Imitating Natural Systems

Towards an Indigenous Agro-Forestry
Organic Orchard Workshop Presentation by Greg House,
Coco Ranch, Solano County, California
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Our geese foraging, developing soil.

Tree frog at home at our orchard.

> *Our only hope for achieving stability and sustainability in our managed ecosystems is to imitate natural ecosystems as much as possible*. — Jack R. Harlan 1991. (1)

The Coco Ranch orchard trees were planted by us in 1998 onto previously conventionally farmed field and row crop land in Solano County, five miles southwest of Davis. Soil is Class I Yolo loam. The entire orchard has been certified-organic by CCOF since 2000. There are seven varieties of apples and four varieties of cherries produced for sale, plus other apples, peaches, nectarines, apricots, pears, quinces, prunes, jujubes, olives, figs, pomegranates, walnuts and other trees, all producing for our own use. The farm also has livestock pastures, a pond, managed vegetative areas, and several vegetable plots for both home production and commercial seed production.

We had at the outset numerous economic intentions for the farm. It was in part intended to be a commercial venture for wholesale production and for retail sales (CSA, farmers' markets and the like). We also have a commitment to subsistence agriculture, caring for ourselves. These various interests can be characterized as three distinct economic uses, described as follows. Each crop is managed differently.

Shipping fruit is grown for the grocery stores. It is sold in the wholesale market via our commission-merchant, CF Fresh, under their *Viva Tierra* label. Growing practices are oriented towards market standards that reward appearance. Grading, and consequently price, is based on color, size and uniformity. The system demands big and "flawless". We work nearly year-round to maintain a vase-shape that lets sunlight into the interior of the tree, to avoid low-hanging, shaded fruit, and to facilitate movement around the trees.

Local fruit is grown currently for local families, CSAs, food coops, schools, and sales at the Coco Ranch Workshop in downtown Davis. We used to sell at the Davis Farmers' Market but found it too tiring and not remunerative enough for the stall hours mandated. Growing practices and harvest programs for this local fruit prioritize taste and nutrition over appearance; freshness is valued. Our fruit is unwashed, unstickered, and varies in shape and size (our customers like a range of sizes, with many preferring small apples). Variability and minor "flaws" signal to our educated buyers that this fruit comes directly from a local small farm.

Domestic fruit is grown as subsistence for us and our kin, emphasizing taste and nutrition (like our local fruit) and is useful in more than one context (fresh, cooked, juiced, fermented, dried, stored, medicinal),

What is local? It is a measure of the attenuation of our modern food system that our local school district - that asks us to pay an additional parcel tax for their support - defines with satisfaction produce brought in from 300 miles away as "local", when a Davis resident who describes an Oregon native with the phrase "local girl makes good" would be looked at askance, and a Davisite who called driving to Bakersfield to purchase a pound of nails as "going down to the local hardware store" would be seen as deranged.

providing a supply throughout the season. This production is part of our Wellness Program for all the people of Coco Ranch. We are committed to taking care of ourselves; there is no better quality food available elsewhere and food is the basis of life.

Our oft-used word "economics" has its heritage in the Greek word *oikonomikos.* The Ancient Greek word, however, in contrast to the current conception of economics as the bottom-line above all, embodied an earlier, pre-industrial meaning — the sustainable management of the home. *Oikos*, means "house", and *nemein*, means "to manage"; *oikos*, notably, is also the root of the modern word "ecology". Modern industrial agriculture has fostered in the farmer a dependence on purchased inputs with a corresponding loss of knowledge capital on the farm and in the farmer, just as the modern home has come to rely on purchased inputs with a corresponding loss of cultural knowledge in the home. We seek to restore this cultural knowledge and develop appreciation of it so as to live our lives sustainably with pleasure and satisfaction.

Orchard Management that Imitates the Natural Ecosystem

In contrast to a management style based on division and reduction of the farm into component parts which are replaceable or independently manipulatable, we work to create a whole living system modeled on a natural interdependent ecosystem. Our fertility program, pest-management, irrigation, vegetation-management, and timing of operations are all inter-related in our management of the orchard.

We work to understand what the place is, contemplating the soil, climate, water, resident vegetation and wildlife. The query, *What was this land before industrial agriculture?* is key to our management now. Our land was once a riparian-oak forest whose deep, highly fertile, well-drained, geologically young soil flooded annually. It responds now to irrigation and supports luxuriant growth. We have developed our farming practices with this deep history in mind.

Some key operational features of our farming approach are:

1. Multiple uses of same land: We nurture the diverse resident-vegetation which grows on the orchard floor, between and around our trees. We have no "weeds" here. Everything that grows at Coco Ranch contributes, is valued, and is used. See Table 1: Ethnobotanical Uses.

