Begin to understand how natural and agroecosystems work (agroecology) (Eco Ag Fall/Winter quarters)
- History of place and social factors that have shaped the landscape (Fall quarter Eco-Ag US context)
- Know how to produce food (Practice of Sustainable Agriculture- Spring, Summer, Fall)
- Chemistry of cooking, nutritional biochemistry and production issues:genetic engineering (2006-07)

Study questions

1. Please answer the “becoming native to this place questions”.
2. What kinds of changes need to be made in the design and management of agriculture so that we can come closer to farming in “nature’s image”?
3. What are the issues of greatest importance that threaten the sustainability of agriculture in this area?



**The
End**