2. Shredding: Tree prunings are shredded and left on the orchard floor to decompose; edible and medicinal mushrooms are just one delightful benefit.

3. Infrequent mowing: We mow once in the spring and occasionally before harvest if growth is high. Our animals, sheep and geese, make good use of the forage, enhancing and cycling the nutrients in the orchard ecosystem as they live and graze.

4. No tillage: Except for making furrows for flood irrigation, the orchard floor is undisturbed by mechanical operations. This, along with the above listed practices, permits the deep development of a organic matter "O" horizon and a humus "A" horizon, stabilizing fertility as humus and forest litter. No NPK has been added to the orchard for over 12 years, and fruit yields are consistently good. This approach develops a more self-sufficient farm system, rather than a system dependent on outside, off-farm inputs.

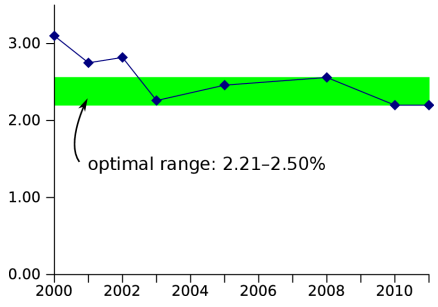

Figure 1: Leaf tissue tests are taken every year, and results compared to UCCE recommendations; N levels have remained at optimum or above.

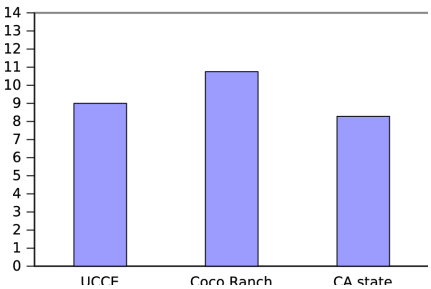

Figure 2: Yield Comparison. The mature yield of Coco Ranch organic apples 10.75 tons/acre. This compares favorably to a recent UCCE publication (2) that estimates 9 tons/acre for conventional apples, and statewide average of 8.28 tons/acre for 2006-2010.

5. Flood irrigation: We flood irrigate in imitation of our land's natural ecosystem, irrigating in an alternate pattern that leaves one alley between tree rows wet and one dry to allow access and to speed the irrigation cycle in the peak usage period of summer. Flood irrigation waters trees, grows resident-vegetation which maintains the fertility of the living system and provides plentiful habitat, nectar, and pollen for beneficial insects, keeps soil micro-organisms flourishing, waters our geese, and controls the potentially devastating gopher and vole populations.

6. Application of Liebig's Law: Liebig's Law tells us to identify the most limiting factor in crop production and address that. This requires close observation, use of qualitative and quantitative measurement and analysis, and a sense of the whole dynamic system. In our orchard we invest considerable management attention to the codling moth, which can devastate production and cross the economic threshold. We do find that if we can control the moth, most other pest insect populations are not a problem most of the time. Rather than using general killers that would disrupt our ecosystem, we focus on materials specific for the codling moth as well as approaches that support the whole ecosystem. We use pheromone mating-confusion strips, applied parasitic wasps *Trichogramma platneri*, G*ranulosis* virus (using UCCE degree-day models for application), and maintain resident-vegetation as food and habitat for moth predators and parasitoids.

7. Sensitivity to timing: Biology has its own inter-related rhythms. Temperature, moisture and sunshine are the drivers. We make every effort to be prepared to act when and as needed. For instance, we irrigated the trees in January this drought year, a first in all our years of growing apples.

8. A light touch: When we act, we seek to disrupt the system as little as possible. Our discussion on codling moth above illustrates this point.

9. Reverence for life: We are all here together and have a responsibility for each other.

Some Handy Resources:

Organic Apple Production Manual, University of California Agriculture & Natural Resources Publication #3403

http://wwwcimis.water.ca.gov/cimis (good source of weather data)

http://www.ipm.ucdavis.edu (degree days models and "weed" identification)

University of California Sustainable Agriculture Research & Education Program (SAREP) http://www.sarep.ucdavis.edu

Indigenous (Traditional) Management Techniques

Steve Gliessman at UC Santa Cruz notes that traditional agriculture can provide models and practices in developing sustainable agricultural systems (3). M. Kat Anderson, ethnobotanist, states that California Indians indigenous to the Sacramento Valley (where our farm is located) used their traditional management practices to develop and maintain the productivity and diversity of plant, fungal, and animal species desired for human use (4). These techniques, often mimicking observed natural disturbances, include burning, tilling, pruning, coppicing, sowing, transplanting, weeding, and harvesting activities; essential to the success of these techniques in achieving management goals is the degree of disturbance, which is related to type of tool used, as well as the timing of that disturbance in relation to the plant growth cycles (*ibid*). R.A. Bye, in his work with indigenous people in Mexico, observed that human disturbance is an important factor in determining the presence and density of *quelites*, the various edible wild greens that are an important local food source (5). M.K. Anderson in her interviews with California Native elders, reports that these elders today remember that their valued greens were not "naturally" productive continuously over many years, but required disturbance to maintain their quality and quantity each year (4).

Beginning with the establishment of our farm in 1997, desired plant species have been identified and studied, and techniques based on researched indigenous patterns of disturbance with its special emphasis on timing have been put into practice and developed. Techniques for the management of resident and emerging native vegetation include selective harvesting, the pinching back of edible greens, dispersing seeds whilst collecting them, managed grazing, use of hand tools, and, in open land other than the orchard, soil disturbance with a light orchard-tractor and disk, timed in relation to plant growth cycles. Extreme disturbance with heavy agricultural equipment or chemicals is avoided.

Values Underlying Indigenous Management Practices

California Indians saw biological diversity and abundance as desirable as they depended on this diversity to meet their needs. According to M. K. Anderson, at the point of European contact, California Indians were actively using well over a thousand of California's native plants (6). Indigenous people here developed techniques to provide for their needs based on a cultural value system that saw participation with and responsibility for nature as relationship with kin. Enrique Salmon used the term **kincentric** to describe this value system (7), which can be contrasted with a **biocentric** view, that nature exists for its own sake, or an **anthropocentric** view, that nature is a resource stockpile (4). This Native American kincentric approach is expressed when elders respond to the question, *Why have all the plants gone?* with *Because people don't use them anymore.* (6).

An Indigenous Approach to Occupying the Land

Botanist Edgar Anderson, visiting Guatemala in the mid-20th century, observed a garden that to his eye, accustomed to a different sort of agriculture, appeared so wildly overgrown that it did not seem to him to be tended, and made these comments in 1954:

"In terms of our American and European equivalents the garden was a vegetable garden, an orchard, a medicinal plant garden, a rubbish heap, a compost heap, and a bee yard. There was no problem of erosion though it was at the top of a steep slope; the soil was practically all covered and apparently would be during most of the year. Humidity would be kept up during the dry season and plants of the same sort were so isolated from one another by intervening vegetation that pests and diseases could not readily spread from plant to plant ... The garden was in continuous production but was taking only a little effort at any one time... I suspect that if one were to make a careful study of such an American Indian garden, one would find it more productive than ours in terms of pounds of vegetables and fruit per man-hour per square-foot of ground." (8)

Table 1: Ethnobotanical Uses of Some Plants Found at Coco Ranch

	F	M	BF	LF	N	NN	SS	NP
Amsinckia menziesii	x		x	x	x			x
Avena fatua	x	x	x	x	x	x	x	
Brassica campestris	x	x	x	x	x	x	x	
Brassica nigra	x	x	x	x	x		x	
Bromus diandrus			x	x	x	x	x	
Bromus mollis			x	x	x	x	x	
Calandrinia ciliata	x	x	x	x				x
Capsella bursa-pastoris	x	x	x	x				
Chenopodium album	x	x		x	x			
Claytonia perfoliata	x	x	x	x				x
Elymus glaucus			x	x	x	x	x	x
Epilobium brachycarpum	x	x	x	x				x
Erodium circularium			x	x				
Hordeum leporinum			x	x	x	x	x	
Lamium amplexicaule	x	x	x	x				
Lactuca serriola	x	x	x	x				
Lolium multiflorum			x	x	x	x	x	
Medicago polymopha		x	x	x	x			
Nascella pulchra			x	x	x	x	x	x
Portulaca oleracea	x	x	x	x				
Raphanus sativas	x	x	x	x				
Rumex crispus	x	x		x				
Silybum marianum	x	x	x	x				
Sonchus oleraceus	x	x	x	x		x		
Stellaria media	x	x	x	x		x		
Urtica dioica	x	x		x				x

F = Food; reference Anderson (4) and our own experience.
M= Medicinal; reference Foster & Hobbs (9) and our own experience.
BF= Bee forage; reference Pellett (10) and on-farm observation.
LF = Livestock forage; reference our own experience.
N = Nitrogen cycling; reference UC SAREP (11).
NN = Non-N nutrient cycling; reference UC SAREP (11).
SS = Soil structure benefits; reference UC SAREP (11).
[NP = Native California plant; reference Hickman (12).]

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